

TOKYO SUMMIT - VI

6TH INTERNATIONAL CONFERENCE ON
INNOVATIVE STUDIES OF
CONTEMPORARY SCIENCES



6TH INTERNATIONAL CONFERENCE ON INNOVATIVE STUDIES OF CONTEMPORARY SCIENCES



The Book of Full Texts

Editors
Dr. Vijay Singh

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CONFERENCE ID

CONFERENCE TITLE

6TH INTERNATIONAL CONFERENCE ON INNOVATIVE STUDIES OF CONTEMPORARY SCIENCES

DATE and PLACE

AUGUST 1-2, 2022 / Tokyo - Japan

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TOTAL NUMBER OF INTERNATIONAL PARTICIPANTS- 50

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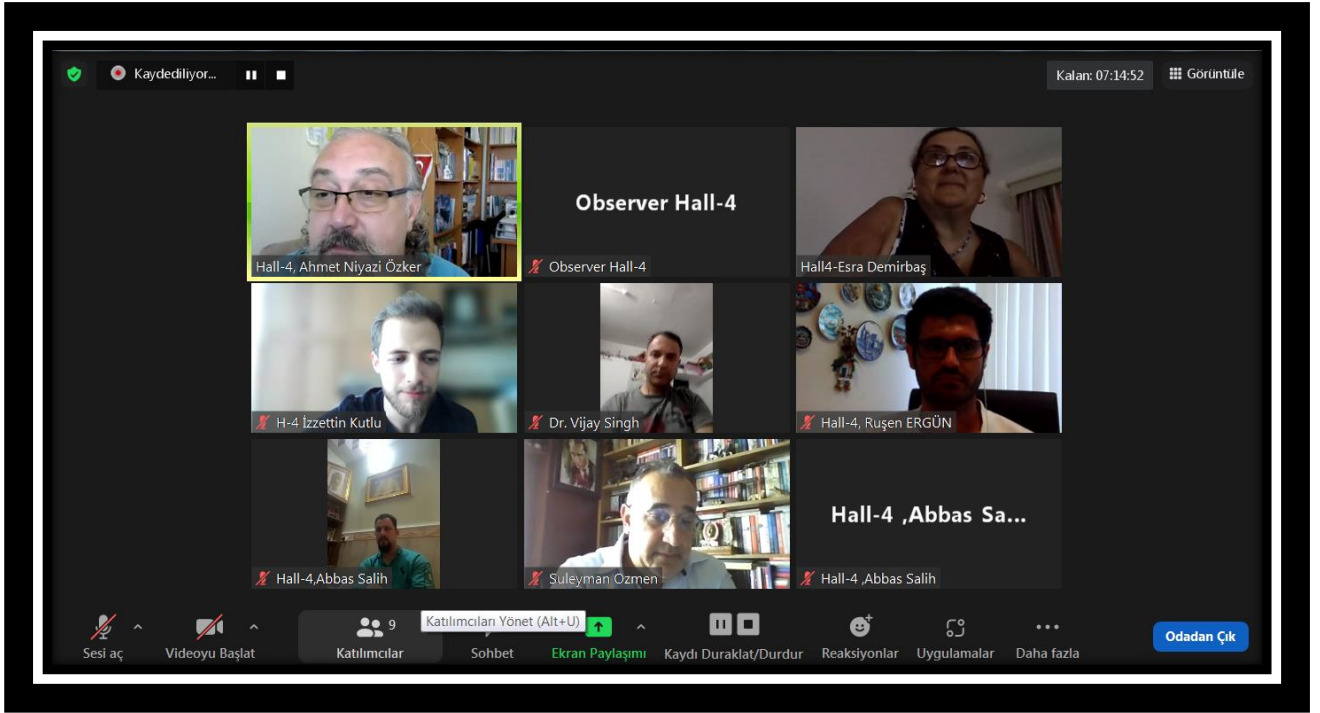


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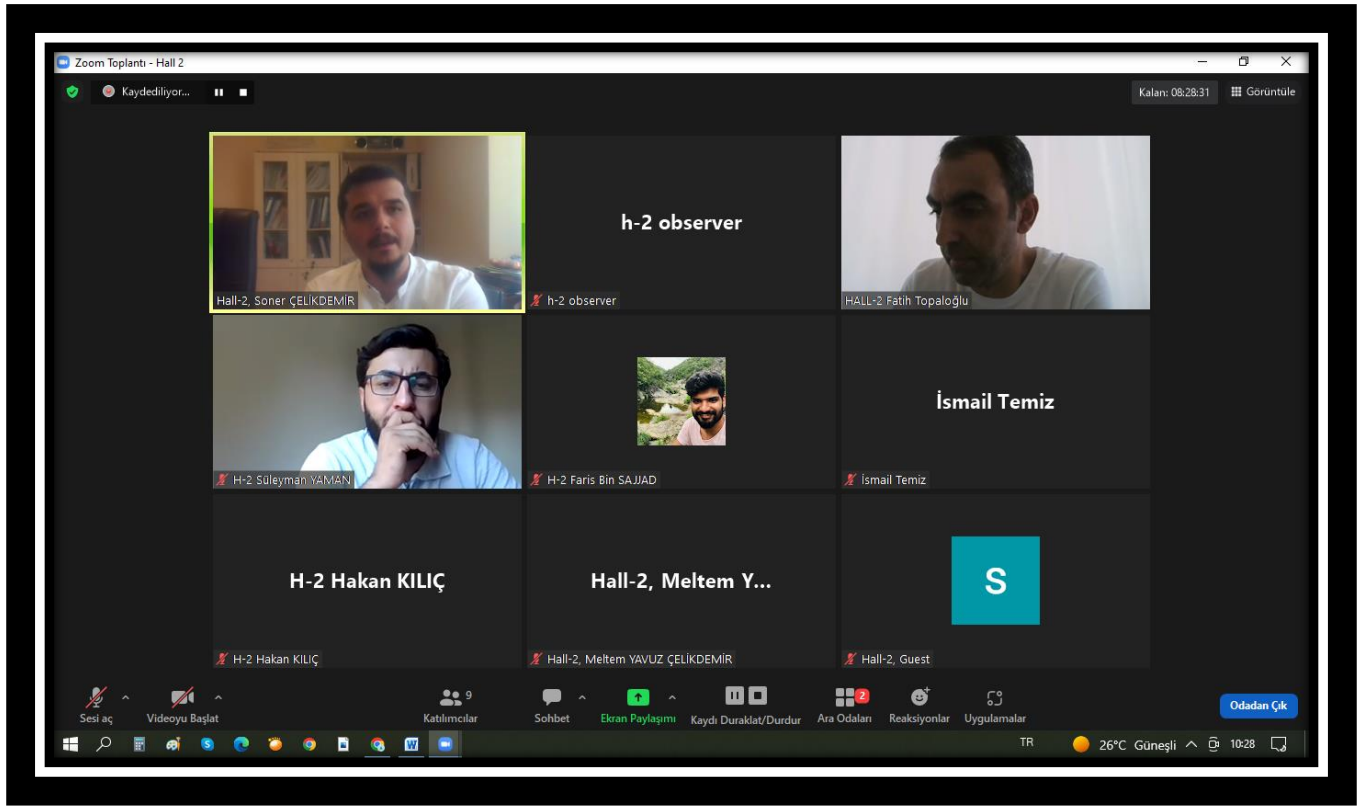
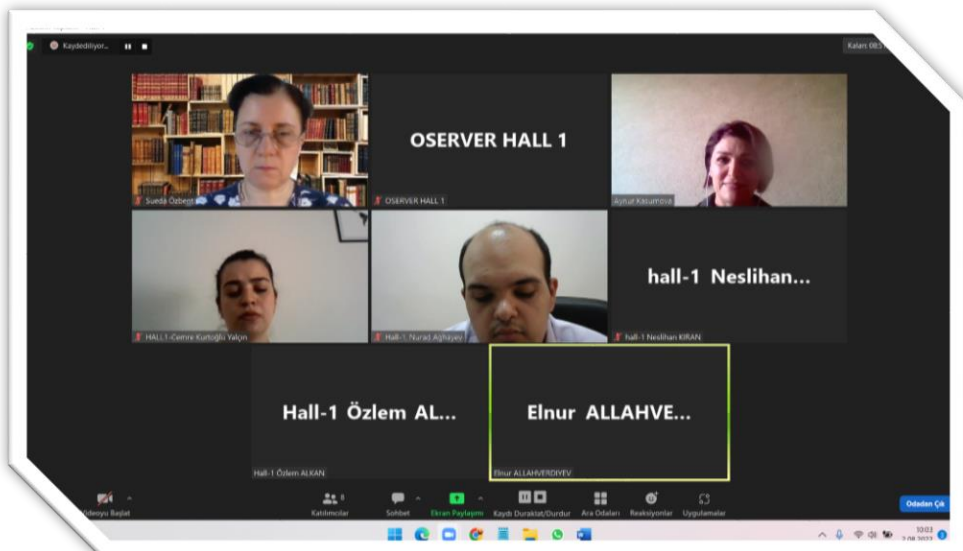


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TOKYO SUMMIT

6th International Conference on Innovative Studies of
Contemporary Sciences

August 1-2, 2022 / Tokyo - Japan

CONFERENCE PROGRAM





Meeting ID: 812 4927 8517
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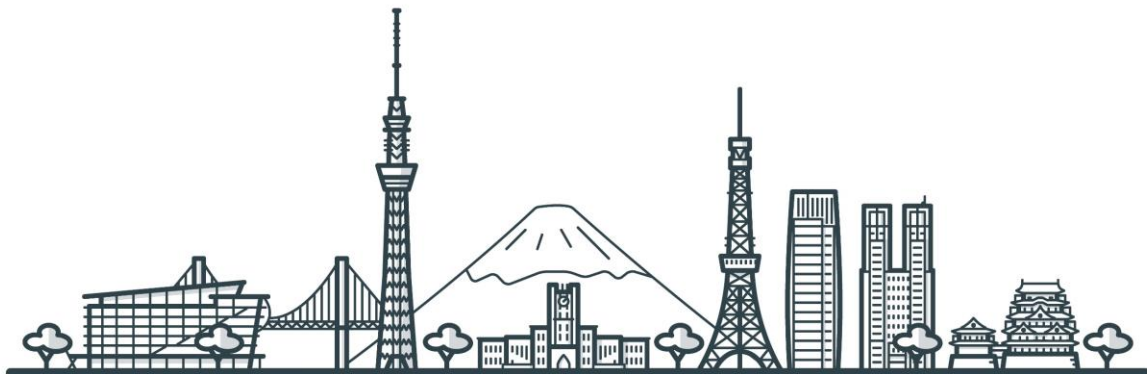
Tokyo Local Time: 15⁰⁰-17³⁰



Ankara Local Time: 09⁰⁰-11³⁰

HEAD OF SESSION: Assoc. Prof. Dr. Koray Karabulut

Mai Duc Nghia Doan Cong Thang	Faculty of Mechanical Engineering, Air Force Officer's College, Nhatrang City, Vietnam	DESIGN AND MANUFACTURING RESEARCH OF THE INFORMATION PROCESSING EQUIPMENT FOR APPLICABLE IN TECHNICAL SAFELY SUPERVISION OF THE FISHING VESSEL'S DIESEL ENGINES
Sandeep Bandarwadkar	Kaunas University of Technology	INVESTIGATION OF THERMAL ENERGY ACCUMULATION USING SOIL LAYER FOR BUILDINGS' ENERGY EFFICIENCY
Assoc. Prof. Dr. Koray Karabulut Nihat Ocak	Sivas Cumhuriyet University	INVESTIGATION OF ENTROPY GENERATION AND EXERGY GAIN OF GO-WATER NANOFLUID DEPENDING ON WORKING CONDITIONS
Hamid Zamanlou Filiz Karabudak	Ataturk University Gumushane University	INVESTIGATING THE COMBINED MODE FAILURE MECHANISM IN HONEYCOMB PANELS AND CALCULATING ENERGY ABSORPTION IN DYNAMIC LOADS
Selma Akçay	Cankiri Karatekin University, Engineering Faculty, Mechanical Engineering Department, Cankiri, Turkey.	EFFECT ON FLOW AND HEAT TRANSFER OF TURBULATORS IN A TRAPEZOIDAL CORRUGATED CHANNEL
Ibrahim Yıldız Prof. Dr. Hakan Caliskan Prof. Kazutoshi Mori	Usak University Usak University Teikyo University	THE COMPARISON OF THE CHANGE IN SOOT EMISSION CONCENTRATION OF A DIESEL ENGINE ACCORDING TO FUEL TYPE AND ENGINE LOAD
Assist. Prof. Dr. Tuna AYDOĞMUŞ	Hitit University	PRODUCTION AND CHARACTERIZATION OF BORON- REINFORCED MULTICOMPONENT ALLOYS
Cansu DİRİL Seyfi ŞEVİK Tuna AYDOĞMUŞ Büyamin ÇİÇEK	Hitit University	A NEW SHIELDING PRODUCT AND AUTOMATIC RADIATION PREVENTION MECHANISM FOR RADIATION ROOMS
Assoc. Prof. Dr. Seyfi ŞEVİK	Hitit University	IMPACT OF MAINTENANCE ON PUMP PERFORMANCE



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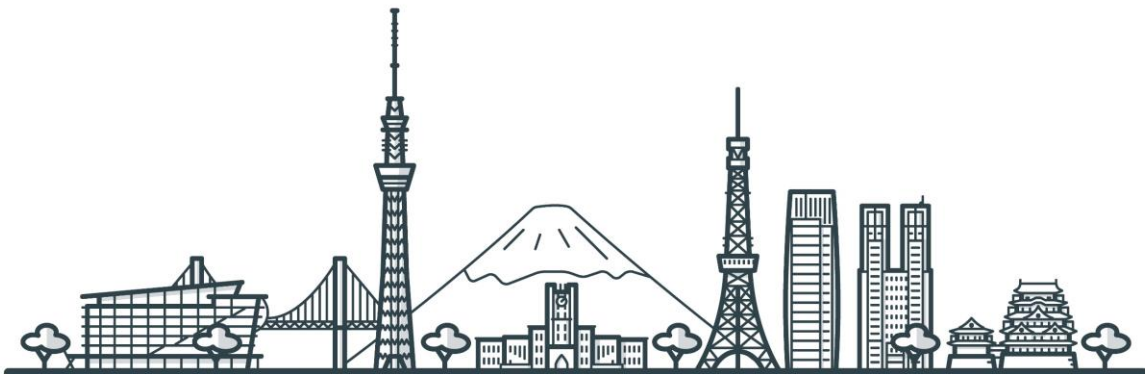
Tokyo Local Time: 15⁰⁰-17³⁰



Ankara Local Time: 09⁰⁰-11³⁰

HEAD OF SESSION: Soner ÇELİKDEMİR

Nour El Houda Benharkat Souad Bentaalla Kaced Chergui Abdelmalek	National Polytechnic School of Algiers Elharrach, Algeria	DIGITAL TWINS AND ITS MANIFOLD APPLICATIONS
Pushkar Pandey Renu Kundu	Indian Institute of Technology, Department of Design, India	UX STUDY ON HANDHELD AUGMENTED REALITY GAMES BY APPLYING SPRADLEY'S NINE DIMENSIONS DESIGN PRINCIPLE
Soner ÇELİKDEMİR Mahmut Temel ÖZDEMİR	Bitlis Eren University Firat University	DEVELOPMENT OF MAINTENANCE COST ESTIMATION FOR SMALL HYDRO POWER PLANTS
Soner ÇELİKDEMİR Mahmut Temel ÖZDEMİR	Bitlis Eren University Firat University	TECHNO-ECONOMIC ANALYSIS OF THE CONVERSION OF VESSELS TO GREEN: THE CASE OF VAN LAKE
Meltem YAVUZ ÇELİKDEMİR Ayhan AKBAL	Bitlis Eren University Firat University	BRAIN ANEURYSM DETECTION USING IMAGE PROCESSING TECHNIQUES
Meltem YAVUZ ÇELİKDEMİR Ayhan AKBAL	Bitlis Eren University Firat University	EXAMINATION OF PRE-OP AND POST-OP CEREBRAL ANEURYSM IMAGES
Hakan Kılıç Merve Temizer Ersoy	Nisantasi University, Istanbul	AUTOMATIC SQL TUNING ADVISOR FOR POSTGRESQL
Faris Bin SAJJAD ALI SHAH Dr. İsmail TEMİZ	Marmara University	AKILLI SENSÖRÜN TASARIMI VE OTOMASYON SİSTEMLERİNDEKİ ETKİSİ
Asst. Prof. Dr. Fatih TOPALOĞLU	Malatya Turgut Özal University	CYBERATTACK RISKS AND POTENTIAL THREATS FOR AUTONOMOUS VEHICLES
Süleyman Yaman Hasan Guler	Firat University	A NEW DEEP LEARNING-BASED APPROACH FOR AUTOMATED KIDNEY STONE DETECTION FROM CT SCANS



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Tokyo Local Time: 15⁰⁰-17³⁰



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HEAD OF SESSION: Dr. Lali Tsivilashvili

Lali Tsivilashvili Giorgi Ghambashidze Medea Burjanadze Zaira Tkebuchava	LEPL Scientific-Research Centre of Agriculture, Department of IPM researchTbilisi, Georgia	MONITORING AND MANAGEMENT OF WEEDS IN HAZELNUT ORCHARDS
Elnur ALLAHVERDIYEV	Director of Baku Business and Cooperation College, Baku, Azerbaijan	THE AGRICULTURAL POTENTIAL OF LIBERATED TERRITORIES OF AZERBAIJAN
Gideon Danso-Abbeam Maxwell Anamdare Asale	Department of Agribusiness, University for Development Studies, Tamale, Ghana	DETERMINANTS OF HOUSEHOLD FOOD SECURITY AND COPING STRATEGIES IN NORTHERN GHANA
Sait TAN Pelın DEMİR Cemil KÜREKÇİ Ali ARSLAN	Firat University	DETERMINATION OF BISPHENOL A (BPA) MIGRATION DURING RIPENING AND PRESERVATION PROCESS IN BRINE WHITE CHEESE RIPENED IN POLYETHYLENE TEREPHTHALATE (PET) PACKAGES
Zahit Kutalmış KAYA Orhan ÇETİN	Selcuk University	DIFFERENT BREEDING SYSTEMS EFFECTS ON BLOOD, FATTY ACID AND AMINO ACID PROFILES IN NATIVE TURKISH GEESE
Zahit Kutalmış KAYA Mustafa Çam Serdar GÜLER	Selcuk University	GROWTH PERFORMANCE AND METABOLIC PROFILES IN THE EARLY PERIOD OF HOLSTEIN CALVES FEEDING WITH TRANSITION MILK
Milivoje Urošević Radomir Mandić Panče Dameski Goran Stanišić	Metropolitan University	BIRTH RATE OF EUROPEAN BISON (Bison bonasus bonasus L. 1758) IN ROMANIA IN THE 2004 – 2020
Bilal Ahmad M.I. Khan M.A. Naeem Aiyeshah Alhodaib Mahvish Fatima Mongi Amami Eman A. Al-Abbad Abida Kausar Norah Alwadai Arif Nazir Munawar Iqbal	The University of Lahore	GREEN SYNTHESIS OF NIO NANOPARTICLES USING ALOE VERA GEL EXTRACT AND EVALUATION OF ANTIMICROBIAL ACTIVITY
Ivan Pavlovic Milan Stevanovic Nemanja Zdravkovic Aleksandra Tasic Nada Plavska	Scientific Veterinary Institute of Serbia, Belgrade, Serbia Academy of Beekeeping and Apitherapy of Serbia, Belgrade, Serbia	SACBROOD VIRUS INFECTION OF BEES IN SERBIA



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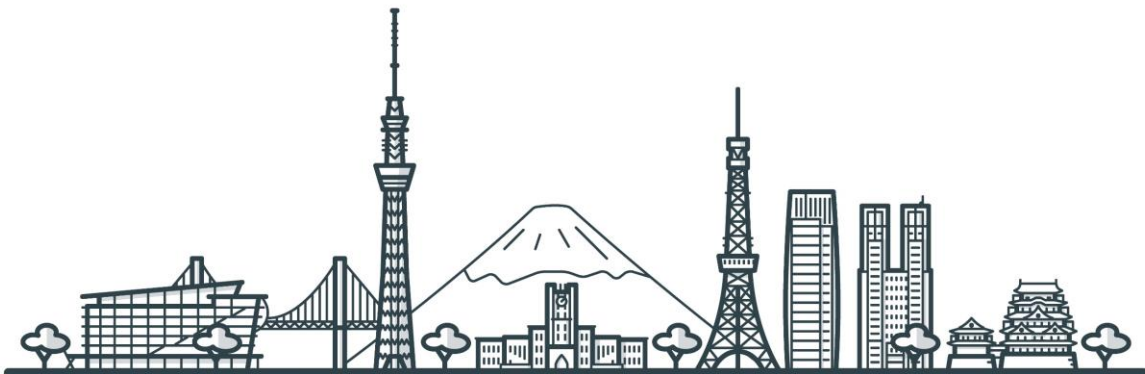
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HEAD OF SESSION: Dr. Bunyamin CICEK

Mehmet Hayrullah Akyıldız Ali Yaşar Zeyrek	University of Dicle, Department of Civil Engineering, Diyarbakır, Turkey	INVESTIGATION OF THE USAGE OF DIYARBAKIR BASALT IN DAM FILLING
Aishah H.O. Al Shehi Gul Ahmed Jokhio Abid Abu-Tair	The British University in Dubai	PREVENTIVE MAINTENANCE USING RECYCLED ASPHALT
Hayat El HAMMI Loubna JABIR Soumya ESSAYEH Mohamed Nor Omar Azougagh Hassan AMHAMDI Abderrahmane El IDRISSE Mohamed ABOU-SALAMA Soufian EL BARKANY	Multidisciplinary Faculty of Nador, Mohamed First University Morocco	FABRICATION OF HYDROXYETHYLCELLULOSE - BASED FLOCCULANT: CHARACTERIZATION, AND FLOCCULATION PERFORMANCE
Dr. Bunyamin CICEK	Technical Sciences Vocational School, Machine and Metal Technologies, Corum, Türkiye	EFFECT OF GRAPHENE ON MICROSTRUCTURE AND HARDNESS PROPERTIES IN MULTI-COMPONENT ALLOYS
Mehmet Aziz SAYAR Assoc. Prof. Dr. Mustafa ULUKAVAK	Harran University	THE EVALUATION OF THE LAND REGULATIONS MADE BY THE DIRECTORATES OF THE CADASTRE IN CONSEQUENCE OF PUBLIC PROPERTIES
Mustafa BİÇER Erkin ALTUNŞARAY	Dokuz Eylül University	INVESTIGATION OF LOW-VELOCITY IMPACT BEHAVIOUR OF CARBON/EPOXY LAMINATED COMPOSITE PLATES AS A BOAT BUILDING MATERIAL
Mehmet Turan Demirci	Selçuk University	INVESTIGATION OF THE EFFECT OF GLASS AND HEMP FIBER- REINFORCED ALUMINUM COMPOSITE SANDWICHES ON EDGEWISE COMPRESSIVE STRENGTH



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HEAD OF SESSION: Major Gheorghe Giurgiu

Athulajayan Ajayan Kochuveetil Srushti Chauhan Catherine Anozie Dr. Gulhan Bizel	Saint Peter's University	PUBLIC SENTIMENT ANALYSIS FOR HIV, HERPES, AND OCD ON THE REDDIT SOCIAL MEDIA PLATFORM
Elchin Aghayev Tapdig Mammadov Zulfiyya Ismayilova	Azerbaijan Medical University	THE EFFECTIVENESS OF LAENNEC IN THE PREVENTION OF ANASTOMOTIC LEAKAGE
Zainab GHOLAMI Assoc. Prof. Dr. Havva SERT	Sakarya University	EVALUATION OF CORONAPHOBIA LEVELS OF INTERNATIONAL STUDENTS STUDYING IN UNIVERSITY DURING THE COVID-19 PANDEMIC PROCESS
Zulfi KADIMOVA	Azerbaijan Medical University	IDENTIFICATION OF ACTIVATION OF LATENT TUBERCULOSIS INFECTION
Prof. Dr. Buket Aksu Hasan Ali Hussein	Altınbaş University	CULTURAL COMPETENCE IN HEALTHCARE
Major Gheorghe Giurgiu Prof. Dr. Manole Cojocaru	Deniplant-Aide Sante Medical Center, Biomedicine, Bucharest, Romania Titu Maiorescu University, Faculty of Medicine, Bucharest, Romania	NUTRACEUTICALS DENIPLANT IN THE NEUROPATHIC PAIN IN DOG WITH SPINAL CORD INJURY
Abdul Hanan Tariq	Lithuanian Sports University, Lithuania	ELECTRICAL STIMULATION IN REHABILITATION PATIENTS WITH FACIAL PALSY
Deema Al Shawan	Imam Abdulrahman Bin Faisal University, College of Public Health, Department of Public Health, Dammam, Saudi Arabia	THE EFFECTIVENESS OF THE JOINT COMMISSION INTERNATIONAL ACCREDITATION IN IMPROVING QUALITY AT KING FAHD UNIVERSITY HOSPITAL, SAUDI ARABIA: A MIXED METHODS APPROACH



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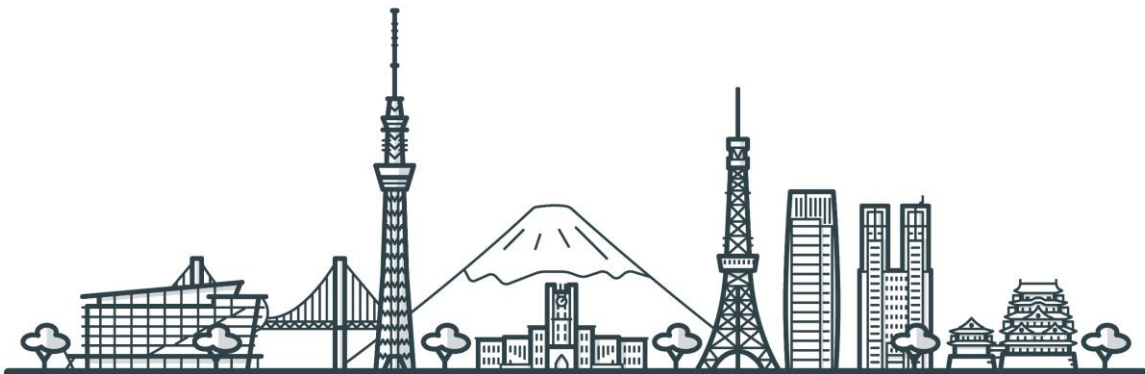
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HEAD OF SESSION: Elnur ALLAHVERDIYEV

Nurad Aghayev	National Aviation Academy	IDEOLOGY OF FEEDBACK
Özlem ALKAN Neslihan KIRAN	Ardahan Üniversitesi	UYGUR-ÇİN SİYASİ EVLİLİKLERİNDE TÖRENLER
Qasimova Aynur Mobil qızı p.ü.f.d. baş müəllim	Azərbaycan Dövlət Pedaqoji Universiteti	METHODS OF TEACHING DIAGRAMS AT SCHOOL
Prof. Dr. Mustafa KARABULUT	Adıyaman University	POPULATION EXCHANGE IN TURKISH NOVEL
Sueda Özbent	Marmara University	SCENES AND FRAMES THEORY IN TRANSLATION
İbrahim Yaşar KAZU Cemre KURTOĞLU YALÇIN	Firat University Ministry of Education, Çubukbey Anatolian High School, Elazığ, Turkey	A LIGHT FOR EDUCATION DURING CORONAVIRUS PANDEMIC: FLIPPED LEARNING MODEL
Dilshoda Mubarakova	Tashkent State Institute of Oriental Studies	TRANSLATION METAPHORS



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Tokyo Local Time: 15⁰⁰-17³⁰



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HEAD OF SESSION: Assist. Prof. Dr. Nasim Kian-Pour

Weam Saed Mohammed Saeed Alyoubi	King Abdulaziz University	MOLECULAR DOCKING AND DYNAMICS STUDY OF NATURAL COMPOUNDS AS TG2 INHIBITORS ASSOCIATED WITH CELIAC DISEASE
Nasim Kian-Pour Ersin Arslan	Istanbul Aydin University	IMPACT OF HYDROCOLLOID-COATING PRE- TREATMENTS ON THE DRYING CHARACTERISTICS, DIFFUSION COEFFICIENT, TRANSPORT AND THERMOPHYSICAL PROPERTIES OF DRIED APPLE
Fehmi SALTAN	Çankırı Karatekin University	PREPARATION OF PVA/PVP/P(AA-co-MA) FILMS REINFORCED WITH GRAPHITE: STRUCTURAL AND THERMAL CHARACTERIZATION
Shatha Alamri	King Abdulaziz University	ELECTRONIC STRUCTURE OF THE LEAD-FREE CHIRAL ORGANIC-INORGANIC PEROVSKITE
Seda Hazer Ayse Aytac	Kocaeli University	DEVELOPMENT OF SMART PACKAGING WITH CURCUMIN TO DETERMINE THE CHANGES IN FOOD QUALITY
Norah Alotaibi	King Abdulaziz University	THE SUCCESSIVE DEHYDROGENATION OF AMMONIA AS A HYDROGEN STORAGE MATERIAL ON NI-BASED NANOPARTICLES: A COMPUTATIONAL STUDY
Ayşe UÇAR Hilal İNCEBAY	Nevşehir Hacı Bektaş Veli University	PREPARATION OF A NANOCOMPOSITE FOR USE IN THE DEVELOPMENT OF AN ELECTROCHEMICAL SENSOR SENSITIVE TO ELECTROSENSITIVE ANALYTES
Hanane Ait Hmeid Mustapha Akodad Mourad Baghour Abdelmajid Moumen Ali Skalli Ghizlane Azizi	Mohamed First University, Morocco.	DSORPTION OF PHENOL POLLUTANTS FROM AQUEOUS SOLUTION USING CA-BENTONITE/ NA- BENTONITE.



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HEAD OF SESSION: Prof. Dr. Kornelija Mrnjaus

Sofija Vrcelj Pamela Grozdanić	Faculty of Humanities and Social Sciences, Croatia	WHY IS STEM A MALE DOMAIN?
Ojo, Cornelius Segun Ph.D Shittu, Ganiyat Adeoti	Ajayi Crowther University	INFLUENCE OF TELEVISION ADVERTISING ON CHILDREN'S CHOICE OF BEVERAGES: A STUDY OF RIBENA AND CAPRI-SUN AMONG PUPILS OF AJAYI CROWTHER UNIVERSITY STAFF SCHOOL, OYO, SOUTHWEST NIGERIA.
SHOA FATIMA	Aligarh Muslim University	THE HISTORICAL SIGNIFICANCE OF UNIVERSITY MUSA DAKRI MUSEUM WITH SPECIAL REFERENCE TO SIR SYED COLLECTION
Hanife EREN Melek ZUBAROĞLU YANARDAĞ	Burdur Mehmet Akif Ersoy University	MENTAL PROBLEMS IN IMMIGRANTS AND THE PSYCHOSOCIAL NEEDS OF IMMIGRANTS
Eva Anđela Delale Kornelija Mrnjaus Lovro Bilić	Institute for Anthropological Research University of Rijeka University of Zagreb	IDENTITY PROCESSING STYLE AND LIFE VALUES OF STUDENTS AND THEIR PARENTS
Prof. Dr. Kornelija Mrnjaus	University of Rijeka, Faculty of Humanities and Social Sciences, Croatia	LISTENING IN EDUCATION
Victoria Q. Paraggua Brillo S. Paje	Philippine Merchant Marine Academy, Zambales, Philippines Don Mariano Marcos Memorial State University, La Union, Philippines	ATTRIBUTES AFFECTING TRAINING INSTRUCTORS' PERFORMANCE IN MARITIME-RELATED INSTITUTIONS: SPRINGBOARD FOR ORGANIZATIONAL DEVELOPMENT INTERVENTIONS
Victoria Q. Paraggua Ma. Nissa C. Espiritu Ellen E. Luna	Philippine Merchant Marine Academy, Zambales, Philippines	THE LIVED EXPERIENCES OF WOMEN LEADERS IN A MALE-DOMINATED WORLD OF WORK: A PHENOMENOLOGICAL STUDY
Yunus EROĞLU Cumhur DEMİRALP Ali Can GÖZCÜ	Hakkari Üniversitesi	MESLEK LİSELERİNDE ÖĞRENCİLERİN GELECEK SEÇİMLERİ ÜZERİNE BİR ALAN ARAŞTIRMASI: HAKKARİ İLİ ÖRNEĞİ



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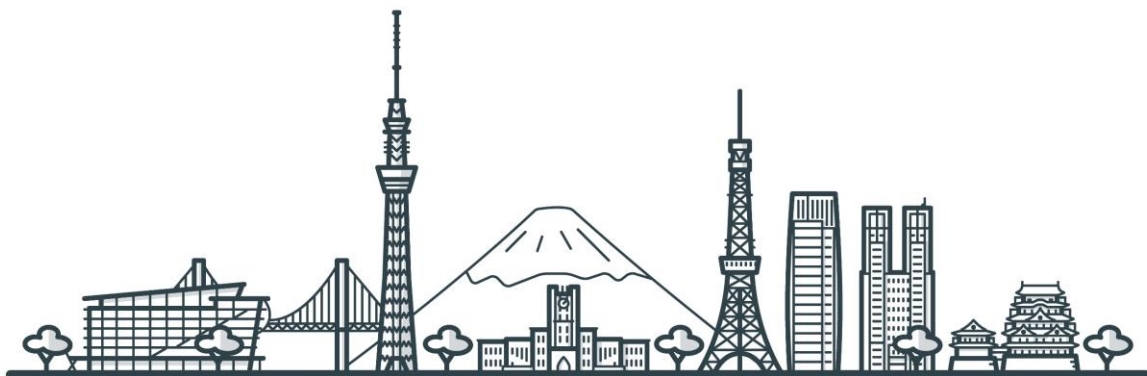
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HEAD OF SESSION: Prof. Dr. Ahmet Niyazi ÖZKER

Prof. Dr. Ahmet Niyazi ÖZKER	Bandirma Onyedü Eylül University	CHANGE EFFECT OF GLOBAL FISCAL RISK FACTORS ON PUBLIC FISCAL POLICIES AND DEVIATIONS IN PUBLIC REVENUES
Gwaison Panan Danladi Mabur Zumbung Danladi Maram Isa Maren Akpan James E.	Department of Economics & Management Sciences Nigerian Police Academy Wudil, Kano, Nigeria	NIGERIA DEVELOPMENT PLANS AND ITS IMPLICATION FOR NATIONAL DEVELOPMENT IN NIGERIA
Dr. K. Praveen	VIT Business School, Chennai, Tamilnadu, India	DOES WORK -FAMILY AND FAMILY-WORK CONFLICTS AFFECT EMPLOYEE COMMITMENT
ABBAS RAHEEM SALIH	Department of Accounting, Plateau State University, Bokkos, Plateau State.	FINANCIAL INNOVATION AS A FACTOR OF POSSIBLE ECONOMICAL DESTABILIZATION: MINSKY'S THEORY
ABBAS RAHEEM SALIH	Faculty of Economics, (RUDN), International Business, Moscow, Russia	STRATEGIC PLANNING FOR THE SUSTAINABILITY OF OIL AND NATURAL GAS RESOURCES IN IRAQ: A STUDY ON MIDLAND OIL COMPANY
Dr. Vijay Singh Prof. Simmi Agnihotri	Himachal Pradesh University	ROLE OF MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT GUARANTEE ACT-2005 TO COMBAT TRIBAL MIGRATION IN HIMACHAL PRADESH: A CASE STUDY OF PANGWALA TRIBE
Esra Demirbaş	İstanbul Yeni Yüzyıl University	E-MARKETPLACES IN TÜRKİYE AND SCRAPE OUT THE REASON FOR THE COMING FAREWELL OF AN OLD ACTOR
Süleyman Özmen	İstanbul Rumeli University	SOCIO-CULTURAL CHANGES CAUSED BY INTERNATIONAL MIGRATION
Ruşen Ergün İrem Bekar İzzettin Kutlu	Dicle University Karadeniz Technical University Mardin Artuklu University	CULTURAL HERITAGE TOURISM AS AN ALTERNATIVE TO COASTAL TOURISM: MERSİN-SİLİFKE
İrem Bekar Ruşen Ergün İzzettin Kutlu	Karadeniz Technical University Dicle University Mardin Artuklu University	EVALUATION OF CONTAINER USE IN ARCHITECTURE ON FLEXIBILITY PARAMETERS



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02.08.2022 | HALL-5



Tokyo Local Time: 15⁰⁰-17³⁰



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HEAD OF SESSION: Dr. Binyam Zigta

Gurel Bozma Nazmiye Gonul Bilgin	Zonguldak Bulent Ecevit University	A NEW TYPE BIVARIATE BERNSTEIN SCHURER OPERATORS
G.P. Ashwinkumar C. Sulochana N.Sandeep	Department of Mathematics, Vijayanagara Sri Krishnadevaraya University, India	EFFECT OF THERMOPHORESIS AND BROWNIAN MOMENT ON 2D MHD NANOFLUID FLOW OVER AN ELONGATED SHEET
G.P. Ashwinkumar C. Sulochana N.Sandeep Dogukan Altıntaş	Department of Mathematics, Vijayanagara Sri Krishnadevaraya University, India	DESIGN AND ANALYSIS OF Y-25 TYPE TRAIN BOGIE CAPABLE OF CARRYING 200 TONS OF LOAD
Ebba (Bullo) Hindebu O. D. Makinde Lemi Guta	--	MODELING HEAT TRANSFER ENHANCEMENT OF FERROFLUID FLOW IN A MICROCHANNEL FILLED WITH A POROUS MEDIUM
Dr. Binyam Zigta	Wachemo University, College of Natural and Computational Science, Department of Mathematics , ETHIOPIA	THE INFLUENCE OF THERMAL RADIATION AND CHEMICAL REACTION ON MHD MICROPOLAR FLUID IN THE PRESENCE OF HEAT GENERATION/ ABSORPTION



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SOCİO-CULTURAL CHANGES CAUSED BY INTERNATIONAL MİGRATION

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Abstract

International migration is the illegal or legal displacement of people. This concept not only provides change and transformation among people but also affects countries socially and politically. Due to its geopolitical position, Turkey is a transit country that fits the concept of migration. Countries have developed and implemented various policies to take advantage of the effects of migration or to reduce its negative effects. For Turkey, which receives immigrants from many countries, Syrian immigrants have special importance especially because of their numbers. Population and spatial expansion related to the admission of Syrian refugees to our country has gained more momentum. Because the refugee population prefers to live in big cities. In addition, the return of refugees arriving in Turkey who do not want or do not want to go to other countries for our country and other countries is an important activity that affects both. This population movement does not matter as much as our country, as well as the political, economic, social, and cultural factors that have the potential to affect the world. The data to be obtained by monitoring refugee mobility for all actors, especially policymakers, is extremely important. Because the common ground of this dynamism is cities, especially metropolitan cities. Studies and projections that need to be revealed regarding economic integration, social cohesion, legal statuses, public policies, and political changes need to be supported by data to be obtained from monitoring refugee mobility. This study has been prepared to obtain general information about the socio-cultural changes caused by international migration.

Keywords: Migration, Urban Development, Urban Livability, Socio-Cultural, Refugee.

ÖZET

Uluslararası göç, insanların yasa dışı veya yasal yer değiştirmesidir. Bu kavram insanlar arasında değişim ve dönüşümü sağlamanın yanı sıra ülkeleri sosyal ve politik olarak da etkilemektedir. Türkiye, jeopolitik konumu nedeniyle göç kavramına uyan transit bir ülkedir. Ülkeler, göçün etkilerinden yararlanmak veya olumsuz etkilerini azaltmak için çeşitli politikalar geliştirmiş ve uygulamaya koymuştur. Birçok ülkeden göç alan Türkiye için Suriye’li göçmenler özellikle sayıları nedeniyle ayrı bir önem taşımaktadır. Suriye kaynaklı sığınmacıların ülkemize kabul edilmesi ile kentsel nüfus artışı ve mekânsal genişleme daha fazla ivme kazanmıştır. Zira sığınmacı nüfus büyük oranda kentlerde yaşamayı tercih etmektedir. Ayrıca Türkiye’ye giriş yapan sığınmacıların geri dönmek istemeleri ya da başka ülkelere gitmek istemeleri de hem ülkemizi hem diğer ülkeleri etkileyen önemli bir hareketliliklerdir. Bu nüfus hareketi ülkemizi olduğu kadar dünyayı da etkileme potansiyeline sahip politik, ekonomik, sosyal ve kültürel unsurlar taşımaktadır. Başta politika yapımcılar olmak üzere bütün aktörler açısından sığınmacı hareketliliğinin izlenmesi ile elde edilecek veriler son derece önemlidir. Çünkü bu hareketliliğin ortak zemini kentler, özellikle büyükşehirlerdir. Ekonomik entegrasyon, sosyal uyum, hukuki statüler, kamusal politikalar, politik değişimlerle ilgili ortaya çıkarılması gereken çalışmalar ve projeksiyonlar, sığınmacı hareketliliğinin izlenmesinden elde edilecek verilerle desteklenmek zorundadır. Bu çalışma sığınmacı hareketliliğinin etkilerini ölçme ve değerlendirmede kriter olarak kabul edilebilecek verileri elde etmek için hazırlanmıştır.

Anahtar Kelimeler: Göç, Kentsel Gelişim, Kentsel Yaşanabilirlik, Sosyo-Kültürel, Sığınmacı

Introduction

In our country, the change of cities due to migration is also the main characteristic of urbanization. It has been argued that migration is almost the main factor in the historical development of cities and social transformation. by Kemal Karpat, aimed at Ottoman cities; The determinations that the social, cultural and ethnological identities of cities can undergo rapid and intense change with migration were made for the Republican period, this time by today's urban scientists, especially Ruşen Keleş.

Migration was the main determinant in the change of cities in the period when economic liberalism was put in the center after 1980. The effects of migration, which change and direct cities, have gained momentum by revealing more intense change in shorter time periods. The process that started with shantytowns has gained a character that reveals and adds small cities to the city in a short period of 10 years in many urban peripheries.

One of the consequences of the change of cities is the increase in the weight of the country's policies in the formation and implementation. Especially in the last 30 years, 2/3 of the population has started to live in cities, forcing general policies to turn into urban policies. Therefore, the increasing administrative weight of the cities requires monitoring the migration, which has become the main change dynamic of the city (Weber, 2003, s. 23). At this point, there are two situations in the relationship between the migration movements originating from Syria and the cities;

At this point, there are two situations in the relationship between the migration movements originating from Syria and the cities. From a social and cultural point of view, the majority of the local population that welcomes Syrian refugees in cities is the first or second generation immigrant population. Although this migration is caused by internal migration and therefore has different dynamics, it can be argued that this situation has an impact on the fact that Syrian refugees do not face inhumane treatment, as they are relatively encountered in other countries.

The second situation is that Syrian refugees, who actually live in rural areas in their own country, in the far peripheries of the city, tend to the cities that are still undergoing changes due to internal migration in our country. Therefore, the migration movement originating from Syria has the feature of being accepted to a country that offers access to socio-economic change and urban living conditions as well as its political reasons.

In order to monitor this change, for which the hypothetical-hypothetical data are not sufficient, field studies should be increased. In particular, it is necessary to determine whether the urban livability levels will be as effective as the political and security level in the description of both Turkey and Syria areas and the return decisions of Syrian refugees; level of access to urban liveability is important (Weber, 2003, s. 27).

The perception of urban livability on both sides of the border and the ratio of the decision to return or stay in Turkey, which can be associated with this, become known, on the one hand, in the reconstruction and resettlement works in Syria, on the other hand, it is created for Syrian refugees who can decide to stay in Turkey. It will help create the necessary integration and harmonization policies (Deniz, 2014, s. 178).

Determining the perception of urban livability will also benefit from another aspect: A new socio-geography has emerged between Turkey and Syria, which has become each other's hinterland, with the Syrian crisis (Çabalar, 2001, s. 41). In addition to the refugees, whose number is approaching 5 million, the population in contact with the refugees has emerged in the cities where they are densely settled. The interaction between the two population clusters will affect the orientation and profile of future cities in Turkey and Syrian cities that will emerge with the return in Syria.

The research and projections on economic integration, social cohesion, legal situation, public policy, political change, which we have made titled "Socio-Cultural Changes Caused by International Migration, The Case of Syrian Refugees" have been supported by data obtained from refugee movement

monitoring. In this study, it is aimed to obtain data that can be accepted as a standard for measuring and evaluating the impact of refugee movements.

Urban Development and Urban Livability Concept

Since World War II, the population living in cities has started to exceed the population living in rural areas in the world. This situation, which is also seen in our country, has turned into the reality of many countries in the world, leading to the fact that 2/3 of the population lives in cities before reaching the first quarter of the 21st century.

One of the important topics of the political and academic agenda on the city in recent years is the concept of urban livability. Cities begin to define most human settlements as populations in countries; In sustainable development studies, it is necessary to consider the concept of urban livability throughout the country and internationally.

The concept of urban livability and its discussions stem from the fact that the city and society are the main factors that complement each other, and that it requires the development of advanced urban functions that will meet the socio-economic development of the inhabitants of the city (Kaygalak, 2009, s. 11).

The concept is also considered important in terms of removing the physical and social barriers that make it difficult for the city's economy, social life and finally the welfare of the city's residents to be presented to the access of its residents. Today, indicators such as urban livability, transportation, education, safety, health, environmental quality and many socio-economic and cultural variables are taken into account; It is a subject that different sciences, disciplines, methods and policies deal with.

The definition of the city made by Weber is still up-to-date. According to him, the city transforms into cities as long as a settlement unit has elements such as trade, shopping, law, employment and management; their quality and activities also reveal the difference and identity of the city (Weber, 2003, s.33).

Jane Jacobs, one of the first authors to bring the theory of cities as livable spaces, emphasized that cities should be living and lively places and stated that the current urban order can be harmful to communities by leading them to live an isolated life in unnatural environments. Jacobs explains that the physical, social and economic structuring of cities should be accepted as places that can meet the needs and expectations of the society and where people can easily realize their human relations. (Armstrong, 1977, s.47).

Both the livability elements and the level of meeting the expectations in the urban social life are directly related to the patch quality expectation phenomenon. The concept of livability and urban quality are intertwined concepts. These two concepts evaluate the possibilities of urban life on different basis. Quality of life, beyond meeting the basic needs of the citizens, expresses their differences and the increasing expectations of the residents. Ruşen Keleş, Livability refers to the spatial, social and environmental characteristics and quality that will contribute to the individual and collective well-being of a person and the satisfaction they will feel from being a resident of that settlement. Research studies on livability are carried out using indicators determined for the research area and sub-variables related to them. Indicators used in livability studies are generally grouped under headings such as health, education, transportation, economy and environment. The phenomenon of livability leads to the definition of the city by the immigrants and to get their thoughts on the livability of the city. Liveability indicators, as well as the essential needs of human beings; It is the gathering of the factors that are effective in reaching the happiness of life. Health, education and security services are used as indicators of livability in the study. The rapid transformation and movement of urban space is two-dimensional; First of all, the transformation in cities reveals a complex sustainable development profile from local to national and global. The reason for this is the identities and relations that are affected and redefined by the changes in social, cultural, economic and technological fields (Koçak ve Terzi, 2012, s.164).

Secondly, it is the prominence of urban spaces in the production of public policies and services that can meet this change. The main problem is that the rate of formation of policies towards these spaces lags behind the pace of the increasing problems of cities. Governments' solution-oriented policies and

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service productions have become dependent on the mechanisms they have established for monitoring and cooperating with the society, starting from the moment when problems and demands arise.

As a matter of fact, at the Habitat II Istanbul Human Settlements Summit (1996), livability concepts and quality of life criteria were determined in terms of social demands and traceability. This list has been updated in the following periods. The table below reflects the principles and values agreed upon in the world.

Table 1: Social Demands and Livability Concepts in terms of Traceability

Problem Area Values	Problem Area Values
Ecology	Noiseless and clean environment, air and water quality
	Ecology and Economy balance
Land Use	Self-contained and uncommon land
	Coexistence of living and working space
Health	Protection of public health
	Creation of healthy living spaces
	Accessible, healthy and sustainable food and agricultural products for all
Public Spaces	Ensuring adequate public space for all
	Affordable, comfortable and accessible housing
	Ensuring the opportunity to participate in decision-making processes
	Structure suitable for diversity, disadvantaged and needy
	Preventing segregation and isolation of people
	Respect for the knowledge, experience and opinions of citizens
Development	Respect for social, sexual and ethnic identities
	Protecting local business enterprises and local production patterns
	Ensuring an economic environment that can create job opportunities, encouraging entrepreneurship
	Providing capacity building opportunities for all
Education / Culture	Promoting local development models
	Ensuring education and social integration
	Respect for cultural identities
	Free socializing spaces for children and young people
Security	Accessible and affordable education for all
	Security for the protection of fundamental human rights and freedoms
	Making cities attractive and safe for all age groups
Transport	Ensuring individual security
	Providing cheap, comfortable and safe transportation opportunities for everyone
	Increasing accessibility and service quality for people with disabilities
Design	Ensuring easy access to urban public services
	Local climatic conditions and use of materials
	Transferring traditional architectural styles to future generations
	Supporting folk arts

Source: BM İnsan Yerleşimleri Konferansı Habitat II, Hedef, İlkeler ve Taahhütler PDF, (chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fwebdosya.csb

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Materials and Methods

The admission of the Syrian refugee population to our country necessitates the monitoring of three different movements, mainly depending on the urban space. This situation can also be called three-stage mobility.

The first mobility emerges with the addition of GKS (Temporary Protection Status) Syrians to the urban population and space increase process of our country, which has gained momentum in recent years. It can be seen that GKS Syrians started to live in urban areas from the moment they came to our country, and they prefer urban areas more than rural areas (Gürel Üçer, Özkazanç ve Atılğan, 2018, s. 612).

The second mobilization is the population clusters, which emerged as a dominant force in the Syrian issue with the results of the military efforts, escaped from certain operations and reached the border regions, stayed here and did not enter Turkey. These groups still live under refugee conditions in villages, towns and small cities of Syria, where public order can be partially maintained. It is aimed that these population groups do not enter Turkey and thus the current number of Syrian refugees in Turkey does not increase further.

The third mobility is the return of asylum seekers who have entered Turkey and stayed for a certain period of time, or to go or attempt to go to a third country.

All three mobility situations are at a level that can affect the world as well as Turkey; political, economic, social and cultural elements. Studies and projections about economic integration, social cohesion, legal statuses, public policies, political changes must be supported by the data obtained from the monitoring of the three mobility situations. The data that can be obtained by monitoring these mobility areas is important for all actors, especially policy makers. Because the common space of the three mobility processes is the city (Tuna, 2014, s. 33).

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Migration became the main determinant in the change of cities in the period when economic liberalism was centered after 1980 (Weber, 2003, p. 78). The effects of migration, which change and direct cities, have gained momentum by revealing more intense change in shorter time periods. This process, which started with shantytowns, has gained a character that reveals and adds small cities to the city in a short period of 10 years in many city peripheries.

One of the results of the change of cities is the increase in the weight of the country's policies in the formation and implementation. Especially in the last 30 years, 2/3 of the population has started to live in cities, forcing general policies to turn into urban policies. Therefore, the increasing administrative weight of the cities requires monitoring the migration, which has become the main change dynamic of the city. At this point, there are two situations in the relationship between the migration movements originating from Syria and the cities;

Sudden waves of immigration, the first of which started in 2012 with the appearance of mass influx, has in fact turned to cities that have undergone intense changes with immigration and have migrated. From a social and cultural point of view, the majority of the local population that welcomes GKS Syrians in cities is the first or second generation immigrant population. Although this migration is caused by internal migration and therefore has different dynamics, it can be argued that this situation has an impact on the fact that GKS Syrians do not face inhumane treatment as they are encountered in other countries.

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in our country. Therefore, the migration movement originating from Syria has the feature of being accepted to a country that offers access to socio-economic change and urban living conditions as well as its political reasons. In order to monitor this change, for which the hypothetical-hypothetical data are not sufficient, field studies should be increased. In particular, the description of urban livability levels in both Turkey and Syria and whether GKS will be as effective as the political and security level in the return decisions of Syrians need to be determined; The level of access to urban liveability is of particular importance.

The perception of urban livability on both sides of the border and the ratio of the decision to return or stay in Turkey, which can be associated with it, become known, on the one hand, in the reconstruction and resettlement works in Syria, on the other hand, the creation of GCS for Syrians who can decide to stay in Turkey It will help create the necessary integration and harmonization policies (Çabalar Bayrak, 2005, s. 27).

Determining the perception of urban livability will also benefit from another aspect: A new socio-geography has emerged between Turkey and Syria, which has become each other's hinterland, with the Syrian crisis. In addition to the refugees, whose number is approaching 5 million, the population in contact with the refugees has emerged in the cities where they are densely settled. The interaction between the two population clusters will affect the orientation and profile of future cities in Turkey and Syrian cities that will emerge with the return in Syria.

Selected Indicators for Research

Questionnaire method was used in the research and questions were asked from 9 question groups (problem areas). The population of the study consists of people living in 8 districts in Istanbul, the majority of which was formed by immigration. While determining the sample size of the study, the Syrian refugee population size and immigration density in the districts were taken as basis. A Pilot Test was conducted on 40 subjects in order to test the applicability of the questionnaire and to identify any possible problems. The data used in the research were obtained through a questionnaire. Closed and open-ended questions were used in the questionnaire form. The collected data were analyzed through the SPSS 17.0 statistical program (Statistical Package for Social Sciences) and frequency analysis, one of the descriptive statistics, was used in the analysis of the data. Detailed data were tried to be obtained by using face-to-face interview method.

Survey Research Field

8 districts were determined as the research area. There is a research area that makes up 22% of the population of Istanbul, which is 15,067,724. The number of Syrian refugees residing in the area is 26% of the number of refugees in Istanbul. The ratio of GCS Syrians in the total population of Istanbul is 3.7%. 3 districts within the research area; Avcılar 5.2%, Esenler 5.9% and Küçükçekmece 5.8% host Syrian refugees, which is much higher than the general rate of Istanbul. Beylikdüzü has 2.4%, Büyükçekmece 2.6% and Silivri 1.5%, which is far below the rate of Syrian refugees in the total population of Istanbul.

It is seen that the rate of Syrian refugees in the total of 8 districts is 4.29%. This rate is more than half the rate of asylum seekers in the total population of Istanbul. The characteristic feature of the districts is that they are settlements that have experienced intense migration mobility in the literature and continue to live. Although they are considered within the peripheral area of Istanbul, they are residential areas that emerged with the motive of "immigrating to Istanbul". Silivri and Çatalca counties, on the other hand, are in the first two places in Istanbul's district land size ranking. In the 1/100,000 scale Istanbul Environmental Plan and Plan Report prepared by the Istanbul Metropolitan Municipality, with the land sizes of Çatalca 1043.58 km² and Silivri 862.54 km², Istanbul is shown as the spatial development projection area.

The plan foresees the spatial development according to the function principle. For example, it is stated that "information and communication-oriented attraction centers in Silivri on the European side, Kartal and Tuzla-Orhanlı on the Anatolian side, where the infrastructure of the information economy will be the driving force in the structural transformation process of the city of Istanbul..." Therefore, as well as

limitations on different physical scales regarding the population growth rate in sample settlements, growth through qualified migration is also envisaged. In this planning projection, the status of the Syrian refugee profile (4.29%) gains importance. An area-sized research will be conducted that will affect the orientation of Istanbul (and our country due to the role of Istanbul) in terms of urban livability. The size of the refugee population in the districts is at the rates that should be taken into account in the studies on livability targets. Therefore, the perspectives of the asylum seekers, who are urban residents, on the city and the livability of the city on the basis of the district they live in, are valuable due to the prolongation of asylum and the related residence period. Again, the effect of these opinions on the decisions of asylum seekers to return to their countries should be examined. The opinions of the refugees in the area regarding the livability of the city stem from their first urban experience outside their country, whether it affects their decision to return or not. Accordingly, GCS Syrians gain an experience of urban life in Istanbul districts, which bear with immigration, and it is necessary to consider that they will carry these experiences to the cities of their own countries on their possible return. In this case, it was planned to obtain data that could be used to develop a projection on the orientation of cities, most of which are close to the Turkish borders, after the return.

Istanbul Survey Research Area

In Istanbul, where the first municipality-like organization was established under the name of Şehremaneti in 1855, municipal services were provided by the Governor's Office for a long time after the Republic. With the municipalities law numbered 1580 enacted on April 3, 1930, Istanbul was divided into a total of 16 branches, 10 of which were included in the provincial municipality borders. With the same law, terms such as şerhmaneti and şerhmini were no longer used. In Istanbul, which was managed in the same way until the 1950s, the first changes were experienced in the administrative borders with Şişli in 1954 and Zeytinburnu becoming a district in 1957. New changes were seen in the following years due to the ever-expanding city limits and increasing populations. Gaziosmanpaşa in 1963; Büyükçekmece, Kağıthane, Pendik and Ümraniye in 1987; Küçükçekmece in 1989; Bayrampaşa in 1990, Avcılar, Bağcılar, Bahçelievler, Güngören, Maltepe, Tuzla, Sultanbeyli in 1992; In 1993, Esenler was separated from the districts they belong to and became independent districts.

GCS Syrians in Istanbul tend to reside in the districts that have been formed in the last 50 years due to internal migration. These districts provide them with advantages such as casual or unskilled work in terms of job opportunities.

Finally, in 2008, Arnavutköy, Ataşehir, Başakşehir, Beylikdüzü, Çekmeköy, Esenyurt, Sancaktepe and Sultangazi became districts, and there are 39 districts, 782 neighborhoods, and 152 villages within the province of Istanbul. All districts were included in the service area of Istanbul Metropolitan Municipality with the law published in the Official Gazette on July 22, 2004. A survey was conducted in 11 districts of Istanbul. These counties are; Avcılar, Beylikdüzü, Bağcılar, Gaziosmanpaşa, Kağıthane, Esenler, Sancaktepe, Şişli, Esenyurt, Küçükçekmece and Sultangazi districts. Asylum-seeker subjects will be determined within the scope of the Project on Refugee Protection Desks in Local Governments carried out by WALD. Collaboration with district municipalities will be made for subject groups consisting of residents. The districts surveyed within the province of Istanbul are shown in bold in the table below.

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Table 2: Population and Number of Syrian Refugees in Istanbul Districts

District	Number of Syrians	District Population	%
Adalar	194	16.119	1,2
Arnavutköy	20.748	270.549	7,7
Ataşehir	1.670	416.318	0,4
Avclar	22.744	435.625	5,2
Bağcılar	43.784	734.369	6
Bahçelievler	20.599	594.053	3,5
Bahçelievler	20.599	594.053	3,5
Bakırköy	2.548	222.668	1,1
Başakşehir	30.735	427.835	7,2
Bayrampaşa	12.799	271.073	4,7
Beşiktaş	322	181.074	0,2
Beykoz	2.265	246.700	0,9
Beylikdüzü	7.826	331.525	2,4
Beyoğlu	13.773	230.526	6
Büyükçekmece	6.461	247.736	2,6
Çatalca	498	72.966	0,7
Çekmeköy	2.686	251.937	1,1
Esenler	26.378	444.561	5,9
Esenyurt	33.937	891.120	3,8
Eyüpsultan	12.537	383.909	3,3
Fatih	35.763	436.539	8,2
Gaziosmanpaşa	20.598	487.046	4,2
Güngören	14.803	289.331	5,1
Kadıköy	756	458.638	0,2
Kağıthane	16.535	437.026	3,8
Kartal	2.062	461.155	0,4
Küçükçekmece	44.523	770.317	5,8
Maltepe	2.594	497.034	0,5
Pendik	5.759	693.599	0,8
Sancaktepe	14.041	414.143	3,4
Sarıyer	2.040	342.503	0,6
Silivri	2.762	187.621	1,5
Sultanbeyli	23.486	327.798	7,2
Sultangazi	36.553	523.765	7
Şile	193	36.516	0,5
Şişli	17.760	274.289	6,5
Tuzla	3.250	255.468	1,3
Ümraniye	17.282	690.193	2,5
Üsküdar	2.311	529.145	0,4
Zeytinburnu	29.079	284.935	10,2

Source: GİGM, http://www.goc.gov.tr/icerik3/ikamet-izinleri_363_378_4709 (Erişim Tarihi: 20.01.2021)

Researched Districts

Table 3: Population and Parameters Based on the Research

DISTR ICT	Numbe r of Syrian GKK Asylum Seeker s	Popula tion (2019)	Propor tion in District Popula tion (%)	The Ratio of the Numbe r of Syrians in the District in the Total of the Resear ch Area (%)	((+)(-) 0.008 sampli ng error) Target Questi onnair e	Missin g Numbe r of Survey s	Numbe r of Aband oned Survey s	Total Survey Study	Numbe r of Survey s Taken into Evalua tion
Avcıla r	30.021	436.89 7	7	5,86	58	9	6	49	43
Beylik düzü	8.302	789.63 3	1	1,62	16	5	9	21	12
Bağcıl ar	79.305	737.20 6	11	15,48	154	11	28	142	114
Gazios manpa şa	37.362	487.77 8	8	7,29	72	6	13	67	54
Kağıth ane	36.640	442.41 5	8	7,15	71	13	5	58	53
Esenle r	58.342	446.27 6	13	11,39	113	13	16	100	84
Sancak tepe	16.445	456.86 1	4	3,21	32	6	2	26	24
Şişli	5.705	365.57 2	2	1,11	11	0	3	11	8
Esenyu rt	127.21 0	957.39 8	13	24,83	247	32	31	214	183
Küçük çekme ce	49.749	789.63 3	6	9,71	96	11	14	86	72
Sultan gazi	63.331	537.48 8	12	12,36	123	21	10	101	91
DISTR ICT	512.41 2	6.447.1 57	8	100	993	117	137	876	739

Application Time and Questionnaire of the Research

Questionnaire

Syrians: 22 June 2019 – 28 August 2019 (CAPI – Computer-assisted face-to-face survey method)

Sample, Confidence Level and Interval

According to the Address Based Population Registration System (ADNKS), the average household size in the survey of Turkish society's opinions about Syrians was 3.35 people in 2019. Household sizes in the surveyed districts vary between 2.7 and 4.1. The average household size in the research area was 3.6. The number of households is 83 million 154 thousand 997 people $\div$ 4.1 = 20.281.706 in 2019 living in the country. Based on these data, the sample size was calculated as 1014 with a confidence level of 95% and a confidence interval of ± 1.88 .

Table 4: Istanbul - Research Area Districts Household Sizes (2019)

<i>County Name</i>	<i>Average Household Size</i>
Avcılar	3,5
Beylikdüzü	3,4
Bağcılar	4,0
Gaziosmanpaşa	3,6
Kağıthane	3,3
Esenler	3,8
Sancaktepe	3,8
Şişli	2,7
Esenyurt	3,7
Küçükçekmece	3,5
Sultangazi	4,1
Research Area	3,6

Sample Size

□□ = 0.05 Sample Sizes for (Yazıcıoğlu ve Erdoğan, 2004, s. 47), (Çömlekçi, 2001, s.33).

Table 5: Sample Sizes

Universe Size	+- 0.03 sampling error (d)			+-0.05 sampling error (d)			+-0.10 sampling error (d)		
	p=0.5	p=0.8	p=0.3	p=0.5	p=0.8	p=0.3	p=0.5	p=0.8	p=0.3
	q=0.5	q= 0.2	q=0.7	q=0.5	q= 0.2	q=0.7	q=0.5	q= 0.2	q=0.7
100	92	87	90	80	71	77	49	38	45
500	341	289	321	217	165	196	81	55	70
750	441	358	409	254	185	226	85	57	73
1000	516	406	473	278	198	244	88	58	75
2500	748	537	660	333	224	286	93	60	78
5000	880	601	760	357	234	303	94	61	79
10000	964	639	823	370	240	313	95	61	80
25000	1023	665	865	378	244	319	96	61	80
50000	1045	674	881	381	245	321	96	61	81
100000	1056	678	888	383	245	322	96	61	81
1000000	1066	682	896	384	246	323	96	61	81
100 Million	1067	683	896	384	245	323	96	61	81

Based on this table, the number of sample subjects within the limits of +-0.003 sampling error in the study is given in the table below.

Table 6: Number of Subjects Over the Sample

DISTRICT	Number of Syrian GKK Asylum Seekers	Population (2019)	Proportion in District Population (%)	The Ratio of the Number of GKS Syrians in the District to the Total of the Research Area (%)	((+)(-)0.008 sampling error) Target Questionnaire	Missing Number of Surveys	Number of Abandoned Surveys	Total Survey Study	Number of Surveys Taken into Evaluation
Avclar	30.021	436.897	7	5,86	58	9	6	49	43
Beylikdüzü	8.302	789.633	1	1,62	16	5	9	21	12
Bağcılar	79.305	737.206	11	15,48	154	11	28	142	114
Gaziosmanpaşa	37.362	487.778	8	7,29	72	6	13	67	54
Kağıthane	36.640	442.415	8	7,15	71	13	5	58	53
Esenler	58.342	446.276	13	11,39	113	13	16	100	84
Sancaktepe	16.445	456.861	4	3,21	32	6	2	26	24
Şişli	5.705	365.572	2	1,11	11	0	3	11	8
Esenyurt	127.210	957.398	13	24,83	247	32	31	214	183
Küçükçekmece	49.749	789.633	6	9,71	96	11	14	86	72
Sultangazi	63.331	537.488	12	12,36	123	21	10	101	91
Research Area	512.412	6.447.157	8	100	993	117	137	876	739

Research Methodology

Istanbul Rumeli University Global Policies Application and Research Center conducted field research in 2019 with the support of the World Academy of Local Government and Democracy (WALD). The aims of the research are defined as follows:

Determination of the definitions made by the citizens of the Syrian state but living with the status of compulsory asylum in Istanbul, to the phenomenon of urban livability, with a priority of 15-99 years;

- ✓ Their views on staying in Istanbul and Turkey in terms of urban livability;
- ✓ In the context of urban livability, the behavior, land and tendencies that show their determination to live in Istanbul districts were tried to be understood by the answers they gave to the survey questions.

A survey was conducted in the offices of the Refugee Support Unit, which was established within the scope of the "Organization of Local Initiatives in the Works for Migrants and Testing of Experiences-Settlement of Refugees" project carried out by the World Academy of Local Government and Democracy, WALD, in cooperation with district municipalities.

MIGRATION MOBILITY

Migration and Asylum

Migration is the most widespread human mobility that has continued from the ancient times of history to the present. It can be said that migration is a sign of vitality, as it is seen in almost all living things, including humans. Therefore, there is hardly any vital place or type of life that the act of migration does not take place or affect. Mankind has not given up on migration mobility today, but has been involved in migration processes in different ways for different reasons. Today, migration has become an action that can be considered interplanetary beyond being just an intraplanetary action.

There are many different causes and types of migration. Like every living thing, human beings have to live in a place. The suitability of this place depends on the survival of the person, his healthy life, and the possibility of his mental and physical activities that can be realized.

However, like all living things, human responds to the possibilities that space cannot provide by transforming or transforming. If the space is suitable for transformation, if it can provide the necessary resources, it can be transformed into a more livable place by people. A new space emerges with the architecture, profession and arts that it has created by making use of the climate, soil, water and other reserves of the space.

Sometimes, a person manages to become harmonious with the space that the space cannot provide and that he cannot change with physical methods, by transforming himself. For example, being compelled to live in a desert or steppe or in the poles can eventually create forms in the human body that will adapt to evolutionary changes.

The livability of people in the space does not always depend on the adaptation of the space with its climate and other characteristics. Even in cases where harmony with the space can be achieved naturally or technologically, livability may be interrupted or livable conditions may disappear.

Historically, the competition that human beings have lived among themselves since their existence has eliminated many places and livability conditions where livability can be achieved. War and conquests are at the forefront of these human causes. Many communities have resorted to wars and conquests throughout history in order to obtain more suitable places to live without giving up their cultural and emotional identities.

Today, new places are tried to be obtained through wars. The essence of such initiatives is the desire to live in a place with better facilities without giving up the self-values of the place such as language, belief and folklore. This condition sometimes reaches the point of ignoring and destroying the architectural and other human values revealed by the ancient society of the space obtained through war. So much so that countless city ruins can be seen in almost every corner of the world, from the Neolithic Age, which is considered to be the settled life of human beings and the emergence of the first cities. Most of them have been destroyed by wars and conquests, and in fact, it shows that this road is not a valid method that increases livability for the new communities who have conquered the place by war or conquest, as they think.

In the event that the livability conditions become difficult, interrupted or disappear in the place where human beings live, the first attempt is to resist. Resistance can be realized through methods such as adapting to this new situation, trying to produce technological solutions that can eliminate the natural or artificial obstacle. But in cases where this resistance could not be achieved or sustained, the most important reaction of mankind has been migration.

Migration is an action based on instinctive or mental decisions that human beings, whether individual or community, display in order to access the livable conditions they have designed. The reflex of avoiding risks or the awareness of places that offer livability in better conditions is the main motivation

for migration. From this point of view, every migration decision is relatively compulsory, indispensable. However, in order to make a formal definition of migration, it must be classified. With this classification, it becomes easier to make the operational and factual characterization of migration.

Two branches of science come to the fore in the definition and classification of migration. The first is what is done by Sociology, as migration is human and community behavior. On the other hand, especially after the Industrial Revolution, immigration has been rapidly studied by the science of law. Because every act of migration affects the rights and responsibilities in private and public spheres, and it has to be evaluated in terms of public order. One of the international sources that define and try to regulate migration is the International Migration Law Dictionary of Migration Terms published by the International Organization for Migration (IOM). According to the dictionary, migration and its types are defined as:

“The movement of a person or group of persons across an international border or within a State. It is the population movements in which people are displaced regardless of their duration, structure and reason. This includes the migration of refugees, displaced persons, economic migrants, people moving for different purposes such as family reunification.”

Terminology of Immigration

Migration has a terminology in which causes, places and parties are defined and named in terms of both the individual and the society. this terminology is essential to understanding such a common but complex phenomenon as migration. Despite this necessity, it is seen that the proper use of terms is not taken into consideration in practice. The first distinction of migration terminology is causal. After causality, the duration of migration and then its spatial side come to the fore. Finally, there are terms related to the parties and size of the migration.

Migration and Causality

Migration is the act of leaving a place and, like every action, it is based on a reason. It is not possible to limit this reason with the will of the decision maker. According to the causality distinction, the types of migration are as follows.

Voluntary Migration - Forced Migration

Events leading to migration can be based on pressure. This pressure can be caused by social reasons such as exposure to violence, or it can be based on the disappearance of living conditions in the region as a result of natural events and disasters. In this case, “forced migration” is in question. However, the phenomenon of “voluntary migration” arises when it only aims to access better living conditions, without any vital threat or limitation. One of the theories based on determining the causality of migration is the push-pull model. According to this model, the factors that cause leaving the country are considered as push factors, while the factors that cause moving to a new country and living there are considered as pull factors.

Temporary Migration - Permanent Migration

One of the first scales in defining and classifying the phenomenon of migration is time. It has been considered important to know how long it will take for the act of migration, that is, to move from the place where one lives to the place where one wants to live. The reason for this is the risk of loosening or even breaking the social and legal ties with the allocated space in the event of a permanent migration. In this case, there will be fundamental changes in the allocated space, and in most of these changes, the return conditions of the individual or community will differ. On the other hand, the length of stay in the migrated or settled place will lead to changes in this new place as well, and the relations between the former residents and those who migrated may need to be interpreted and rearranged socially and legally.

In short-term migrations, the change in both places will be temporary, and palliative tools and methods may be sufficient in regulating social or legal interaction. To give a concrete example; The first issue where the scale of continuity – temporality is important is housing. A temporary migration will continue to be assets that do not require the sale of the house left in the reserved area, and that can be held at the time of the claim of legal rights over the house and the return. However, continuous immigration has

made this residence; It turns it into an asset that can no longer be claimed, that it can be sold, that is used by others against the will, that becomes difficult to find when returned.

The same problem can be in question in terms of citizenship rights. Many states characterize long-term migration as a decision to leave the homeland and renounce citizenship ties. However, these states can accept that citizenship bonds are not affected in temporary migrations; tax does not exempt the immigrant from duties such as military service. There is no agreed time between states on the duration of migration in the international arena. However, a period of 1 year is mentioned in the texts related to migration in the United Nations acquis, and this period has been accepted in the states and scientific literature as customary.

Voluntary Migration

In general, migration is defined as a population group living in a geographical area leaving their place of residence for different reasons. This separation may be temporary or permanent, as well as optional or compulsory. Coercion can also be based on natural or social-political events.

Another distinction made for immigration is made in terms of the acceptability of immigration in terms of states. Accordingly, if there is a question of immigration with the permission of a state, regular migration; Movements outside the regulatory norms of the sending, transit and receiving countries are considered irregular migration. The important side of irregular migration is the absence of documents such as passports, transit documents, or the absence of approval or visa. The immigrant tries to cross the border illegally.

One of the important aspects of migration in terms of its humanitarian dimension is its relation to national security. Most migration movements are due to the fact that a population group does not feel safe in their own country. On the other hand, in the country that accepts immigration, the immigrant is also a subject in terms of security. It is constantly discussed how safe the immigrant feels in the receiving country or the meaning of the immigrant for the order and security of this country.

Migration is also a livability issue. From a sociological point of view, there is a process in which livability has become more or less controversial since his life in his own country. Therefore, the partial or complete inability to provide livability can provide scales that should be considered in terms of the emergence of migration and migration management. This is also the case in migration movements, where the return conditions of IDPs are discussed. In cases where livability cannot be ensured, migration is inevitable and migration management becomes difficult, and return conditions cannot be mentioned.

In order to understand the relationship between migration and livability, it should be emphasized that the concept of livability is a literature concept. The 17 goals for development determined by the United Nations also explain the criteria for livability. Accordingly, the UN is leading the efforts to realize these 17 goals, as "Sustainable Development Goals (SDGs), in other words, the Global Goals, a universal call to action to eradicate poverty, protect our planet and ensure that all people live in peace and prosperity". Ensuring these conditions is important in terms of ensuring the return conditions of millions of people living in Turkey and other countries.

Repatriation is a phenomenon described in the literature. In international documents; The right of refugees or prisoners of war to return to their country of origin (Definition and conditions are set in the 1949 Geneva Conventions and 1977 Protocols, the Regulation on Respect for Laws and Customs in Land Wars Supplementary to the 1907 Fourth Hague Convention. According to these documents, returning is an individual's personal right. .

As important as the availability of livability criteria in the immigrant's decision to return, who will decide whether these conditions exist or not is another controversial issue. The migrant cannot be compelled to make a decision to return, even when the existence of livable conditions is clear and present. The principle of international refugee law that prohibits states from returning refugees to countries or borders where their life and freedom may be threatened in any way. The principle of non-refoulement is seen as part of customary international law. Another regulatory area that allows for return is the readmission agreements between states. (readmission agreement) These agreements, either as an individual's choice or as a decision of states, complement immigration management legislation. Because

migration management means a planned approach to the development of policies, legal and administrative regulations that will address key issues related to migration, as well as institutional arrangements.

One of the handicaps that immigrants face in the migration process is access to a reasonable “livability” condition in a “safe country”. The definition of a safe country as a place where livability can be ensured in the international arena is made by the UN. The UN considers the safe country in two categories. The first category is the safe country of origin (Safe Country of Origin), where conditions leading to refugees are not assumed; the second refers to the safe country of asylum seekers (Safe Country of Asylum). In both categories, an evaluation should be made in terms of livability scales, especially life safety.

Migration and Space

Migration is the act of leaving one place and continuing to live in another. Most of the time, the travel between these two places requires being in other places. Therefore, the need for terminological distinction of spaces arises in the spatial description of migration. Accordingly, it is possible to define the places that can be mentioned in the act of migration as “source”, “transition” and “arrival”. This situation has been subjected to a national distinction in the literature.

Source (Source Country) Survey Research Field

Migration is a process that starts with the abandonment of a place with the intention of settling in a certain place. This means that the survivors may have migrated here from another place a short or long time ago, or they may be the inhabitants of this country that can be considered "native" and cannot remember where or when they came from. Regardless of this situation, it is defined as a "resource" that is settled for a short or long term and decided to leave.

Transition (Transition Country)

In the process of carrying out the migration action, it may not be possible to directly reach the desired destination from the source. Migrants often direct the act of migration towards a specific goal. However, in most migration movements, it is necessary to find another transit country for a short or long term in order for the migrant to reach his destination. For a short or long term, the transition to be made in order to pass to the targeted country is called a transit country, as defined in the international literature. Transit migration, which is considered as a sub-category of irregular migration, defines the state of being in transit countries. The sensitive side of migration mobility in the transit country, which is also called a transit country, is the possibility that temporary migration will always turn into legal or illegal permanence.

Arrival (Destination Country or Destination Country)

Migration is a process that ends when the destination is reached after the living has been abandoned. As long as the immigrant does not decide to migrate again, he aims to live in this new place and even to keep the new generations alive here. It can be accessed directly from the source as well as its transition can be used.

Migration and Size

The number of people involved in migration mobility is one of the scales used in the categorization of migration. Accordingly, the realization of the mobility by a single person or a large number of people is accepted as a migration divider and a distinction is made between "individual" or "mass". Individual migration (individual migration) has been defined as “the situation in which people migrate individually or with their families”. “Sudden movement of people in high numbers” is defined as mass / collective migration. The 18th and 19th centuries caused significant mass migration movements. In this period and afterwards, Turkey started to come to the fore in terms of mass migrations. The Küçük Kaynarca Agreement of 1774 during the Ottoman Empire is accepted as the beginning of the mass migrations that lasted until recently.

The wars with Russia in 1783, 1828 and 1851 caused mass migration of Tatars, Circassians, Abaza and Laz to Anatolia. The 1877-1878 Ottoman - Russian War (93 War) caused these migrations to turn into

large human influxes. As a part of these events, many individuals and groups applied for asylum (asylum) for political reasons, both to the Ottoman Empire and to the European states. During this period of turmoil until the Balkan Wars of 1912-1913, the Ottoman Empire lost 69% of its territory and 300 thousand people emigrated.

Turkish Migration Legislation and Practice

Turkey has been a constant contact with the phenomenon of migration since the eve of its establishment and has experience in almost all types of migration, source country, transit country and destination country. Within the scope of the Lausanne Treaty, which registered its establishment in 1923, it had to make an immigration agreement called "Exchange". From this date on, it has been a party to different migration movements at short intervals.

This history of frequent and intense migration has constantly affected the demographic structure of the country. In addition to external migrations, internal migration movements continued without a break. Internal migration emerging as migration from rural areas to urban areas, labor migration with Europe, political crises and wars in other countries, the last link of forced mass migration movements is migration mobility originating from Syria.

Despite these intense migration movements, Turkey's migration management policies and migration legislation have developed slowly. The reason for this is the desire to be seen with the political or social sides of each of the migration movements, with their mass impact. The political will wanted to manage the migration management in Turkey with individual-particular decisions. Therefore, the phenomenon of migration has been approached through the issue of resettlement, which is the first effect of migration mobility. In migration mobility, practical issues such as where individuals and families will settle, how they will be taken for granted by the society, how well they can keep up with the society and similar practical issues are prioritized over political motives.

In other words, Turkey has inherited a tradition that existed before its establishment, has taken families and individuals as subjects of migration mobility as a criterion, and has tried to stay away from mass migration experiences as much as possible. Another remarkable point is that, again, with a practical approach, the assumption that if a person or family has entered the country through immigration, they will remain in the country permanently is accepted in advance. With this aspect, it can be said that Turkey is a country that loves immigration. As a state policy, Turkey prefers an understanding that prefers to be careful against mass migration flows, but analyzes and tries to manage migration through its practical consequences in case of inevitability of mass migration. The second prominent feature of Turkey's understanding of migration management; It is his long-standing insistence on "ancestry-oriented" immigration resettlement. Turkey's migration management policies and legislation can be historically examined in four periods.

1923 - 1938

In the years of the Union and Progress rule and the years following the First World War, the deportation and resettlement practices for the non-Muslim population, determined by the internal and external security concerns, changed the composition of the population in the Anatolian lands. It can be said that approximately one third of the country's population, which was 17.5 million, was displaced as a result of the dispatch and resettlement movements that took place between 1913 and 1918. These transfers and settlements are among the main determinants of today's ethnic and religious distribution of Anatolia.

In the 2nd article of the Settlement Law No. 885 dated 31/05/1926, which regulates the conditions sought for those who will be accepted as immigrants from abroad, "Anarchists, spies, Gypsies and those who have been expelled from the country are not accepted." With the expression, the basic feature sought in those who will be accepted as immigrants has been determined as "Turkish culture". The Settlement Law No. 885 remained in force until 1934 as the basic legal regulation for the resettlement of immigrants who were accepted under different names and titles within the framework of the principles determined for the immigration policy, and for the relocations carried out within the borders of the country.

1938-1960

In the period when migration movements gained momentum, foreign migration from the Balkans to the country was dominant. However, the development of industrialization and urbanization caused the first steps to be taken in the control of out-migration. Turkey's migration policies have been tried to be managed with a two-headed system. In general, international changes are taken into account, but in practice, domestic legal regulations and customary practices dominate the practice. With the Settlement Law No. 2150 adopted in 1934 and the Passport Law No. 5682 adopted in 1950, and the Law No. 5683 on the Residence and Travels of Foreigners in Turkey adopted in the same year, it was aimed to regulate migration movements with domestic law. In 1951, Turkey became a party to the Geneva Convention on the Legal Status of Refugees by making reservations on "history" and "geography". This convention is important in that Turkey recognizes international concepts and provisions for the first time in the history of migration management.

1960 - 2004

In this period when the social structure underwent sudden and radical changes, 77% of Turkey's population moved to cities within the country and moved. For the transition to the developing country category, rapid and intense urbanization has been accepted as the inevitable result of policies aimed at transferring the Industrial Revolution to the country, albeit with a delay. These policies were tried to be carried out together with the political and economic crises experienced in this period. In the legal system and democracy of the country, results such as "the laws that change frequently and lose their effect in practice", as well as "the interruption of democracy with military coups and the constant amendment of the constitution with two constitutional amendments" have emerged.

After 2004

The systematic change that is called the "new right" in the world and focuses on the integration of neo-liberal policies with the populist and global economy has also been effective in Turkey. Information and technology developments in the world have been interpreted as a new and great change called the 4.0 version of the Industrial Revolution or the Information Revolution. Adaptation to the experienced change has affected all countries regardless of their level of development, but the adaptation of developing or underdeveloped countries has been painful. With the 2008 global economic crisis, the problems of social change, whose roots go back to the Cold War, gave birth to street movements such as the Arab Spring, Occupy Wall Street, Yellow Vests, and Gezi Resistance. One of these movements, the Arab Spring, is also accepted as the reason for the huge migration movement originating from Syria. Another striking feature of the period for Turkey is that it stood out as a transit country or destination country in migration movements originating from Asia and the Middle East, as well as Syrian migration mobility. This situation has caused Turkey to experience the second major change in the history of migration policies after recognizing the 1951 Geneva Convention and international concepts and provisions. Migration management has a bureaucratic order; Immigration law, on the other hand, has been brought to special regulations such as the 1994 asylum/refugee regulation, which was enacted by the decision of the Council of Ministers in 1994.

Immigration and Status

The phenomenon of migration has created a terminology in the literature and the migrant has been defined with different statuses in international law and country laws. These statuses enable the person or group to determine the rights and responsibilities affected by migration mobility and to obtain assurances. There are international documents regulating the status and rights of the migrant in general. Article 14 of the Universal Declaration of Human Rights states that everyone has the right to seek and obtain asylum from any country. According to the 1951 UN Convention Relating to the Status of Refugees and its revised 1967 Protocol, the return of refugees to countries where they may be at risk of persecution is prohibited. According to the 1990 International Convention for the Protection of the Rights of All Migrant Workers and Members of their Families, the responsibility to protect immigrants also includes their families. These protections and statuses are covered more extensively in documents such as the 1969 Organization of African Unity Convention, the 1984 Cartagena Declaration, the European Union Common Asylum System and the Dublin Procedure.

The number of people with migrant asylum seeker and refugee status in the world is increasing every year and today, according to UNCHR data, 79.5 million people have been forced to leave their country or city in which they live.

Immigrant

Despite its prevalence and importance for humanity, there is no universal definition of immigrant in the international arena by international law. The main reason for this is the complex structure of migration mobility and the fact that the situation in which the person is located cannot be determined objectively. Many factors such as the reasons for the decision to leave the person or group, the duration of the act of abandonment (temporary - permanence), the possibility of returning, the permanence in the country of destination are within the scope of the exercise of the rights related to the will of the person and it is the personal responsibility of the person or group to bind these intentions, decisions, thoughts or actions to a certain standard in the public sphere. The idea that there is a violation of human rights makes it difficult to make universal definitions. Each definition also brings about the legal statuses to which the individual will be subject, and the concern is put forward that this situation may lead to the violation of basic human rights.

Despite this, many international organizations, especially the United Nations, make suggestions for universal definitions. For example, in the UN – IOM Glossary of Migration Terms, for migrant;

“The United Nations defines a migrant as an individual who has resided in a foreign country for more than one year, regardless of reasons, whether voluntary or not, migration routes, regular or irregular. Within the scope of this definition, people who travel for shorter periods with the status of tourist or businessman are not considered as immigrants. However, widespread use also includes some types of short-term migrants, such as seasonal agricultural workers who travel for short periods of time to plant or harvest agricultural products.

It makes the definition. As it can be understood from the definition, the most emphasized factor is time and 1 year is accepted as the limit.

On the other hand, Amnesty International and many international non-governmental organizations define immigrants as people who live outside their own country and who are not immigrants or asylum seekers. Two trends stand out in the development of legislation on the protection of immigrants' rights:

Firstly, the tendency of countries to accept the regulations protecting the rights of immigrant persons and groups as a domestic issue continues, and most states prefer to move the issue to the international arena through bilateral agreements with other states. This makes it difficult to prepare an agreement that can create a universal immigration law that has an impact on the international arena.

Second, the refugee type of immigration tends to become the basis of immigration law. Refugeeism, both internationally and nationally, causes serious human rights violations due to its emergence and processes, and turns into an important study subject of human rights law. This situation leads to the priority acceptance of the regulations regarding refugees in the international and national arena. Therefore, the regulations on refugee law in immigration law reveal texts that can be applied to all categories of immigrants in general. The fact that the "constantly rising number of immigrants" in our world today causes the categories of immigration to increase and be reinterpreted.

CONCLUSION

As part of the Migration, Urban Development and Urban Livability Project, this survey conducted by the Global Policies Application and Research Center (RUPAM) as the 1st phase with the support of the Scientific Research Program of Istanbul Rumeli University, shows that the Syrian population with temporary protection status is 4% of the total population of the country. carried out due to the achievement of

Turkey was initially accepted as a transit country during the migration process originating from Syria (2011-2014). However, it can be said that it is in the position of destination country in the following period.

European countries are accepted as the destination of migration mobility originating from Syria. However, among GCS Syrians with temporary protection status, as irregular or regular immigrants, access to the destination is limited.

Syria is the source country for migration mobility and migration mobility in this area continues in the category of internally displaced persons (IDP).

Therefore, Turkey, in its migration management experience of more than 10 years, is faced with the permanence of the migrating population.

Interpretation of the data obtained in this survey research, which is the first phase, was avoided, focusing only on the explanation of the tables. Because the necessity of evaluating the Turkey (transit-arrival) situation together with the mobility in the destination and source places has been accepted for methodological reasons in this research.

SOURCE

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IDENTIFICATION OF ACTIVATION OF LATENT TUBERCULOSIS INFECTION

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Abstract

Introduction: According to the World Health Organization, one third of all humankind has a latent tuberculosis infection (LTI). From 5-20% of infected there is a risk of development of active TB during their lifetime and in most cases tuberculosis develops in 2-5 years after infection. Thus LTI is the reservoir of future tuberculosis, therefore, detection of activation of LTI is necessary in order to control the infection with the help of preventive treatment.

The purpose of the study. The aim is to identify the activation of LTI.

Methods: 100 persons with suspicion of tuberculosis aged from 2 to 18 years, 60 men and 40 women were examined using generally accepted clinical, laboratory, radiological examination methods, TST and the innovation test with use of tuberculosis recombinant ESAT-6-CFP-10 protein allergen – “Diaskintest” (DST). All persons carried out qualitative and quantitative determination of total antibodies to M.tuberculosis (TTA) in the blood serum by EIA method. Tuberculosis antibodies detected using a set of “AT-Tub-Best” on the unit “Bio-Screen 500” (USA). Circulating immune complexes (CIC) were determined in blood serum with photometric determination at a wavelength of 450 nm on a spectrophotometer SF 26 (LUMAM).

Results: The examined persons did not have a pronounced syndrome of general deviations, but only weakly expressed symptoms of intoxication in various combinations. The results of TST were positive in all the examined persons. Hyperergic reaction was observed in 22% of cases. DST was positive in 26% of cases. Hyperergic reaction according to the results of the TST and DST coincided in 9 people. In patients with positive TST and positive DST the value of TTA was in the interval 0,14-2,28 units of od, the level of the CIC was reduced to $0,045 \pm 0,005$ units of od.

Conclusions: In persons with latent tuberculosis infection with the level of TTA in the range 0,14-2,28 u.o.d., normal or reduced CIC values, a positive DST result the presence of only symptoms of intoxication should be interpreted as signs of activation of LTI which is a prescription for preventive chemotherapy.

Keywords: Latent Tuberculosis Infection, identification of activation, preventive treatment.

INTRODUCTION

Despite the fact that children and adolescents make up 26% of the world population and 42% of the population of a low income countries, insufficient attention has been paid to research and development in the field of tuberculosis (TB) in this age group [Newton S.M. et al., 2008; World Development Indicators, 2018]. It is estimated that 1 million children under age of 15 get TB every year in the world, while 233000 children die from it every year [Global Tuberculosis Report, 2019; Snow K.I. et al., 2018]. Another half a million estimated cases of TB occur annually in older children (15-20 years) [Snow K.I. et al., 2018].

Currently, there is a certain increase in attention to the problem of TB in children and adolescents, both within the framework of Global Public Health Programs, and the prevention and treatment of TB [Groschel M.I. et al., 2019].

The World Health Organization (WHO) has set a goal to eliminate TB as a global problem by 2035 [D'Ambrosio L. et al., 2014; Global Tuberculosis Report, 2016]. Infection control (measures to reduce morbidity, early diagnosis and treatment) has become the most important direction of the strategy to combat TB, the next stage of reduction is to reduce the prevalence, which, in turn, should be based on preventive therapy of latent infected people. The latest measures are aimed at reducing of pool of infected people and preventing new cases of the disease [Van der Werf M. et al., 2013].

According to available data, the detection and treatment of latent tuberculosis infection (LTI) can reduce the risk of developing an active disease by more than 90% [Comstock I., 1999], thereby reducing the number of potential sources of infection [Rieder H., 2002; Trajman A., 2013]. That is, if the treatment of people with TB prevents further transmission of the infection, then the treatment of people infected with TB prevents the development of the disease in the future [World Health Organization, 2015].

According to WHO estimates, a third of all mankind has LTI. 5-28% of infected people have a risk of developing active TB during their lifetime, and in most cases TB develops 2-5 years after infection [Global tuberculosis report WHO, 2013]. The problem of differentiating latent and active tuberculosis infection is therefore, a very relevant, but difficult and not yet completely solvable task [Maertzdorf J. et al., 2012; Getahun H. et al., 2015; World Health Organization, 2015].

LTI is a condition of a persistent immune response to the antigens of MBT in the absence of clinical manifestations of the active form of TB [Федеральные клинические рекомендации по диагностике и лечению латентной туберкулезной инфекции у детей, 2015].

According to the definition of the Center for Disease Control and prevention (CDC): "LTI is the presence of MBT in the body detected by a positive Mantoux test or a positive test for the release of interferon gamma".

A person with LTI is not sick and is not contagious to others.

Tuberculin diagnostics plays a significant positive role in the detection of TB, but it has a low specificity in vaccinated children and does not allow in some cases to distinguish post-vaccination allergy from infections, active TB infection from cases of cured TB or infection with MBT [Барышникова Л.А. и др., 2012; Валиев Р.Ш. и др., 2012; Мотанова Л.Н. и др., 2013].

The low specificity of the skin tuberculosis test – Mantoux is due to the fact that tuberculin is a mixture of more than 200 antigens obtained from *Mycobacterium species Humanum* and *Bovis*, which are also found in other non-tuberculosis, atypical mycobacteria, as well as in BCG strains [Алексеев А.П. и др., 2014].

After the decoding of the MBT genome in 1998 [Cole S. et al. 1998], it became possible to use individual MBT-specific proteins for the diagnosis of TB. About 4000 proteins are encoded in the MBT genome, and the profile of genes expressed at different stages of infection may vary [Dillon D. et al., 1999; Shi L. et al., 2004].

The most widely used antigens for diagnostic (ESAT-6 and CFP-10) purposes are encoded in the RD1 zone of the MBT genome, and importantly, they are expressed during the reproduction of MBT and are absent in *M. Bovis*, BCG, and most non-tuberculosis mycobacteria, except *M. kansasii*, *M. szulgai* and *M. marinum*. They are associated with the virulence of MBT [Quinn K. et al., 2004; Harboe M. et al., 1996]. In the number of countries ESAT-6 and CFP-10 were used in the development of specific diagnostic tests. On their basis an innovative reagent for a skin test was created, called "Diaskintest", which is a recombinant protein CFP-10 – ESAT-6, produced by *Escherichia coli* (tuberculosis allergen, recombinant) [Слогоцкая Л.В. и др., 2011].

The technique of the test is similar to the technique of the intradermal tuberculin test (the Mantoux reaction) [Медников Б.Л. и др., 2009].

One of the factors reflecting the transition of the LTI to active TB is the pool of total antituberculosis antibodies (TTA).

Antibodies bind the pathogen, form circulating immune complexes (CIC) and contribute to their removal from the body (<https://biofile.ru/bio/9002.html>).

The purpose of the study is to detect early the activation of LTI with the aim of prescribing preventive treatment as early as possible.

MATERIAL AND METHODS

100 children and adolescents were examined for TB. Among them there were 60 male and 40 female persons aged from 2 to 18 years. All patients were examined using generally accepted clinical, laboratory and radiological research methods.

The presence of BCG vaccination, the presence or absence of a post-vaccination scar, its size, previous diseases, living conditions, contact with a tuberculosis patient, the nature and duration of contact were revealed. All the examined patients were diagnosed with Mantoux reaction and Diaskintest (DST).

Qualitative and quantitative determination of TTA in blood serum by enzyme immunoassay was performed in all patients. TTA were detected using a set of “AT-Tub-Best” (“Vector Best”, Novosibirsk) on an enzyme immunoassay “BioScreen-500” USA. Another method of investigation was the determination of CIC in blood serum with photometric determination at a wavelength of 450 nm on a spectrophotometer SF-26 (LUMAM) CIC was studied by the method of precipitation of antigen-antibody complexes in a 3,75% solution of polyethylene glycol, followed by photometric determination of the density of the precipitate. Statistical processing of the obtained results was carried out using Excel 2010.

THE RESULTS OF THE STUDY

The results of the study made it possible to exclude active TB in all patients. The examined persons did not have a pronounced syndrome of general deviations, but only weakly expressed symptoms of intoxication in various combinations. When analyzing tuberculin sensitivity by the Mantoux reaction, a positive test of varying intensity was detected in all the examined persons.

The inclusion of DST in the scheme of examination of children made it possible to clarify the nature of sensitivity to tuberculin.

All 100 examined individuals were tested using DST. Of these, 74% had a “negative” DST, and 26% had a “positive” one. The positive reaction was taken into account in the following three variants: a papule with a diameter of up to 5 mm, up to 15 mm and more than 15 mm. Papule up to 5 mm, namely 3 mm was formed on the DST in 2%, up to 15 mm in 8% (of which 1 subject had 5 mm, 3-10 mm, 3-12 mm and 1-14 mm), more than 15 mm in 16% of examined (of which 3 people had 15 mm, 1-16 mm, 3-17 mm, 2-18 mm, 1-19 mm, 3-20 mm, 1-22 mm, 1-23 mm and 1-25 mm). The response to DST with the formation of papules with a diameter of 18 mm, 20 mm and 23 mm was accompanied by the formation of a vesicle.

Hyperergic reaction according to the results of tuberculin test and DST coincided in 9 people. In patients with “positive” tuberculin test and “positive” DST the level of TTA was in the interval 0,14-2,28 u.o.d. (units of optic density), the level of the CIC was reduced to $0,045 \pm 0,005$ u.o.d.

It was in those with positive DST (26%) that more diverse symptoms of intoxication were found. The intoxication syndrome was more pronounced in individuals with a coincidence of the hyperergic reactions of Mantoux test and DST.

CONCLUSION

If the results of clinical, laboratory and radiological studies allow us to exclude manifestation of active TB, in persons with latent TB (“positive” Mantoux test) with the level of TTA in the range 0,14-2,28 u.o.d., normal or reduced CIC values, a “positive” DST result the presence of only symptoms of intoxication should be interpreted as an early sign of activation of LTI which is a prescription for preventive chemotherapy.

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**BIRTH RATE OF EUROPEAN BISON
(BISON BONASUS BONASUS L. 1758)
IN ROMANIA IN THE 2004 – 2020**

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ABSTRACT

European Bison population in Europe decreases due to the habitat damage, deforestation and lack of food. The males in the wild are usually most reproductive at an age of 6 to 12 years. As to females, they normally reach maturity by the age of 3 years. Reproduction intensity depends much on the amount and quality of food. The reproduction time slows down by the lack of food. Biological mechanism inhibits reproduction of the young that are not able to get food for survival that is for the good growth and right development. This mechanism works vice versa: the reproduction potential comes to the fore when there is plenty of food.

The data from the European Bison Pedigree Book (EBPB) were used to analyse the natality of the European Bison in Romania. There were examined the total European Bison number, the gender ratio with number of born calves. The gender ratio of new-born calves was also analysed.

There were 1.684 European Bison in Romania at the observed period of time. 912 of it were females (54,16%), and the rest of population were males (45,44%). The females number for the year of 2019 is not complete, and in the official EBPB document for the Armenis Forest, where European Bison live in the wild, females and males number is not indicated at all. Based on these incomplete data, the proportion of male calves is 55,07% and female calves is 44,93%.

Key words: European Bison, reproduction, population, natality rate.

INTRODUCTION

The males in the wild are more active in the sense of reproduction at an age of 6 to 12 years (Krasinska Malgorzata, Krasinski A.Z., 2008). There might be exceptions. The authors state that there was a 17 years old reproductive male registered in Białowieża national park in Poland. As to females, they usually reach maturity by 3 years old age. Calving of 2 years old females have been also known. The authors state that females keep reproductive quite longer than males. It was noted that cows calve at an age of 19 and 22 years old (Koch 1956, cit. Krasinska Malgorzata, Krasinski A.Z., 2008).

According to Krasinska Malgorzata, Krasinski A.Z. (2008) 63-91% of females calves every year. They say that there was a female that calved every year for 14 years.

Reproduction intensity depends much on amount and quality of food. In case of its lack the reproduction time slows down. Biological mechanism inhibits reproduction of the young that are not able to get food for survival, that is for the good growth and right development. And reproductive potential is quite high when there is plenty of food.

Having studied the European Bison natality in two herds in Germany (Urošević, Mandić, Dameski and Stanišić, 2022) in the years 2000 – 2018, they learned that females mating in the first group occur at an

average age 42,54 months with variation interval from 23 to 84,5 months. The average age in the second group was 31,67 months with variation interval from 39,5 to 66,93 month. The average calves number in the first group was 7, and in the second group 13. As to the gender ratio: 16 males (48,48%) and 17 females (51,51%) were born in the first group. 16 males (40,0%) and 24 females (60%) were born in the second group.

While studying wisent population in Caucasus at the period from 1960 to 1989, Trepet (2008) says that the adult females ratio in the population is 46% – 58,8%.

MATERIALS AND METHODS OF THE STUDY

The data from the European Bison Pedigree Book (EBPB) were used to analyse the natality of the European Bison in Romania. There were examined the total European Bison number, the gender correlation with number of born calves. The gender ratio of new-born calves was also analysed.

RESULTS AND DISCUSSION

Table 1 shows the total European Bison number and gender by years for the research period from 2003 to 2020 in Romania. Animals number correlation 1.1. by years.

Tab.: 1. Total European Bison number and gender correlation

Year	Total animals	Females	%
2003	5	2	40,00
2004	7	5	71,43
2005	6	4	66,70
2006	15	8	53,33
2007	16	8	50,00
2008	59	35	59,32
2009	69	40	57,80
2010	81	47	58,02
2011	86	49	56,98
2012	97	56	57,73
2013	102	57	55,90
2014	124	63	50,81
2015	128	74	57,81
2016	157	88	56,05

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2017	166	93	56,02
2018	167	94	56,29
2019	186	103	55,38
2020	213	86	40,37
Total	1.684	912	54,16

There were 1.684 European Bison at the observed period of time. 912 of them were females (54,16%), that means 45,44% males of the total number. The females number in 2019 is not complete, and in the official EBPB document for the Armenis Forest, where European Bison live in the wild, females and males number is not indicated at all.

The total calves number born in the observed period of time and gender correlation are given in the Table 2.

Tab: 2. Total calves number and the number of calves by gender

Year	Total calves born	Male	Female
2003	1	-	1
2004	-	-	-
2005	-	-	-
2006	1	-	1
2007	5	1	4
2008	3	-	3
2009	1	-	1
2010	-	-	-
2011	6	4	2
2012	5	3	2
2013	10	8	2
2014	6	3	3
2015	10	6	4
2016	7	5	2

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2017	5	3	2
2018	9	5	4
2019	3	-	3
2020	6	4	2
Total	69	38	31

It is evident from the incomplete data, as it was mentioned above, that the rate of male calves is 55,07% and of female calves is 44,93%.

It is quite clear from the first glance at the Table above that there was something wrong with the reproduction. It is not possible to analyse the reasons for this phenomenon now, we can only state the fact.

The following Table shows the correlation of the females number with the total calves number.

Tab.: 3. Total females number correlation with the calves number

Year	Total females	Calves number	%
2003	4	1	25,00
2004	5	-	-
2005	4	-	-
2006	8	1	12,50
2007	8	5	62,50
2008	35	3	8,57
2009	49	1	2,04
2010	47	-	-
2011	49	6	12,24
2012	56	5	8,93
2013	57	10	17,54
2014	63	6	9,52
2015	74	10	13,51
2016	88	7	7,95
2017	93	5	5,38

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2018	94	9	9,57
2019	103	3	2,91
2020	86	6	6,98
Total	912	93	10,18

During the survey time there were no calves natality registered in 3 certain years. For the years 2004 and 2005 it might be explained so that only few European Bison females were kept in the Zoo then, but the situation in 2010 when there were 47 females is not quite clear.

CONCLUSION

For the survey period of time from 2003 to 2020 the European Bison reproduction in Romania was on quite unsatisfied level. Natality rate for calves was 10,18%. Similar results were also received in the other countries. Krasinska Malgorzata and Krasinski A.Z. (2008) state that the lowest natality rate 9,9% was registered in Poland in 1986, whereas in 1961 it was 32,3%.

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**A NEW SHIELDING PRODUCT AND AUTOMATIC RADIATION PREVENTION
MECHANISM FOR RADIATION ROOMS**

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Abstract

In this study, a lead-coated automatic side-sliding mechanism has been developed for the observation window of the X-ray room control console. In order to monitor the patient, especially children, the automatic sliding mechanism that opens when the healthy person gets close to the window is designed to close when the person leaves. Thus, the X-ray room control console is isolated. The sliding mechanism system has been created and tested. It has been observed that the sliding mechanism makes photocell detection and opens and closes in a short time like 0.8 seconds. In addition, a new type of anti-radiation application method has been developed that allows the lead plate to be easily mounted on the wall instead of inside the wall by coating the lead plate with resin. Co-57, resin (3mm), concrete (9mm), concrete (12mm), lead (1mm), lead (1mm) + resin (3mm), resin (3mm) + lead (1mm) + resin (3mm) and lead (1mm) + concrete (9mm) were exposed to Co-57. Each prepared radiation shield was exposed to the source for 180 seconds and measurements were taken with the ÇNAEM NEB-211 dosimeter. In the case of one side of the lead plate covered with resin, an improvement of 10.5% was achieved compared to the lead sheet alone, while an improvement of 21.5% was achieved in the case of resin-coated both sides of the lead plate. Thus, both the lead plate is covered and the radiation protection feature is improved up to 21.5%.

Keywords: Radiation shielding product, automatic anti-radiation mechanism, Co-57, lead plate coating, radiation room.

**RADYASYON ODALARI İÇİN YENİ BİR ZIRHLAMA ÜRÜNÜ VE OTOMATİK
RADYASYON ÖNLEME MEKANİZMASI**

Özet

Bu çalışmada, röntgen odası kumanda konsolunun gözetleme penceresine kurşun kaplamalı otomatik yana kayar bir mekanizma geliştirilmiştir. Hastanın, özellikle de çocukların, gözetlenmesi için sağlık personelinin cama yaklaşması halinde açılan otomatik kayar mekanizma, personel uzaklaştığında kapanacak şekilde tasarlanmıştır. Böylece, röntgen odası kumanda konsolu izole edilmiştir. Kayar mekanizmalı sistem oluşturulmuş ve test edilmiştir. Kayar mekanizmanın fotoselli algılama yaptığı ve 0.8 saniye gibi kısa bir sürede açma ve kapama yaptığı görülmüştür. Ayrıca, kurşun plaka üzeri reçine ile kaplanarak kurşun plakanın duvar içerisine montajı yerine duvar üzerinde kolayca montajına imkan sağlayan yeni tip bir radyasyon önleyici uygulama yöntemi geliştirilmiştir. Co-57, reçine (3 mm), beton (9 mm), beton (12 mm), kurşun (1 mm), kurşun (1 mm) + reçine (3 mm), reçine (3 mm) + kurşun (1 mm) + reçine (3 mm) ve kurşun (1mm) + beton (9mm) Co-57 kaynağına maruz bırakılmıştır. Hazırlanan her bir radyasyon zırhı 180 saniye kaynağa maruz bırakılıp ÇNAEM NEB-211 dozimetre ile ölçümler

alınmıştır. Kurşun levhanın bir tarafının reçine ile kaplanması durumunda, tek başına kurşun levha ile karşılaştırıldığında %10.5'lik bir iyileşme sağlanırken, kurşun levhanın her iki tarafının reçine ile kaplanması durumunda %21.5'lik bir iyileşme elde edilmiştir. Böylece, hem kurşun plaka kaplanmış hem de radyasyon önleme özelliği %21.5'e kadar iyileştirilmiştir.

Anahtar Kelimeler: Radyasyon zırhlama ürünü, otomatik radyasyon önleme mekanizması, Co-57, kurşun plaka kaplama, radyasyon odası

1. Introduction

There are three important aspects of radiation protection, these are; time, distance, and protective barrier. Lead is an ideal X-ray shielding material and 99.9% pure lead sheets are used to cover walls, floors, and other surfaces in x-ray rooms. However, in recent years, different studies have been carried out to develop alternative products to lead; Protective barriers are produced by using polyester matrix vermiculite, meerscham, polymer-tungsten compounds, sodium pentaborate, boron carbide, nano-boron powder, gadolinium, and fabrics using different materials. Bayaner and Şevik [1] aimed to develop radiation shielding with nano-doped new (especially organic) materials, which can be an alternative or supplement to lead, and materials that are partially more economical, healthy, and easier to supply. In addition to traditional materials, they formed a polymer structure prepared with nanomaterials. The radiation attenuation rates of elastomer materials containing antimony, tin, tungsten, and barium were examined by Yucel et al. [2]. The lead equivalent thicknesses achieved experimentally were compared to the lead equivalents established by the material manufacturers. During the investigations, it was found that some manufacturers listed lead equivalents that were greater than the results of the experiments, indicating that the claimed radiation protection may not entirely exist.

Gücen et al. [3], in a study on the knowledge, attitudes, and behaviors of radiology workers employed in public hospitals in Kayseri, Türkiye, in 2012, found that the attitude of the employees towards radiation was not sufficient. It has been determined that 54.5% of radiologists use lead screens and 51% use lead coats. The use of thyroid protectors, lead gloves, and lead glasses was found to be 32.7%, 5%, and 14.4%, respectively. According to their study, 21.9% of radiation professionals admitted that they did not use a dosimeter. As a result of the research, it was determined that 22.5% of the employees in radiology did not use a lead vest during radiological recordings. In a hospital in Iran, Amiri et al. [4] found that self-protection strategies were used by 94.7% of the technicians, whereas only 26.3% of the technicians used patient and other healthcare professional protection measures,. In another study conducted by Vural et al. [54] in Kocaeli province, Türkiye, it was found that while all employees were aware of the side effects of radiation on health, many surgeons did not use thyroid protectors, and some employees were not even aware of the presence of a protector. While the knowledge level of many employees about the harmful effects of radiation is quite good, it has been observed that their behaviors about taking protective measures are insufficient. As a result, it has been observed that radiation safety measures are ignored in hospitals. In a study conducted by Balsak [6] on radiology technicians in Diyarbakır in 2014, it was determined that the majority of the employees did not have sufficient information about how much radiation they were exposed to as a result of radiological examinations. Balsak [6] also found that healthcare professionals in Malatya were largely inadequate in the use of protective clothing, both by themselves and by the patients. The findings of Palacı et al. [7] also support the inadequacies of Turkish education policies.

Personnel working in radiology units should be protected from the harmful effects of X-rays by wearing lead or lead equivalent aprons, thyroid armor, goggles, and gloves. Personnel should stay as far away from the source as possible and stay behind lead glass while the run images are being taken. However, in general, personnel do not use these products because of the weight of lead products and the thought that "nothing will happen". The problem posed in the above literature can be solved in two ways; the first is training/discipline, and the second is to take protective measures for the personnel who do not protect themselves.

This study focuses on the second option. First; it is the development of a new type of radiation protection application method that allows the lead plate to be easily mounted on the wall instead of inside the wall

by coating the lead plate with resin. Second; it is to prevent the radiation from entering through the control console observation window in the X-ray room, both to eliminate personnel negligence and to form an anti-radiation layer.

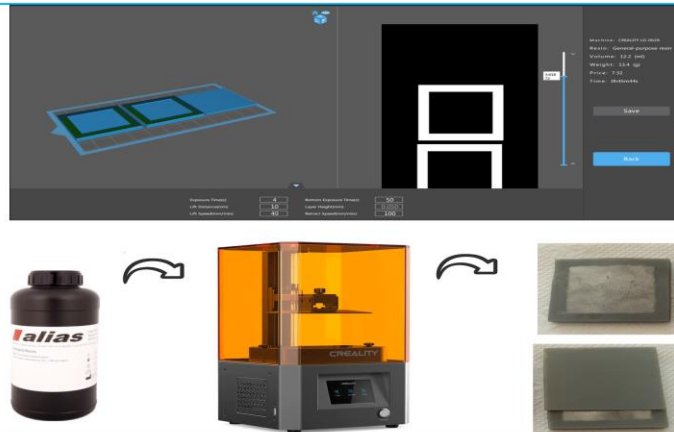
2. Materials and Methods

The study was carried out in two phases. In the first phase, single-sided and double-sided coating of the lead plate was carried out. Phase-1 consists of design, preparation of the resin and a 3D printer, printing the products on the 3D resin printer, cleaning the products, curing the products, and testing. Coating processes were done with a resin 3D printer. Creality LD-002R 3D resin printer, developed for 3D printing with LCD technology, which provides much higher quality printing than FDM printers, can produce products with a printing resolution of 0.02 to 0.05 mm with liquid resin material. In the second phase, an automatic sliding mechanism with four photocells is designed. Phase-2 consists of system design, system fabrication, and the experimental process. The flowchart of the study is given in Table 1. Fig.2 shows the encapsulation method of the radiation shielding product. Fig. 3 shows application of the automatic sliding mechanism to the x-ray room.

Table 1. The flowchart of the study

Purpose of Study	
Developing a new method for applying radiation shielding by coating lead sheet with a resin product.	Developing a lead plate automatic side-sliding mechanism for the observation window of the X-ray room control console.
Phases of Study	
Phase-1	Phase-2
Production of a new product	Production of side sliding mechanism system
1. Design Stage	1. System design Stage
2. Resin and 3D Printer Preparation Stage	2. System production Stage
3. The Stage of Printing the Products on a 3D Resin Printer	3. Experimental results
4. Cleaning of Products Stage	4. Reporting
5. Curing Stage	
6. Test Phase of Products	

Phase-1



Phase-2



Fig. 1. Resin coating of lead and automatic sliding mechanism

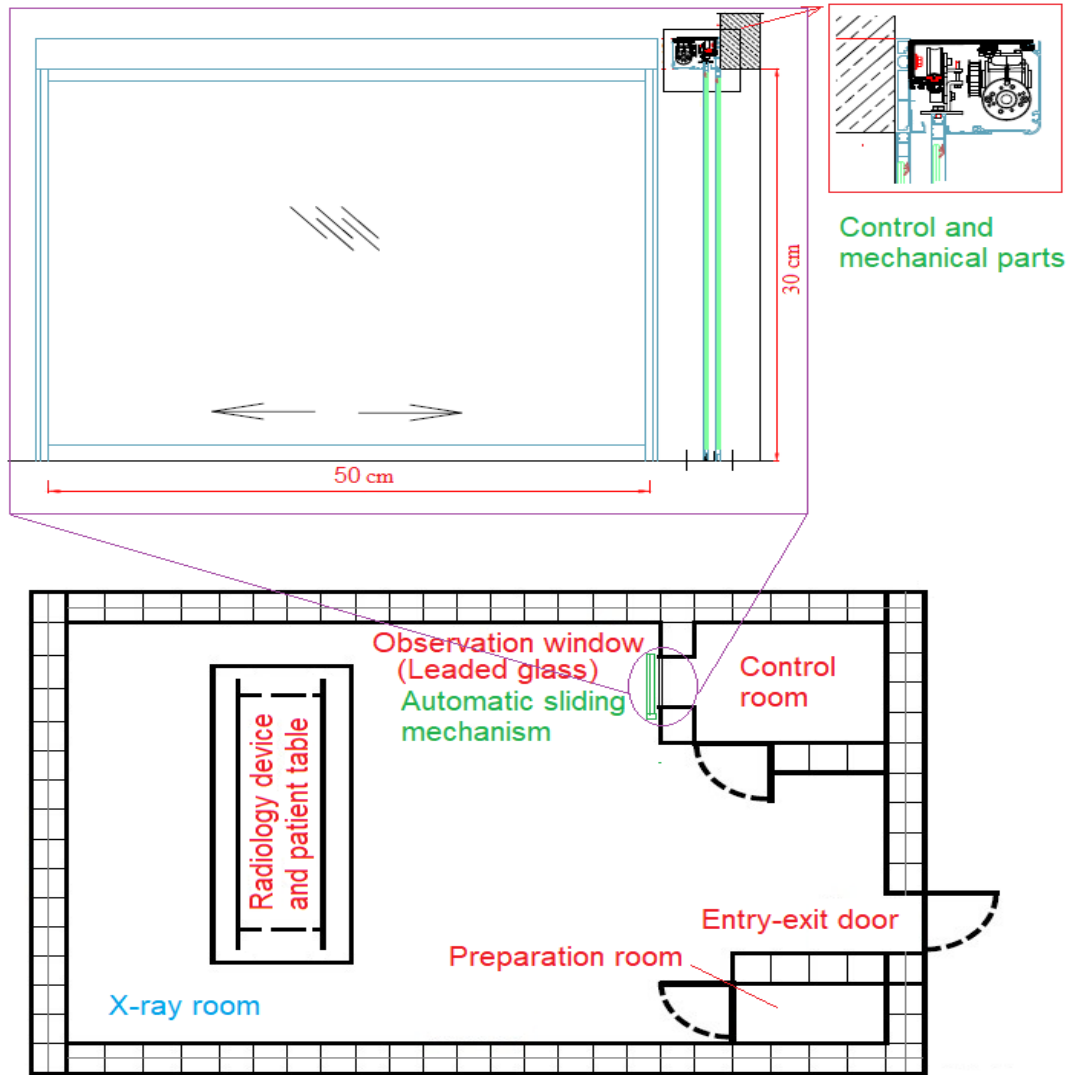


Fig. 2. Application of the automatic sliding mechanism to the X-ray room

3. Result and Discussion

The lead plate was coated both on its single and double sides in the initial phase. Fig. 3 shows a scanning electron microscope (SEM) image of the 3D resin-printed coating. For SEM examination, a sample was prepared from the side where the layers of the product could be seen. The product is coated with Pt (platinum) for surface electrical conductivity. Then the product was placed in an SEM vacuum environment on carbon bands. Finally, SEM images were taken. When the image is examined, it is seen that there is a production with layer thicknesses close to each other. The layers programmed as 50 microns in the 3D printer production details were formed in the range of 48-50 microns. It is seen that the amount of external imprute is negligibly low. There was no volumetric gap between the layers or the lack of adhesion of the layers to each other.

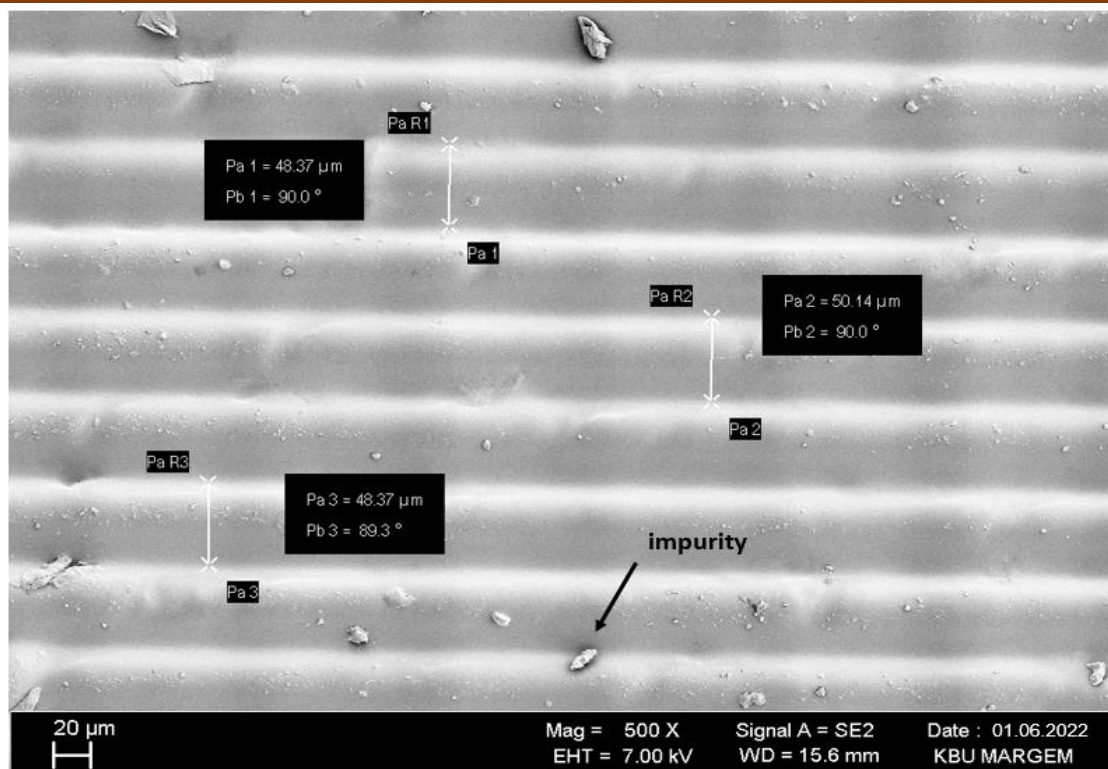


Fig. 3. SEM image of the 3D resin-printed coating

Co-57, resin (3mm), concrete (9mm), concrete (12mm), lead (1mm), lead (1mm) + resin (3mm), resin (3mm) + lead (1mm) + resin (3mm) and lead (1mm) + concrete (9mm) were prepared for testing. For testing, lead sheets with a 3D resin printed coating were placed on top of ÇNAEM NEB-211, then Co-57 was placed on top of it. For protection during the tests, a 4 mm thick lead plate was placed between the measuring person and the Co-57. Fig. 4 shows the test of products with ÇNAEM NEB-211. Tests of 180 seconds were carried out. A large number of values were recorded and averaged during this time. Each product was tested in triplicate and averaged.



Fig. 4. Test of products with ÇNAEM NEB-211

Figs. 5 and 6 show the test results. Products are divided into two groups as high value and low value products. In Fig. 5, the products are shown in a single bar. In Fig. 6, the products are shown in double bars so that lower value products can be seen more clearly. It is seen that there is a performance increase between 10% and 55%. The distance effect due to the thickness difference is neglected.

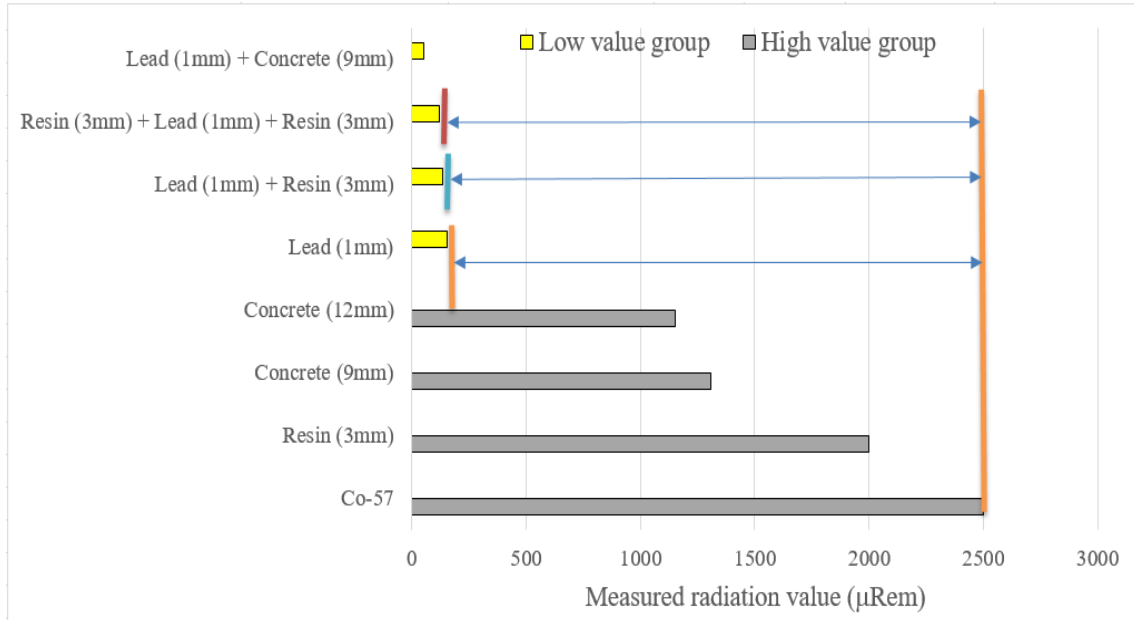


Fig. 5. View of products in one bar

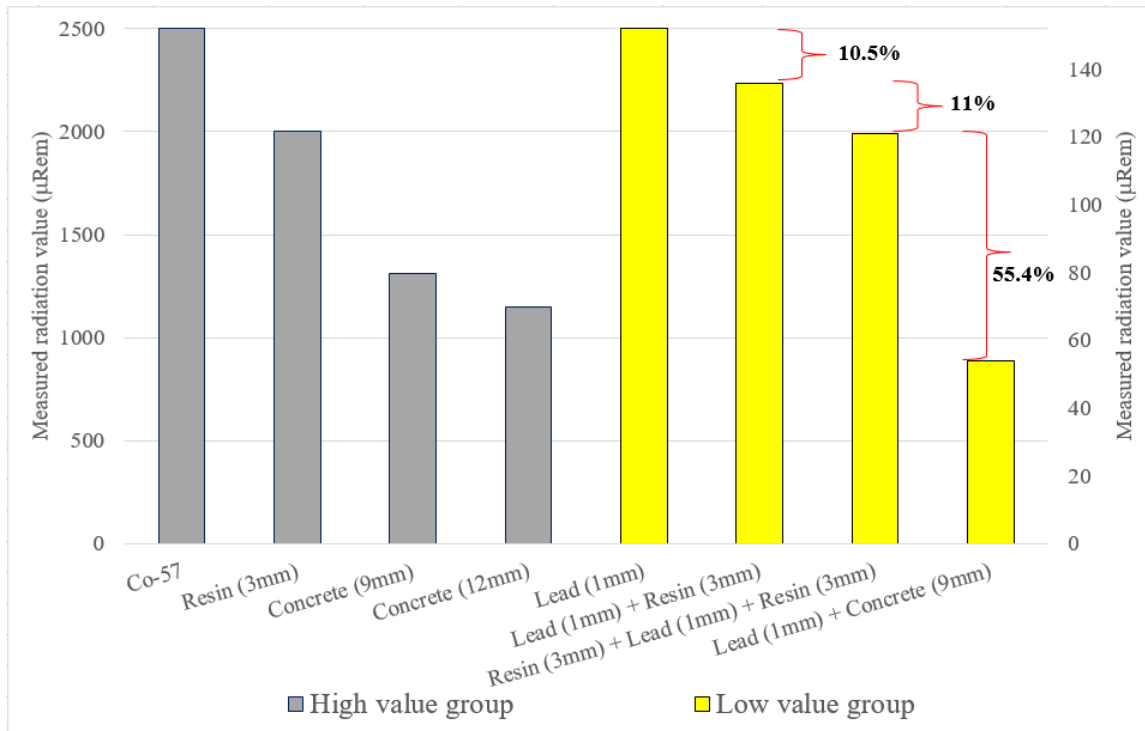


Fig. 6. View of products in double bars for clearer visibility of low value products

The photocell hermetic type sliding mechanism is mounted on a pedestal using treated timber for

framing and support. Treated plywood were used to seal the bottom and the sides. Hermetic type sliding mechanism with photocell uses spindle drive method. Photocell hermetic type sliding mechanism consists of a detection system, control panel, sliding mechanism, motor, and execution group. The photocell control system is a system consisting of light-sensitive resistors. These resistors detect the light with a method similar to the human eye, and as a result of this detection, the sliding mechanism is actuated by the control system. By applying a little force to the motor, the door is made to move. The radiation shielding plate moves thanks to the toothed-belt. The sliding mechanism is driven by a DC motor operating between 12V and 30V. Rail profile is available. Both sides of the rail profile are equipped with stoppers. The system works automatically in both directions.

When the person approaches the observation glass, the photocells of the automatic sliding mechanism detect the personnel in a very short time. Afterward, the system trips at a speed of less than 1 second. When the personnel moves away from the sight glass, the photocells detect the personnel in a very short time and the system can shut down in less than 1 second.

4. Conclusion

The investigation was conducted in two stages. The lead plate was coated on both its single and double sides in the initial phase. A four photocell automatic sliding mechanism is constructed in the second phase. Also, seven distinct items—resin (3 mm), concrete (9 mm), concrete (12 mm), lead (1 mm), lead (1 mm) + resin (3 mm), resin (3 mm) + lead (1 mm) + resin (3 mm), and lead (1 mm) + concrete (9 mm)—were manufactured and tested. This resulted in a 10.5% improvement by coating on one side and an 11% improvement on the other side, as well as the lead plate being coated and the radiation protection feature being strengthened. It has been seen that the sliding mechanism detects photocells and opens and closes in under 0.8 seconds.

The automatic sliding mechanism eliminates the risks that may occur due to hairline cracks that may occur in the glass, damage that may occur in the glass, not installing suitable glass, not insulating the glass frame well, and not installing a thyroid protector even if the suitable glass is installed. Depreciation is taken into account for the retirement of radiology workers. This system can reduce the exposure of radiology workers. Thus, with the decreasing dose, the safe working time of the personnel will be extended and the share of health expenses will decrease.

Acknowledgments

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**CHANGE EFFECT OF GLOBAL FISCAL RISK FACTORS ON PUBLIC FISCAL
POLICIES AND DEVIATIONS IN PUBLIC REVENUES**

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Abstract

This study aims to reveal a structural end effect in which financial risk factors cause different effects on tax revenues as essential public revenue. It is seen that this level of structural relationship also explains the reasons for some critical financial changes in the post-2010 period. The position of financial risk factors after 2010 caused some significant deviations, especially by negatively affecting the targeted public revenue portfolios. It is observed that within the scope of OECD and European Union countries, all public financial revenues mainly are constituted by dynamics of new public reform understandings and the search for new public resources. This phenomenon has also raised the question of the current effectiveness of fiscal risk factors. Namely, this phenomenon has made balancing the target public revenues and the budgetary risk factors inevitable, especially in overcoming the contradictory trend between public policies and fiscal targets in EU countries. An inflationary process of financial risk factors, especially in developing countries, has put forth a new public balance policy process inevitable. EU fiscal balance policies have come to the fore with different approaches in recent years. It appears that public fiscal balance policies have transformed into fiscal balance policies on a global and periodic basis rather than budget-based ones. This structure means possible controllable public budget options beyond a situation where budget deficits and balance are absolute, especially at the global level. This trend, after 2010, has formed the reason for a controllable global fiscal balance position with new changes in the targeted public fiscal policies and its formation with global standards.

Key Words: Budget Balances, European Unity, Fiscal Risks, Global Risk Factors, Public Revenues.

JEL Codes: H11, H13, H21.

INTRODUCTION

It appears that the most critical deviation values in the global financial crisis processes are the targeted public revenues in the public economy. This public revenue sell-off causes significant financial problems in OECD countries, especially in tax revenues. Undoubtedly, at the beginning of these problems are the abbreviations in the countries' investments that cannot reach public revenues and the deterioration in the target growth limits. Another important reason for the decrease in public revenues is the emergence of fiscal deficits related to budget expenditures, and the value of any financial deviation that may arise, especially in investment-oriented emerging economies, also causes other significant macro deviations (Ocampo et al, 2000).

The degree of influence of the factors of the global financial crisis in the formation of monetary policies also expresses the global targets focused on economic growth and the targeted financial balances, including public revenues. This expression also means specifying priority targets in formulating fiscal policies and questioning the compatibility of these targets with economic policies. The global problems in the financial crisis processes are a fundamental reason fiscal policy change in the budgetary structure has significantly affected emerging economies (OECD/The World Bank, 2019). This influence process has also done the search for public revenues more comprehensive, which may arise with different values. Inflation and deviations in a sectorial employment capacity, which are important causes of deviations in public revenues, not only prioritize overcoming deviations such as unemployment and other macro balances, but it also means reaching target economic growth values. In this context, the

most essential value that can achieve economically is undoubtedly the rational sharing of all public revenues that feed the economic growth trends between the sectors and the public economy and as an effective public income limit in the process (Commonwealth of Australia, 2019). This process also differentiates the objectives of fiscal policies, which stem from the difference in development between countries. While this differentiation causes fiscal policies to emerge with different values, especially in developing countries, it is important for interventionist public policies to take place in the fiscal policy process.

Finding more place in the process with the interventionist nature of fiscal policies and investigating the effectiveness of an interventionist investment and public target policies at the economic level also takes place in the process as an important handicap of developing countries (Cole et al, 2020: 31-32). Today, the value and implementation dynamics of an interventionist structure that conflicts with the liberal free market economy directly shape the fiscal policies that primarily aim to overcome the crisis process. This phenomenon also reveals that current fiscal balance policies should act simultaneously with economic growth policies. It can also be said that the different purposes of all the countries existing in the OECD countries, which can be considered as a ground of emphasis at the global level, at different levels of public revenues come to the fore with a significant difference in this purpose. In addition, it appears that the effectiveness of fiscal policies in overcoming the global financial crisis phenomenon based on financial practices is no longer only a problem for developing economies but also that it emerges as an essential financial tool in developed countries (Hofmans and Coevering, 2014). This approach is the structural ground where interventionist public monetary policies take place in the process and are used effectively intended for all countries. These differences have now turned into a structural position that can be expressed as fiscal balance policies and fiscal balance policies aimed at overcoming the financial crisis processes rather than paying more attention to public deficit policies within countries. The most crucial sub-dynamic provided by this transformation is reaching the limits of public revenues targeted by financial policies, and the presence of economic-oriented growth trends in the process also means supporting the sectorial structure with public policies (Ross, 2005).

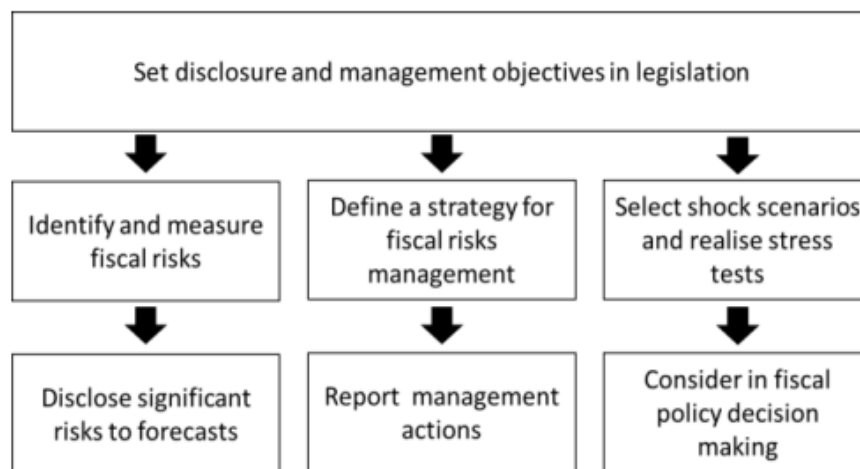
THE ACTUAL POSITION OF THE GLOBAL FISCAL CRISIS AND THE DYNAMICS OF CRISIS-ORIENTED FISCAL POLICIES

Even though developed countries have a more liberal free market economy today, they need public intervention policies more today, and they often put forth a process that is preferred for fiscal balance policies. Despite the contradictions between the interventionist structure of financial policies and the free market economy, these actual policies, especially in overcoming the economic crisis processes, are the primary fiscal policies focused on public revenues in recent years. It should also emphasize that the emergence of financial risk elements, especially structurally significant deviations, stems from the possible official phases of the decision-making processes. The lack of a transparent structure in the analysis and evaluation of the financial risks process and the fact that the fiscal policies do not have the relevant support potential in overcoming the financial risks process also cause significant errors in estimates (Hébert and Schreger, 2017).

This structural fact is also considered among the reasons for substantial deviations in terms of financial projections. In this context, the relationship of financial policies, especially towards overcoming financial risks, requires, first and foremost, the correct evaluation of financial change processes in both medium and long-term forecasts and expressing them in a clear position. In the second stage, the risk-related deviations related to the estimated values that can be estimated within the scope of the legislation in question are determined with an accurate scenario and with the support of the criteria within the scope of the legislation. Creating future projections in overcoming the financial risks related to the global process also needs a vital follow-up to clarify which estimates are based on fiscal deviations.

In the third stage, financial risks cause a structural and negative process at a specific location, necessitating a particular program and government policy in determining macroeconomic risks and controllable public debts and deficits after classifying all kinds of risk definitions (IMF, 2016). It should also mention again that uncertain budget demands, especially public borrowings and deviations in budget policy deficit estimates, are important risk factors in macroeconomic terms. The political basis of the potential magnitudes of financial risks and possible management approaches to financial risks

also has an important place in this third stage of criticizing the said fiscal deviations (European Central Bank, 2020). In Figure 1 below, it is possible to see the structural relations and mutual influence dynamics of a global financial crisis process:



Source: OECD (2020), *OECD Best Practices for Managing Fiscal Risks: Lessons from Case Studies of Selected OECD Countries and Next Steps Post COVID-19*, Working Party of Senior Budget Officials GOV/PGC/SBO(2020)6, Virtual Meeting, 23 June 2020, Paris: OECD Public Governance Directorate, 2020, p. 19.

Figure 1. Sub-Dynamics of Financial Risk Management and Structural Interaction Process

As seen in Figure 1 above, it is clear that the mutual influence level of structural relationship dynamics in global financial risk analyses has an essential place in global risk management. In this sense, it is seen that the important sub-dynamics of the countries in the definition of the financial risk process of the global common financial understandings and approaches to the national legislation of the countries are also clarified.

In other words, it is understood that in an essential stage of analysing the financial risk process and measuring-defining the deviation limits in the financial targets, the public decision-making processes frequently also engage in forming financial risk management strategies. Establishing financial stress grounds reconciling future projections and scenarios, especially for financial shocks, and the frequent emphasis on a process where financial stress-risk tests are applied constitutes an essential stage of financial risk management, especially in the public decision-making process (Irwin, 2015). In this sense, putting forward and reporting particularly striking cost risk understanding estimates means unravelling the common points regarding risk management activities at the global level. On the other hand, it is clear that the provision of impact values that can be expressed in different values within the understanding of financial risk also needs institutional requirements, and risk management, which will be provided with corporate support, makes it necessary to establish the common point of tax analysis targets.

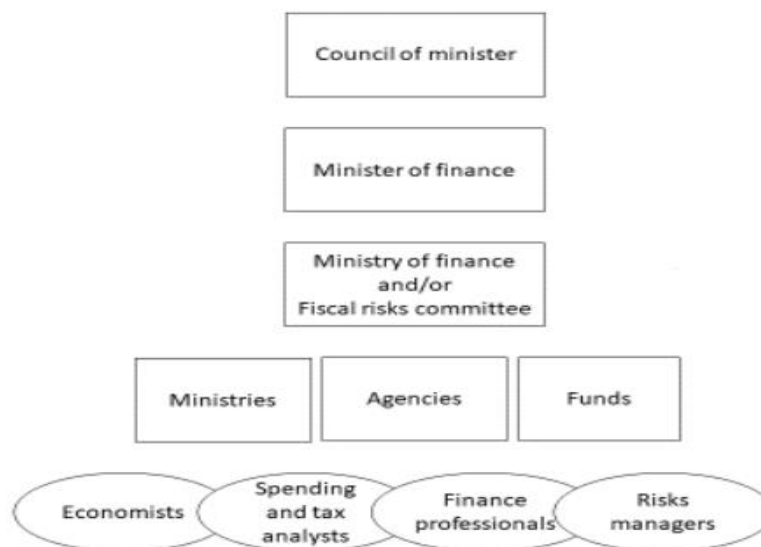
Defining financial risk management in the global financial risk understanding and creating a financial efficiency based on the past reported values of the management activities of the related strategies means that some critical international standard criteria are also included in the process and become transparent (Pamies and Berti 2017). This approach, which can also consider raising the global efficiency level of financial policies and defining rational risk priorities in decision processes, also means that standard public procedures must be determined by typical dynamics worldwide. In this respect, it appears that the formation of financial policies focused on financial risk management on the global surface and the priority targets within the scope of monetary policies are focused on preventing deviations in public revenues.

On the other hand, this fiscal fact points out that the main idea of corporate approaches focused on global economic growth and institutions that ensure global budgetary balances (Baldacci and Kumar,

2010). And also, this phenomenon means that as needed fiscal resources are more needed, the emerging economies that aim at the considered economic levels may face more global risk factors. Addressing the issue at the institutional level regarding the management of this process in terms of global financial risks and fiscal policies means the inevitable presence of effective corporate fiscal policy practices in the process.

In other words, it is revealed that the ministries in the central government process, especially the Ministry of Finance-weighted institutional structure, need a separate independent committee to manage financial risk processes. The relevant committee should provide critical projectionist rational analyses by providing resources from different funds. It appears that the mutual institutional relationship of the ministries and the fact that all kinds of professional evaluations of financial and economic experts are focused on tax analyses, as expenditures and public income constitute the central theme of corporate risk management. Access to accurate information, supported by the Ministry of Finance and other sub-institutional unions, for any independent application in the formation of financial risk committees, means an essential stage of corporate responsibility in the rational decision-making process (Barrero et al, 2020).

Decisions alone are insufficient to make the right global decisions and have the right strategies to overcome systemic financial risks. It is an essential structural element of global financial risk management at the institutional level that the decisions taken take place in a practical implementation process at the institutional level. Establishing an effective structure for the decision-making process of corporate governance and creating the financial funding process in which it is fed with the necessary funds is an essential global phenomenon that can be achieved where a common consensus is formed worldwide. In this respect, applications that can create global corporate financial units inevitably need international financial crisis management policies in which common corporate structures can be made. It means that a typical application ground also shapes rational expectations. This process is ensured by new institutional activities and mutual institutional mutual information sharing, and the creation of a trend of standard applications. In Figure 2 below, it is possible to monitor the institutional inter-structural relationship and institutional major impact units and structural sub-dynamics of a global fiscal risk process management, which can address at the institutional level:



Source: OECD (2020), *OECD Best Practices for Managing Fiscal Risks: Lessons from Case Studies of Selected OECD Countries and Next Steps Post COVID-19*, Working Party of Senior Budget Officials GOV/PGC/SBO(2020)6, Virtual Meeting, 23 June 2020, Paris: OECD Public Governance Directorate, 2020, p. 20.

**Figure 2. Institutional Responsibility for Deviations toward Public Revenues
in the Fiscal Risk Process**

As seen in Figure 2 above, it is understood that the common points of an institutional level financial risk process reveal a corporate global standard criteria value that needs professional financial approaches and risk management. In particular, it appears that the financial factors at the institutional level come to the fore and the micro-analyses that each of the corporate monetary units, where financial analyses are made, can create with their infrastructure and the sub-units. These analyses also reveal common institutional objectives regarding the determinations to risk management intended for public revenues on a global scale.

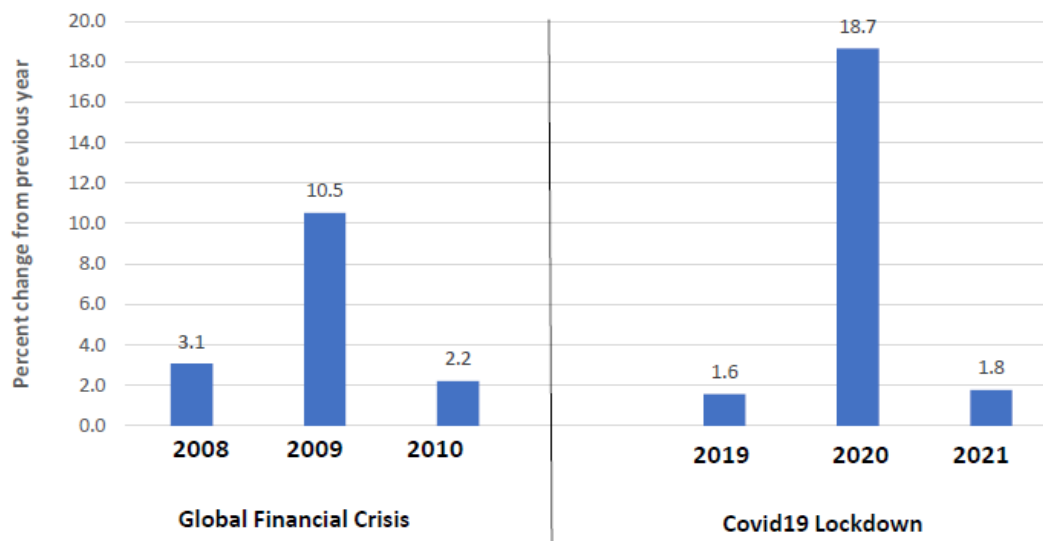
In brief, structural analyses to ensure the balance of expenditures and public revenues based on corporate goals regarding financial risk management make corporate effectiveness inevitable. Although each institutional practice at the global level brings different structural issues to the schedule at each institutional sub-unit level, overcoming the financial policy-oriented crises, especially regarding the current position of the global fiscal problems, makes the existence of international institutional criteria inevitable. The fact that global financial crises are subject to larger-scale deviations in public revenues, especially in emerging economies in recent years, has caused a further decline in the rationality of corporate efficiency targets at the global level and crisis-oriented policies to become more critical.

RECENT ALTERATIONS IN GLOBAL FISCAL RISK FACTORS AND DEVIATIONS IN PUBLIC FISCAL OBJECTIVES

The deviations created by the global financial crisis processes, especially in the public financial targets, have an essential meaning in terms of absolute and actual deviation values. This significance also means that gross debt ratios based on all world countries have increased in real terms at the global level. In general terms, the borrowing trends, which had an important upward trend after the World Wars from the beginning of the last century to the present, started to reach these gross proportional increase values in the past with a percentage increase that could reach the old debt increase values after 2000. It reveals that the deviations in the impact values of financial risk factors, primarily based on developed economies, have increased in the last ten years as an absolute percentage value equivalent to the world wars in the past years. Although this variability in the last periods of global financial risk factors also creates a significant upward trend in the impact values of emerging economies.

But, this fact reveals a lower process subject to fluctuating movements with fluctuating gross position towards the variability in the gross debt values for emerging developed first-world countries based on real values. Considering that all kinds of deviations in public revenues experience an increase in gross debt values, these real values based on GDP mean an increasing need for public financing, especially in developed first-world countries. A more significant fluctuating trend in real debt in developed countries can be explained by mutual global interactivity, in addition to being a result of changing public policies, as well as the fact that developed countries are more affected by the global financial crisis (Cantore et al, 2017). Certainly, these real fiscal deviation values cause a higher public financing deviation regarding the global impact. In addition, it is possible to explain an essential explanation of the abbreviations in the actual borrowing trends from the past century to the present, with the incomplete and erroneous and periodic inconsistency of the analyses in financial risk definitions and reporting.

It should especially emphasize that the inability to meet the increasing debt limits by public revenues is due to the failure to control public expenditures within the scope of benefit and cost analysis rather than the limited public revenues during the financial crisis (Siegel and Garcia-Feijóo, 2019). Consolidation and monitoring of debts related to financial risks and stocks of all financial risk flow values by public institutions did not take place in the process as a management strategy that presents an apparent and successful approach in terms of different risk types. Even though the increased debt securities in the management of financial risks increased due to extraordinary expenditures, it was not possible to prevent the public debts from entering a significant increase trend after the global financial crises of 2001 and 2009 (Dieppe and Guarda, 2015). When we pay attention, it appears that in financial processes where it is impossible to meet the real debt burdens with increasing public revenues, the deviations in public values inevitably create a budget debt-oriented public deviation effect and centre. In Chart 1 below, it is possible to monitor the volatility of long-term real public borrowing trends as a result of deviations in public revenues:



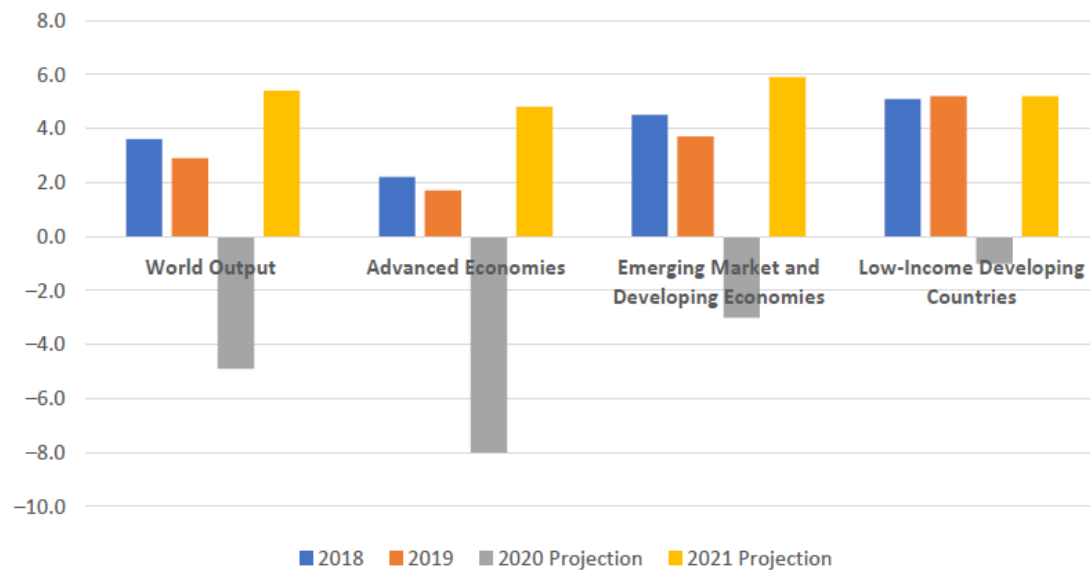
Source: IMF (2022), *World Economic Outlook - April 2022*, Washington D.C.: International Monetary Fund (IMF), 2022, pp. 62-63.

**Graphic 1. Countries' Gross Debt Position and Debt Level Alterations
in Global Time Period**

Chart 1 above shows a significant difference between emerging and developed economies in the change of long-term public debt trends. Their exchange values affecting the debt limits directly as per cent of GDP are also striking in analysing public revenue targets related to increasing public debt limits. The increasing debt burden is more affected by the financial crisis in developed economies, causing more significant financial deviations on an institutional basis, which differed as some financial variations became more controllable due to the smaller financial infrastructure not developing on an institutional base in emerging. This difference can also be explained by the fact that in the analysis of different risk types that can be expressed at the global level, risk value scales in developed economies cause higher deviations in these countries since they have very high financial resources.

At the same time, significant deviations from the review of the deviation values of financial markets, especially in America and Europe-based markets, on how to manage financial risks also caused a substantial loss of effectiveness in this regard. It should also emphasize that explaining these deviations in public revenues with debt provision values is a critical analysis technique and a financial strategic analysis approach based on case studies. Consolidation of all public debts after the world wars in countries of the world and the distant nature of these consolidated debts in the impact analysis of financial support programs resulted in the unsuccessful values of the financial flow process for achieving a target financial balance being (Mourre, 2019). This phenomenon means that a public revenues policy in the process of financial risks arising from the ineffectiveness of financial control mechanisms is also subject to significant global deviations and reveals an irrational implementation process.

On the other hand, this approach can be classified at the global level based on development-based world countries as a financial phenomenon during a worldwide financial crisis, but also as deviations in economic growth trends. This classification phenomenally, it can be considered as a structural economic growth projection based on production and output levels, developed economies, emerging economies and developing economies. It means that the effectiveness of implementing fiscal policies regarding the balance of debt and economic growth targets also makes deviations inevitable based on public revenues. In Chart 2 below, it is possible to follow the projection of economic growth trends based on public revenues among developed economies, emerging economies and low-income countries in the last period after 2018:



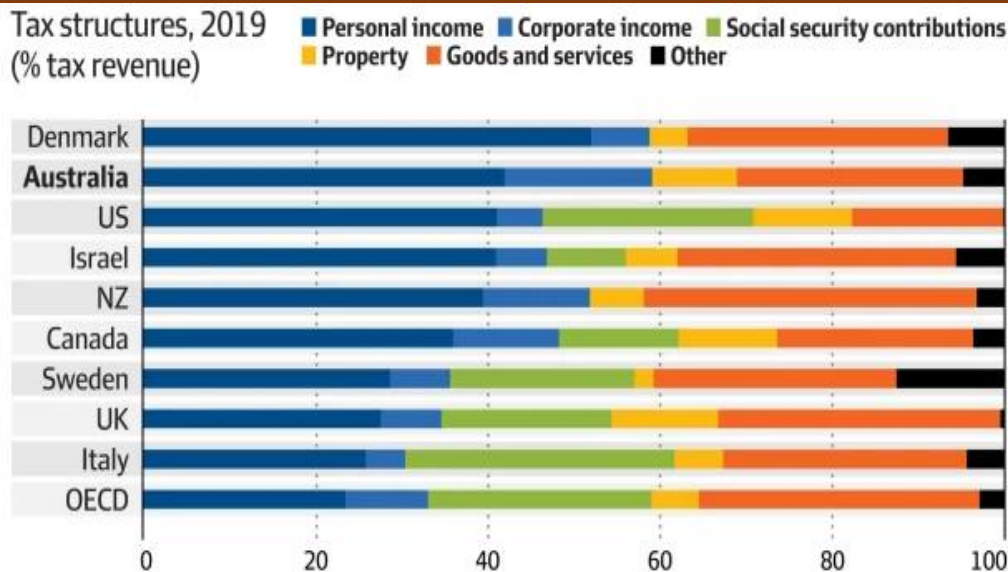
Source: Anthony J. Makin and Allan Layton (2020), “The Global Fiscal Response to COVID-19: Risks and Repercussions”, *Economic Analysis and Policy*, 69(4), pp. 1-26.
DOI:10.1016/j.eap.2020.12.016.

**Graphic 2. Outlook of Economic Growth Trends in the Global Classification
in Recent Years**

As seen in Chart 2 above, there has been a significant decrease in world production at the global level, especially in 2020, and the largest scale negative effect of this deviation is seen in developed economies. Again, it shows that the effect of an ongoing financial crisis within the Corona-19 pandemic process of 2020 reveals the most significant deviation from public revenues for 2020. It is understood that this significant deviation is on a smaller scale in emerging economies and low-income developing countries. Comparing this possible effect of the global production output values based on public revenues with a less deviation, primarily based on these countries, in terms of global production output also indicates a meaningful structure for the last period. However, it is understood that emerging economies are a world output within the scope of the worldwide 2021 projection.

After 2018, the importance of financial deviations and the causes of the financial crisis, especially in the world, as a result of different policies after the financial problems, the emerging economies also created a different economic shrinkage effect, especially in the 2019 pandemic process, the fiscal models' policy in developed economies for 2020 caused a substantial economic growth-based public income deviation. It is clear that tight monetary and fiscal policies significantly affect public incomes positively, and public expenditure trends regarding growth projects are more balanced in this process for these countries (Bouakeza et al, 2017).

In this context, to understand the recent deviation in public revenues, it is necessary to focus mainly on tax revenues, which constitute the central theme of public revenues. This obligation also means examining the distribution of income items within the tax composition scope, including tax revenues. As of the last period of 2019, it is possible to see the structure that emerged with different values in the change of tax revenues as a percentage of tax values on 2018-2019 basis. It is understood that the deviations in tax revenues in 2019 are mainly due to the contraction in personnel and corporate tax revenues compared to 2020. Graph 3 below shows the tax structure composition and the changes based on it according to the percentage tax income distribution in 2019:



Source: John Kehoe (2021), *Personal tax take second highest in OECD*, Financial Review, <https://www.afr.com/policy/tax-and-super/personal-tax-take-second-highest-in-oecd-20211206-p59f3y>, (Accessed July, 22.2021).

**Graphic 3. Distribution and Deviations of Tax Composition at the Global Level
in the Recent Period**

As can be seen in Chart 3 above, the percentage changes in tax revenues in the last period of the 2019 financial crisis emerged with significantly different structural value variability. It is also understood that these values are subject to significant deviations in tax compositions compared to 2019 after 2017 and 2018. Although it appears in different values in countries such as Denmark and Australia, where taxes are pretty high in the tax burden, it is seen that it has different meanings as personal income taxes. Within the scope of corporate tax and personal income tax, it is seen that social security taxes have been subject to significant public income deviations during the Coronavirus-19 process, mainly in the average OECD countries. This negative phenomenon has been balanced with the increases in social security contributions (Batini et al, 2018).

This process, which coincides with the period when social security services increased, also means a portfolio of public revenues, with the increase in the needed public revenues and the increasing social security benefits. As for the taxes to be provided for goods and services, a meagre increase occurred in 2019, again as the OECD average. It is observed that a fiscal policy was implemented as the deviations in the tax rates that can be taken from the service-oriented practices regarding goods and services, especially in developed countries, increased even more based on the tax base (Burriel,et al, 2020). Namely, the taxes on goods as property taxes have been subject to deviations at the lowest rates among the total taxes. These taxes have not been subject to a significant deviation with a slight increase value, with different values at the global level, based on the worldwide level. After the financial crises, it is observed that the deviations in the recent tax revenues at the global level are based on public revenues, especially the reduction of personal income taxes to a lower average and the increase in the taxes of goods and services offered as service assets.

DISCUSSION

The tariffs as under-participation shares have created a significant tax composition. It is understood that the economic growth trends in 2019 were lower, especially in developed economies, and the economic growth trends in low-income countries, on the contrary, were more prominent. The most important feature of this phenomenon is that the public income projections of the economic growth trends of emerging economies and developing countries between 2018 and 2021 are formed correctly, and that general income targets are included in the process as a more consistent phenomenon. This process can also be interpreted as the increasing financial crises in developed economies turning into a more

significant financial crisis within the coronavirus-19 process, and a considerable deviation in public revenues created a lower economic growth effect (Jorda, 2020). Especially in developed countries and countries representing emerging and emerging economies, this fiscal alteration has been taking place meaningful creating different each other. The deficiencies in the cost-benefit and economic growth-oriented fiscal policies of optimal strategic financial analyses in countries representing emerging developing countries have been included in the process as public debt analytics have been subject to more controlled and interventionist tight fiscal and monetary policies (European Commission, 2020). It shows that all income deviations for 2019 have a deviation value equivalent to the tax burden in total taxes. Although there is no significant turning point in tax compositions, the tax burden shares in the tax composition become the main criterion for the deviations. In public revenues, the tax burden in the tax composition is mainly increased in percentage shares, which means public revenues deviations in recent years, which affect the new public revenues projections (Alloza et al, 2019). However, it is seen that in developing countries where technical, and financial features are not efficient at the desired level, fiscal deviations are also in question at a higher level to ensure the balance in public revenue policies, an important tightness in expenditures and monetary. Despite everything, it is still a structural fact that economic-oriented deviations in public income levels create a lower-oriented deviation effect in emerging and emerging economies. However, because developed countries have higher financial reserves, it is understood that a higher economic negative scale effect is created due to financial fluctuations that express higher costs and deviations in public revenues at higher limits.

CONCLUSION

In the process of global financial risks, it is observed that deviations in public revenues occur in different situations and at different scales, especially concerning the development level of countries. In addition to the development level of the nations, the institutional efficiency levels that create different impact values in the financial risk processes have also made different deviations in different public income levels with varying mechanisms of impact. The most important reason for the difference in these fiscal deviations stems from the differences created by the taxes on different scales and in different tax compositions, especially in the tax-oriented balancing of the public expenditures in the public revenues policy and the process of income imbalance. It is observed that significant increases in tax scales related to social policies come to the forefront in essential periods such as the recent Corona-19 pandemic process in developing countries, and the resulting financial burdens make some significant deviations on the effects of economic growth. This scale has also created a composition of public revenues with different value scales in emerging economies that have implemented tight monetary and fiscal policies for the emergence of different public revenue values. The main reason is that in tight monetary and fiscal policies, all kinds of tax-oriented public revenue formation prioritize a process in which financial losses are minimized.

Contrary to the high budgetary deviations in developed countries, lower-cost financial appearances in developing countries affected the economic growth trends of these countries less negatively compared to developed countries. On the other hand, despite its negative impact on economic growth levels in developing countries, it also brought the weighted effect of much more intrusive fiscal policies to the fore, with a lower deviation in public revenues, more at the national as well as the global level. In the global process of financial crises, it appears that the macroeconomic balances of the countries and possible inflation processes also have a significant deviation effect on managing financial problems and public revenues. Countries subject to significant macro deviations, especially in the process of macroeconomic deviations, are also included in the process as countries that frequently bring deviations to the schedule in essential public income elements. In this period, fiscal policies are seriously emphasized, which stand more out for emerging and developing countries. Another factor that causes significant problems in the financial crisis processes is undoubtedly the fact that the financial crisis processes are not defined accurately and clearly. A process in which the program and policy risks related to the correct definition of financial crisis processes and uncertainties within the scope of the budget are in question also means an important public revenue divergence process, especially for less developed countries. This process, in which financial risks significantly shape debt policies, primarily to provide a balanced policy within national income policies, reveals a global process in which public income expectations are also increasing. Countries that need a higher level of financial resources appear

as countries that are open to all kinds of policies that can take place in the process, especially with borrowing policies, and can be directly affected by global crises. This phenomenon also reveals that these countries aim for a total fiscal budget balance but cannot create actual policies for periodic credits other than this budget balance.

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**CULTURAL HERITAGE TOURISM AS AN ALTERNATIVE TO COASTAL
TOURISM: MERSIN-SILIFKE**

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Abstract

Silifke is one of the largest districts of Mersin province and is located on the Mediterranean coastline. Due to its location, Silifke is suitable for sea-sand-sun tourism and has an important cultural heritage as it was ruled by various civilizations throughout history. Although this district has many important cultural heritage values, the fact that it is usually mentioned with sea-sand-sun tourism has prepared the background for this study. Silifke has cultural tourism, which will be an important alternative to sea-sand-sun tourism. The development of cultural tourism will contribute to the economic development of the local people and will also provide an important opportunity for the preservation and reuse of cultural heritage sites. There are various religious buildings, historical water structures, military buildings, and mausoleums in this region, which had been ruled by many civilizations such as the Ottomans and Seljuks, especially during the Roman and Byzantine periods. These tangible cultural structures are values and traces of the past. In addition to these, there are natural formations such as caves and sinkholes that can be evaluated within the scope of cultural tourism. In the scope of the study are discussed Roman Temple, Cambazlı Church, Alaaddin Mosque, Zeus Temple and Church, and Aya Thekla Church (religious buildings); Poimenios Bath and Three Beauties Mosaic, Stone Bridge, and Tekfur Warehouse Water Cistern (historical water structures); Silifke Castle, Tokmar Castle and Liman Castle (military buildings); Adam Kayalar, Demircili Mausoleum and Mezgit Castle (mausoleums) and Heaven-Hell Sinkhole and Astım Cave as natural formations. The fact that these structures are not actively used as an alternative cultural tourism element does not provide economic benefits to the local people and causes many structures to be unused and destroyed. As a result of the study, it is observed to be important to transform the region into a more active and attractive cultural touristic area by including these cultural structures in the scope of cultural tourism. In this context, promotions and landscaping, strengthening structural elements, necessary restorations, and tourism routes should be created for the region.

Keywords: Cultural heritage, alternative tourism, historical buildings, natural formations, Mersin

Özet

Silifke, Mersin ilinin en büyük ilçelerinden biri olup Akdeniz kıyı şeridinde konumlanmıştır. Silifke, konumundan dolayı deniz-kum-güneş turizmine elverişli olmasının yanı sıra tarih boyunca çeşitli medeniyetlere ev sahipliği yapmasından dolayı önemli bir kültürel mirasa da sahiptir. Bu ilçenin genel olarak deniz-kum-güneş turizmiyle anılması ve birçok kültürel miras değerine sahip olmasına rağmen kültür turizminin yetersizliği bu çalışmanın yapılmasına zemin hazırlamıştır. Deniz-kum-güneş turizmine önemli bir alternatif olacak kültür turizmi potansiyeline sahip olan Silifke’de bu turizmin

artması yerlin halkın ekonomik olarak kalkınmasına katkı sağlayacağı gibi kültürel miras öğelerinin de korunması ve yaşatılması için önemli bir fırsattır. Özellikle Roma ve Bizans dönemi olmak üzere Osmanlı ve Selçuklu gibi birçok medeniyete ev sahipliği yapmış olan bu bölgede geçmişin izlerini taşıyan, çeşitli dini yapılar, su yapıları, askeri yapılar ve anıt mezarlar bulunmaktadır. Bunların yanı sıra kültür turizmi kapsamında kullanılabilecek doğal oluşum olan mağara ve obruklar da bulunmaktadır. Roma Tapınağı, Cambazlı Kilisesi, Alaaddin Camii, Zeus Tapınağı ve Kilisesi ve Aya Thekla Kilisesi, dini yapılar; Poimenios Hamamı ve Üç güzeller Mozayiği, Taş Köprü ve Tekfur Ambarı Su Sarnıcı, su yapıları; Silifke Kalesi, Tokmar Kalesi ve Liman Kale askeri yapılar; Adam Kayalar, Demircili Anıt Mezarı ve Mezgitkale anıt mezarlar; Cennet Cehennem Obruğu ve Astım Mağarası ise doğal oluşumlar olarak çalışma kapsamına alınmıştır. Çalışma alanında bulunan bu yapıların alternatif bir kültür turizmi unsuru olarak aktif olarak kullanılmaması hem yöre halkına ekonomik fayda sağlamamakta hem de birçok yapının kullanılmaz hale gelmesine ve yıkılmasına neden olmaktadır. Çalışmada, Silifke’de mevcut kültürel yapıların, kültür turizmi kapsamına alınarak bölgenin daha aktif ve çekici bir kültürel turizm alanına dönüştürülmesinin önemli olduğu sonucuna varılmıştır. Bu kapsamda bölge için tanıtım ve çevre düzenlemesi, gerekli yapı elemanlarının güçlendirilmesi ve restorasyonların gerçekleştirilmesi ve ayrıca turizm rotalarının oluşturulması önerilmektedir.

Anahtar Kelimeler: Kültürel miras, alternatif turizm, tarihi yapılar, doğal oluşumlar, Mersin

INTRODUCTION

Culture is the whole of the material and spiritual values that society has learned through trial and error in the historical process (Aktan & Tutar, 2017). Religion, geography, topography, climate, social relations etc. are the factors that determine the culture of a society (Selanik Ay & Kurtdeğid Fidan, 2013). Societies differ from each other in terms of such cultural characteristics.

According to the definition of the Turkish Language Association, heritage is 'what one generation transfers on to the next generation'. Heritage is a whole that includes nature, economy, art, history, religion, etc. Cultural heritage is the whole of the anonymous features such as religion, customs and traditions, knowledge, etc. that are in constant change and transformation from past to present (Convention on the Value of Cultural Heritage for Society, 2005). Cultural heritage is a concept that has been suggested only for masterpieces with artistic and historical value; however, today it includes all elements in the cultural context that reflect a society (Ahmad, 2006; Dönmez & Yeşilbursa, 2014). Cultural heritage is divided into two: tangible cultural heritage and intangible cultural heritage. Tangible cultural heritage is divided into two subgroups: movable cultural heritage (which can be taken from one place to another) and immovable cultural heritage (which cannot be removed from its location) (ICCROM & UNESCO, 2006; Table 1).

Table1. Cultural heritage – Tangible cultural heritage and intangible cultural heritage

CULTURAL HERITAGE		
Tangible Cultural Heritage		Intangible Cultural Heritage
Immovable cultural heritage	Movable cultural heritage	
Architectural structures,	Pictures,	Traditions and customs,
Archaeological sites,	Statues,	Beliefs,
Historical parks and gardens,	Historical coins,	Handicrafts,
Bridges,	Musical instruments,	Folk dances,
Wells,	Books,	Theatre,
etc.	etc.	etc.

At the beginning of the 21st century, tourism was thought to make an economic contribution, but over time it was understood to be important in terms of socio-cultural and ecological aspects. With this understanding, alternative tourism has been sought for sea-sand-sun tourism and alternative tourism types such as congress tourism, golf tourism, sports tourism, adventure tourism, cultural tourism etc. have emerged (S. Çelik, 2018).

Cultural tourism examined in this study is one of the alternative tourism types and it is learning-based unlike other alternative tourism types. Cultural tourism is the trips made by different communities from the region to get to know the tangible and intangible cultural heritage and to improve their knowledge (Akıanoğlu, 2010; Halaç & Ergün, 2020; Öztürk & Yazıcıoğlu, 2002). One of the most positive aspects of cultural tourism is that it contributes to the preservation of cultural heritage, in addition to providing economic income. However, using cultural heritage sites for tourism may cause irreversible damage if not planned and carried out in an organized way (Emekli, 2012). The word “cultural tourism” was used for the first time in the 1980s by the European Commission. As stated above, cultural heritage emerged as a result of social thoughts and acknowledges from the past to the present, and therefore, cultural tourism should be connected not only with the heritages that emerged in the past, but also with the lifestyles of the societies in the current period. Cultural tourism is defined as visits made for the purpose of discovering such art, architecture, historical values, culinary products, music, etc. by the World Tourism Organization (UNWTO, 2017).

The leading regions of sea-sand-sun tourism in Turkey are the Mediterranean and Aegean coasts (Sezer, 2017). Silifke district of Mersin, located in the Mediterranean Region, is also one of the important places in coastal tourism. This region also has important tangible and intangible cultural heritages as an alternative to coastal tourism. However, it has been determined that today the cultural tourism potential in the region has not been developed sufficiently. Developing cultural heritage tourism as an alternative to sea-sand-sun tourism is an important factor to ensure competitiveness (Oskay, 2012). In this study, the tangible cultural heritages in Silifke were discussed and it was aimed to increase the use of cultural heritage in tourism. In this context, religious buildings, historical water structures, military buildings, mausoleums, and natural formations in the region were examined. Along with the collection of resources in the existing literature and conduct of area studies, a table was created in the findings of the study, and suggestions were made.

MATERIALS AND METHODS

The study consisted of two stages. In the first stage, the general characteristics of Silifke were investigated. In the second stage, structures with tangible cultural heritage potential were identified and defined through a comprehensive literature review. After the definitions, area studies were conducted. The area studies showed that the region is quite inadequate in terms of cultural tourism and increased the necessity of investigation. The considered cultural heritages were selected from those that were taken under preservation as protected areas by the Adana Cultural Heritage Preservation Directorate.

STUDY AREA: SILIFKE GEOGRAPHICAL BORDER AND FEATURES

Silifke is a district of Mersin province located in the Mediterranean region of Turkey. It is bordered by the districts of Mersin, Mut and Gülnar in the west, Erdemli district in the east, Karaman province in the north and the Mediterranean Sea in the South (Figure 1).

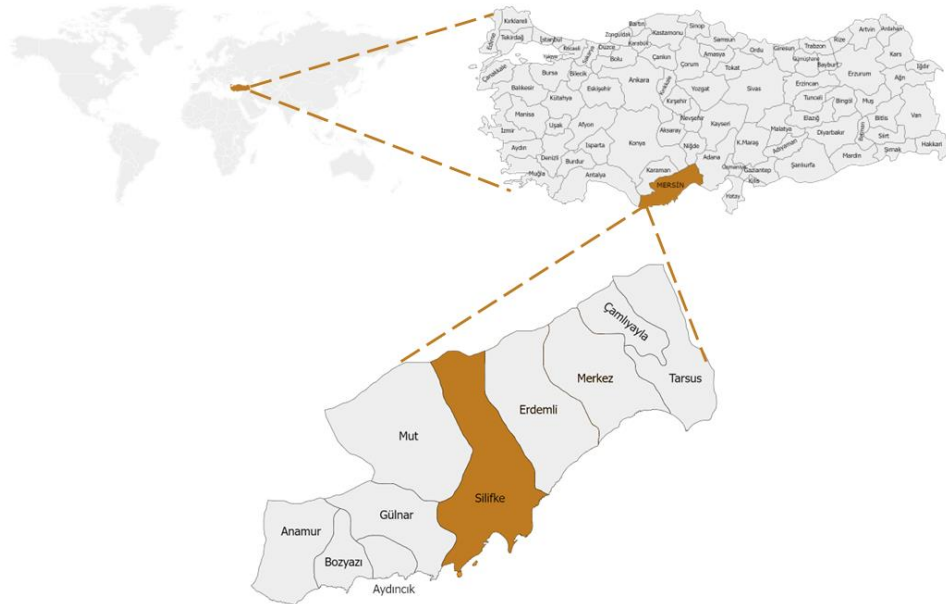


Figure1. Location of Silifke.

The foundation of Silifke is based on the Greeks founding the Holmi colony in the Taşucu district of Mersin in the 7th century Before Christ (BC) and also the first civilization known in Silifke is "Holmi Colony" (Genç, 2003). The colony of Holmi was settled in today's Silifke location by Seleucos Nicator I, one of the chief commanders of Alexander the Great and also the founder of the Syrian Kingdom. However, the Holmi colony began to decline in this region over time. Silifke, which was known as Seleukia at the time it was founded, was ruled by many civilizations such as the Kingdom of Egypt, Selekos, Rome, Byzantium, Karamanoğulları and the Ottoman Empire. Silifke developed significantly during the Roman period and reached the level of Tarsus district of Mersin, which is one of the most important settlements of the region (Çelik, 2009; URL-1).

THE CULTURAL HERITAGE VALUES OF SILIFKE

Silifke has been under the rule of different civilizations many times over the centuries and important cultural heritages have remained from these civilizations. As a result of the contribution from these civilizations, there is an important cultural tourism potential in the district. Some of these important cultural heritages are religious buildings, historical water structures, military buildings, mausoleums, etc.

Religious Buildings

Today in Silifke, there are churches and temples built during the Roman and Byzantine periods, as well as mosques and tombs built during the Seljuk and Ottoman periods. While the Roman Temple, Zeus Temple and Church, Aya Thekla Church (Meryemlik) and Cambazlı Church are among the cultural heritage buildings of the Christian period, Alaaddin Mosque is among the important Islamic cultural heritage buildings.

Roman Temple: It is thought that the building was built by the Romans in the 2nd century. Through studies, it was concluded that the long side of the building in its original state consisted of 14 columns and the short side consisted of 8 columns. However, it is seen that only one of these columns survived (URL-1).

Cambazlı Church: The church is located in Cambazlı village of Silifke. It is thought that the church was built by the Byzantines towards the middle of the 5th century (Yakar et al., 2009). The church is 29 m long and 22 m wide. (Figure 2. a) Today, the building generally preserves many of its original features. The church and the environment are located in the 3rd degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

Alaaddin Mosque: The building is located to the west of the River Göksu and it is also known as the Central Mosque and Mosque Kebir. The exact date of construction of the mosque, which is thought to have been built by the Seljuk Sultan Alaaddin Keykubat, is not known (Özbey, 1995). The mosque and the environment are located in the 2nd degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

Zeus Temple and Church: The building, which was built as a temple in the 2nd century AD, was reused as a church by the Byzantines. Through studies, it was concluded that the building had 14 columns on the long side and 8 columns on the short side in its original state (Figure 2. b). It is seen that the building has a rectangular plan and most of the original columns were destroyed (Mansel, 1943).

Aya Thekla Church (Meryemlik): Located approximately 2 kilometers south of Silifke, the building became the center of the Aya Tekla culture in the 5th century. It was determined that the building was also used as a pilgrimage center (Almaç et al., 2019). The church and the environment are located in the 1st degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

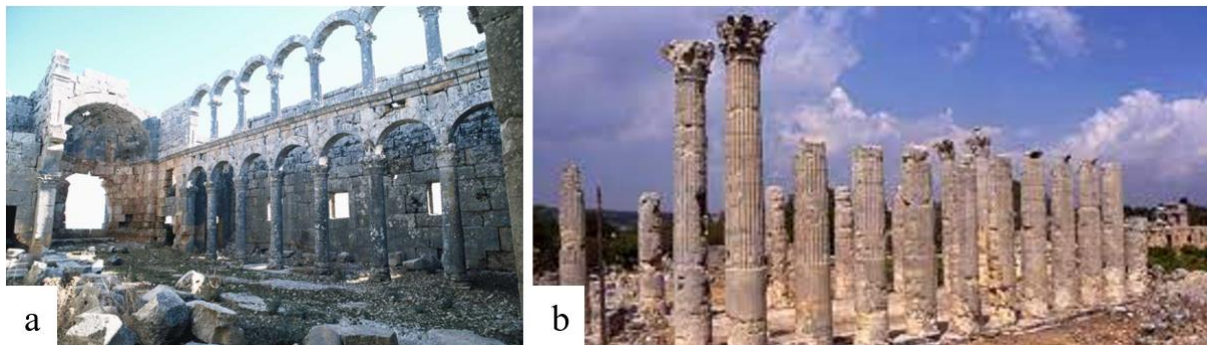


Figure2. Religious Buildings in Silifke – **a.** Cambazlı Church (URL-2), **b.** Zeus Temple and Church (URL-3)

Historical Water Structures

Poimenios Bath and Three Graces Mosaic: It is thought to have been built by Poimenios in the 4th century during the Roman Period. There is a mosaic in the bath of the building (Figure 3. a). The bath was built where the stream passing under the Cennet sinkhole reaches the sea. Zeus' daughters Aglaia, Euphrosyne and Thalia are depicted on the mosaic (URL-1). The building located in Narlıkuyu is located in the 1st degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

Stone Bridge: As a result of studies, it was determined that the bridge was built with 7-eyes in the Roman period. Over time, it was restored as a 5-eyed one as a result of important changes in the Ottoman and Republican periods. It is located on the River Göksu in the city center of Silifke (Figure 3. b). Today, the bridge extending in the east-west direction is actively used pedestrians and vehicles (Yeşilbaş, 2016).

Tekfur Warehouse Water Cistern: The cistern was built 12 m deep into the ground and was built 45 m on the long side and 23 m on the short side during the Byzantine period. The structure, located in the southeast of Silifke Castle, was filled with water from the castle and the hill (Kerem, 2009). The cistern and the environment are located in the 3rd degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

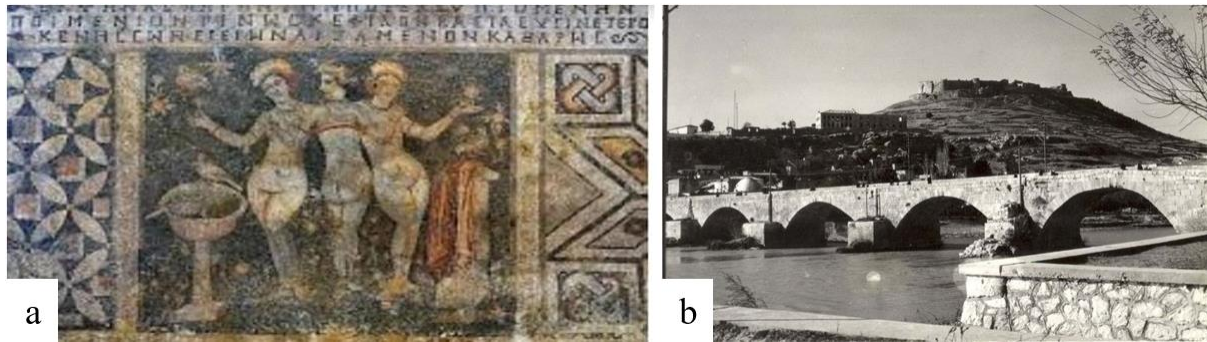


Figure3. Historical Water Structures in Silifke - **a.** Poimenios Bath and Three Graces Mosaic (URL-4), **b.** Stone Bridge (URL-5)

Military Buildings

Silifke, had been ruled by many civilizations due to its significant location, and these civilizations built many buildings for defense, attack and living. Some of these buildings examined in the study are Silifke Castle, Tokmar Castle and Liman Castle.

Silifke Castle: It is thought by researchers that the castle was built in the early Roman period and there is Tekfur Warehouse Water Cistern to the east. It has been determined that the castle consists of a total of 23 bastions in its original state, but only 10 bastions remain today (Bingöl, 2004). The castle and the environment are located in the 1st degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

Tokmar Castle: The castle was built on a hill overlooking the sea in the 12th century. Today, most of the castle has been destroyed, but only 1 defensive bastion remains (Figure 4. a). The castle is located in the 1st degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

Liman (Ak) Castle: It was built by the Ottoman Empire in 1571 for maritime trade and defense purposes in Silifke Taşucu, 150 meters from the sea. There are some building remains in the courtyards of the two-courtyard castle (Sözlü, 2015; Figure 4. b). The castle and the environment are located in the 1st degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

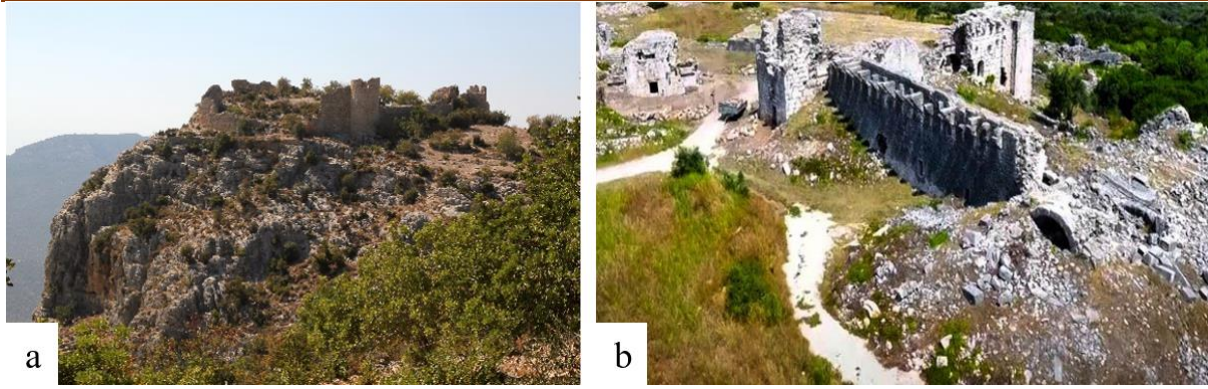


Figure4. Military Buildings in Silifke – **a.** Tokmar Castle (URL-6), **b.** Liman Castle (URL-7)

Mausoleums

Adam Kayalar: It was built by the Romans in the 2nd century AD on the steep slope of the Devil Creek valley in the Hüseyinler village of Silifke. Adam Kayalar was built by the families of important statesmen to carve the rocks after their death and there are reliefs of 11 men, 4 women and a goat (Figure 5. a). The mausoleum and the environment are in the 1st degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

Demircili Mausoleum: These one or two storey mausoleums belonging to the noble class of the Imbriogon Ancient City are in Uzuncaburç area of Silifke (Figure 5. b). It was built in the 2nd century during the Roman Period (URL-1). The mausoleum and the environment are in the 1st degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

Mezgit Castle: The mausoleum, also known as the Fearless King Mausoleum in Silifke's Susanoğlu location, is thought to have been built in the 2nd or 3rd century during the Roman Period (Yakar & Doğan, 2017). The mausoleum and Susanoğlu environment location are in the 1st and 3rd degree archaeological conservation sites (Adana Cultural Heritage Preservation Directorate, 2022).



Figure5. Mausoleums in Silifke – **a.** Adam Kayalar (URL-8), **b.** Demircili Mausaleum (URL-9)

Natural Formations

Heaven – Hell Sinkhole: It is located approximately 22 km northwest of the centre of Silifke, and both sinkholes were formed by the collapse of the surface as a result of chemical erosion. Heaven Sinkhole is at a depth of 70 meters and can be reached by a ladder with 452 steps. There is a cave at the deepest point of the sinkhole and there is a small church building at the entrance of the cave. Hell Sinkhole is 128 meters deep and it is not possible to reach the inside of the sinkhole (Figure 6. a). Both sinkholes are in the 1st archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

Astim Cave: The cave is located 300 m southwest of the Heaven and Hell sinkholes and is known as an asthma cave because it is thought to be good for asthma. The cave is approximately 300 m long and there are stalactites, stalagmites and pillars inside the cave (Figure 6. b). The cave is located in the 1st degree archaeological conservation site (Adana Cultural Heritage Preservation Directorate, 2022).

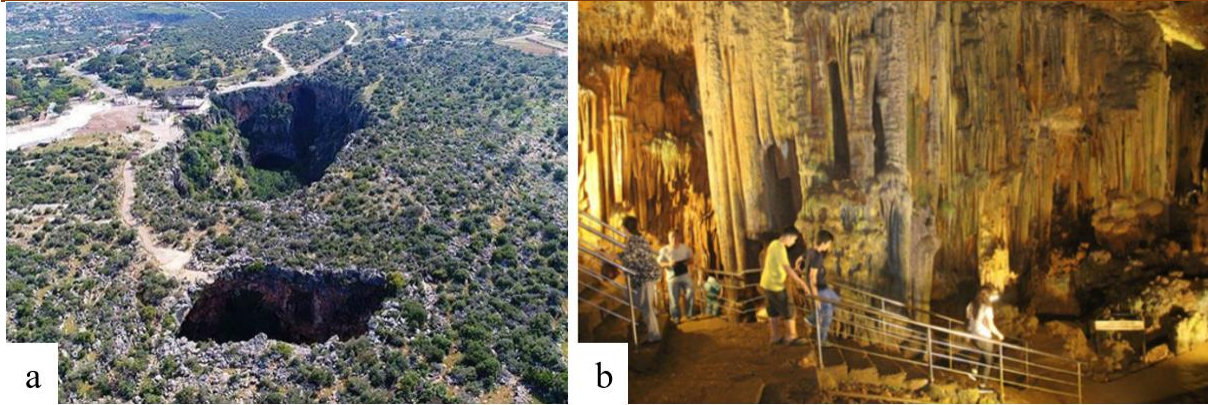


Figure6. Natural formations in Silifke – **a.** Heaven – Hell Sinkhole (URL-10), **b.** Astım Cave (URL-11)

CONCLUSION

Cultural tourism is one of the most important alternatives of sea-sand-sun tourism. The main difference of cultural tourism from other alternative tourism types is its being for learning-based purposes. The main purpose of this type of tourism is to learn the tangible and intangible cultural heritages of the region visited as a traveler. This cultural heritage can be tangibles such as buildings, wells, bridges, etc., or intangible such as religion, language, tradition, custom, folk dances.

Within the scope of the study, the tangible cultural heritage areas the Silifke of Mersin district were researched and defined. The main purpose is to increase the tendency towards cultural tourism as an alternative tourism. In the study, a total of 17 tangible cultural heritage structures were examined and all of these heritages are under preservation by the conservation board. As a result of the literature reviews in the study, it has been determined that these structures are not adequately evaluated and the promotions are insufficient within the scope of cultural tourism. In the study, it was concluded that necessary promotions should be made by official institutions, various tours should be organized and tourism routes should be created without damaging these cultural heritages. With these suggestions, it is absolutely necessary to increase the participation of the areas considered in cultural tourism.

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BRAIN ANEURYSM DETECTION USING IMAGE PROCESSING TECHNIQUES

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Abstract

In this study; Intracranial aneurysms causing vital aneurysmal subarachnoid hemorrhage were examined in brain cerebral computed tomography angiography (CTA). Among these aneurysms, the existing data set of non-ruptured saccular brain aneurysm was used. For this, image processing techniques were used in the MatLab programming language. For a new approach proposed in the study, values such as area, diameter, maximum and minimum axis distances were calculated as numerical data for each region determined as a result of filtering techniques in the medical image. Numerical results of aneurysm in the study; perimeter length is calculated as 79.0380 units and area is calculated as 404.0000 units.

Keywords: Image Processing, Brain Aneurysm Detection, Cerebral CTA

1. Introduction

Aneurysm is referred to as vasodilation. This vasodilation is the budding of artery from one point to the outside. It is also the fact that a segment has the appearance of a balloon (Adnan 2014). Aneurysms are caused by constant pressure from blood flow where the artery bifurcates (Cinar and Oran 2022; Malek et al. 2000). As aneurysms occur in any vessel in the body, they are commonly seen in the abdominal aortic artery, thoracic aortic artery and intracranial artery. The most critical of these aneurysms are brain aneurysms. Aneurysms in the brain are an abnormal protrusion that develops in the cerebral artery where the vessel wall is weakened.

Early diagnosis of brain aneurysms is important for both surgical and endovascular treatment. Due to this importance, the imaging method to be used for the diagnosis of intracranial aneurysm should be easily applicable. In addition, it should not cause any complications in the patient. However, these transactions should be carried out cheaply and quickly (Ali et al. 2003). In the diagnosis of intracranial aneurysm, three different methods are preferred to determine the morphology of the aneurysm. These; computed tomography angiography (CTA) after venous injection, magnetic resonance angiography (MRA) and digital angiography (DSA) methods.

Accurate diagnosis of brain aneurysm is an issue that is frequently addressed by researchers. For this, the CTA method is preferred. CTA generates software-based rendered images from advanced CT that show cerebral vessels in three dimensions. The new image obtained in a short time can be checked for surgical planning and should contain images of the brain, skull bones or vascular structure. CTA and MRA are recommended as the first approach in the detection of non-ruptured aneurysms due to their less invasive nature.

In studies in the literature, image enhancement studies have been frequently discussed in order to diagnose brain aneurysm. For this reason, image processing and deep learning-based studies applied to medical images in the early detection and diagnosis of the disease have become increasingly important in recent years.

In the study, a data pool was created by collecting brain CTA image data of a patient. An image processing-based method has been determined using the Matlab program. Then, by applying digital processing techniques, parameters such as contrast, pixel density, signal-to-noise ratio in the image are improved. In this method, segmentation-based techniques are used to extract the numerical data of the aneurysm region. For this, the study was carried out in three stages. Firstly, preprocessing steps were applied to detect the aneurysm during the segmentation process. As a preprocessing, the brain CTA image is converted to grayscale. Secondly, image enhancement is performed using thresholding techniques, sharpening, and filters. As a final stage, segmentation is done for regional analysis.

2. Brain Aneurysms

Brain aneurysms are classified into different types based on size, shape, and location (Malek et al. 2000). Aneurysms are examined in four classes for size.

- ✓ Small aneurysms <5mm (1/4 inch)
- ✓ Medium aneurysms 6-15 mm (1/4 – 3/4 inch)
- ✓ Large aneurysms 16-25 mm (3/4 – 5/4 inch)
- ✓ Giant aneurysms >25mm (5/4 inch)

According to their morphology, it is possible to examine aneurysms in two classes as saccular and non-saccular. Saccular aneurysms are examined in two ways as narrow-necked and wide-necked aneurysms. Non-saccular aneurysms are classified as fusiform, dissecting, mycotic, neoplastic, and pseudoaneurysm.

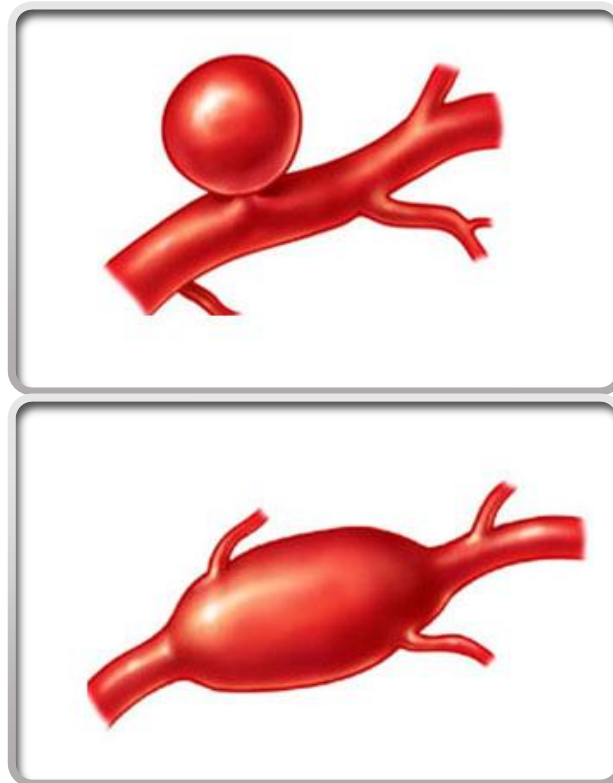


Figure 1. Types of Aneurysms According to Their Morphology

3. Image Processing with MatLab: A Case Study

In the study, brain CTA coronal images of a patient with brain aneurysm treated in the neurosurgery outpatient clinic were examined. For this, the brain CTA image data scanned with 0.5 mm thin

sections was transferred to Matlab software. The 3D medical image of the data is [512x512x693] in size. Then, the image was converted to binary form by squeezing it. The 3D medical image and its binary form are given in Figure 2.

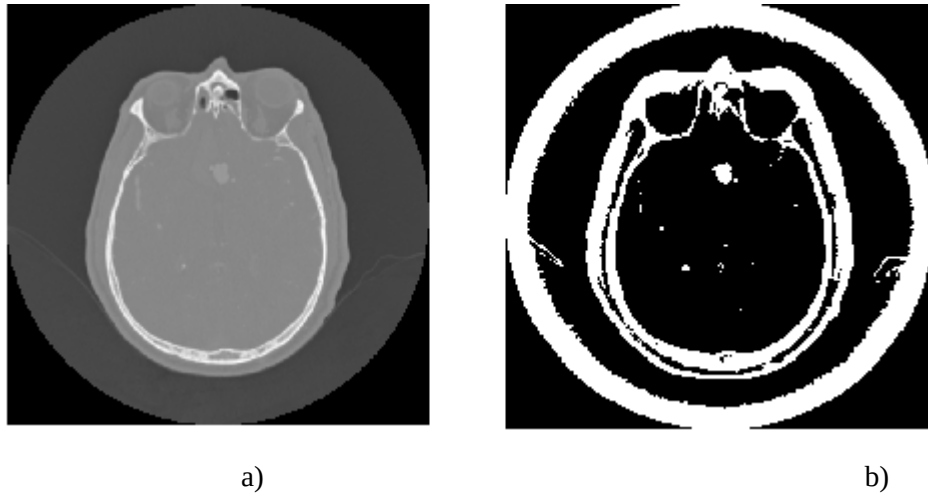


Figure2. a) Brain Aneurysm b) Binary Form

After obtaining the binary form of the brain CTA, the region of the aneurysm was separated, mask and filter process was performed. The resulting image is given in Figure 3.

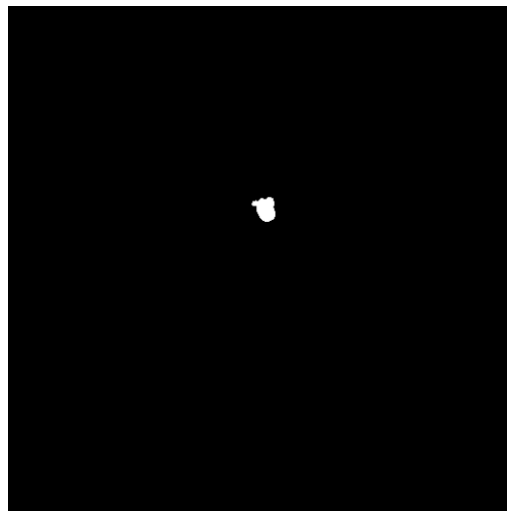


Figure 3. View of Aneurysm with Image Segmentation

4. Results and Discussion

In the study, a new approach is proposed on the 3D brain CTA medical image of a patient with aneurysm. For this approach, values such as area, diameter, maximum and minimum axis distances were calculated as numerical data for each region determined as a result of filtering techniques in the medical image. Analysis results covering different regions of the image are given in Table 1. Accordingly, the region of the aneurysm is shown in green.

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Table 1. Numerical Data Analysis for Regions Identified in the Patient's CTA Image

Region No.	Area	Major Axis Length	Minor Axis Length	Eccentricity	Orientation	Euler Number	Equivalent Diameter	Perimeter
1	45856.0000	685.9337	678.3667	0.1481	-1.0870	1	241.6313	1605.2320
2	27121.0000	484.7802	414.1078	0.5199	87.7721	1	185.8266	1148.4310
3	404.0000	26.3651	20.8770	0.6107	-64.6817	1.0000	22.6801	79.0280
4	36.0000	7.8039	6.0716	0.6282	65.8864	1.0000	6.7703	19.1950
5	27.0000	6.5245	5.3905	0.5634	-77.5084	1.0000	5.8632	15.3410
6	25.0000	9.4642	4.7336	0.8659	-3.6790	1.0000	5.6419	26.5970
7	20.0000	5.2662	5.0728	0.2685	-45.0000	1.0000	5.0463	12.8270
8	19.0000	7.7334	3.6756	0.8798	4.0728	1.0000	4.9185	15.5480
9	18.0000	9.2007	2.9547	0.9470	-81.2952	1.0000	4.7873	17.3260
10	12.0000	5.4188	3.0864	0.8219	4.8367	1.0000	3.9088	10.0150
11	12.0000	8.9931	2.2140	0.9692	24.7539	1.0000	3.9088	16.2180
12	11.0000	10.5527	1.9245	0.9832	83.6135	1.0000	3.7424	17.3010
13	10.0000	4.1633	3.3546	0.5923	-45.0000	1.0000	3.5682	8.6260
14	10.0000	4.5314	2.9212	0.7645	-26.5651	1.0000	3.5682	8.1460
15	8.0000	5.6713	2.0622	0.9316	-29.6501	1.0000	3.1915	8.9980
16	8.0000	3.6515	2.9721	0.5809	-45.0000	1.0000	3.1915	6.8310
17	6.0000	3.2660	2.9059	0.4564	26.5651	1.0000	2.7640	6.2770
18	4.0000	3.6515	1.8257	0.8660	-18.4349	1.0000	2.2568	5.0530
19	4.0000	2.3094	2.3094	0.0000	0.0000	1.0000	2.2568	3.5560
20	4.0000	2.3094	2.3094	0.0000	0.0000	1.0000	2.2568	3.5560
21	3.0000	2.5820	1.7638	0.7303	45.0000	1.0000	1.9544	3.0930
22	3.0000	2.5820	1.7638	0.7303	-45.0000	1.0000	1.9544	3.0930
23	3.0000	2.5820	1.7638	0.7303	45.0000	1.0000	1.9544	3.0930
24	3.0000	2.5820	1.7638	0.7303	-45.0000	1.0000	1.9544	3.0930
25	3.0000	2.5820	1.7638	0.7303	-45.0000	1.0000	1.9544	3.0930
26	3.0000	3.4641	1.1547	0.9428	90.0000	1.0000	1.9544	3.9200
27	3.0000	2.5820	1.7638	0.7303	-45.0000	1.0000	1.9544	3.0930
28	2.0000	2.3094	1.1547	0.8660	0.0000	1.0000	1.5958	1.9600
29	2.0000	2.3094	1.1547	0.8660	90.0000	1.0000	1.5958	1.9600
30	2.0000	2.3094	1.1547	0.8660	90.0000	1.0000	1.5958	1.9600
31	2.0000	2.3094	1.1547	0.8660	90.0000	1.0000	1.5958	1.9600
32	2.0000	2.3094	1.1547	0.8660	90.0000	1.0000	1.5958	1.9600
33	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
34	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
35	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
36	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
37	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
38	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
39	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
40	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
41	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
42	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
43	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
44	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
45	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
46	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
47	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
48	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
49	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
50	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
51	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
52	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
53	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
54	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
55	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
56	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000

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57	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
58	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000
59	1.0000	1.1547	1.1547	0.0000	0.0000	1.0000	1.1284	0.0000

The binary image of the aneurysm area in the 0.5 mm thin section 3D image of the brain CTA of the patient with aneurysm is given in Table 2.

Table 2. Binary Image of Aneurysm

[illegible]

According to this; the binary size of the aneurysm was calculated as [25x23] and 458 units.

5. Conclusion

In this study, image processing techniques were used to obtain a clearer image of the aneurysm in the image data of patient with brain aneurysm. As a processing step, the image was preprocessed. The image has been improved by applying the necessary filtering methods to remove noise. For the detection of aneurysm in the patient's image, segmentation was performed and regional analysis was performed.

The literature of this study:

- Determining the risk of bleeding in brain aneurysms
- Early diagnosis and diagnosis of similar diseases of vital importance
- Being a guide to radiologists

contributions have been made.

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EXAMINATION OF PRE-OP AND POST-OP BRAIN ANEURYSM IMAGES

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Abstract

In this study, clipping process applied as a surgical treatment in brain aneurysms using image processing techniques was investigated. For this, a preoperative and postoperative computed tomography angiography (CTA) image data pool was created. Ruptured and non-ruptured medical images in different time periods were examined by applying image processing techniques to the obtained data set. In the image of the ruptured aneurysm before the operation, it is seen that the clipping process was applied at the end of the operation. As a result of the surgical procedure, it was observed that the aneurysm was non-ruptured. As a result of the study, it was determined that the preoperative aneurysm area, perimeter, and axis length values increased according to the image processing data. On the other hand, it was observed that these values decreased in the data obtained after the surgery.

Keywords: Image Processing, Craniotomy, Ruptured Aneurysm

1. Introduction

Aneurysm is outward enlargement that occurs at a weakened point in the vessel wall for various reasons (Cinar and Oran 2022). Intracranial aneurysms are the most common type of aneurysm among clinical conditions encountered in neurosurgery. Middle cerebral artery aneurysms are the second most common aneurysms among all aneurysms. In addition to ruptured aneurysms that cause subarachnoid hemorrhage, there are saccular aneurysms that do not bleed and are detected incidentally. Although endovascular methods are used in the treatment of the disease, surgical treatment methods are usually at the forefront. Dissection and separation of the aneurysm neck and dome is another phase of surgical treatment. After this stage is completed, closing the neck of the aneurysm with an aneurysm clip and separating it from the systemic circulation is the aim and the last stage of the surgical treatment method (Cokluk et al. 2014).

Different methods can be used in the surgical treatment of middle cerebral artery aneurysms. These surgical treatment methods are given in Figure 1.

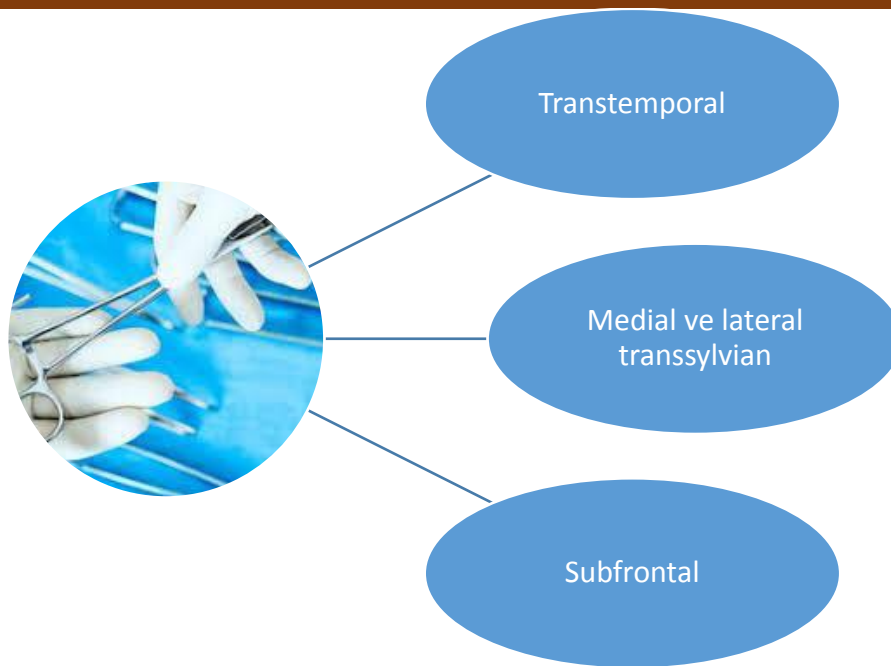


Figure 4. Methods Used in Surgical Treatment of Aneurysms

Metallic aneurysm clips used to separate the aneurysm from the systemic circulation with surgical treatment are only required to separate the aneurysm from the systemic circulation. It is undesirable to cause a decrease or arrest in middle cerebral artery blood flow velocity (Cokluk et al. 2014). After the clip application, the aneurysm can be reduced and its effect may disappear. Other aneurysms can be seen and treated during surgical treatment. The blood elements around the aneurysm and in the brain tissue can be cleaned during surgery. Eliminates the risk of bleeding. During the process, blood can be drained from the subarachnoid space. Due to the high mortality and morbidity rates of ruptured aneurysms, early diagnosis is vital for both surgical and endovascular treatment (Adnan 2014). Various imaging methods are available for the diagnosis of brain aneurysms. These imaging methods are given in Figure 2.

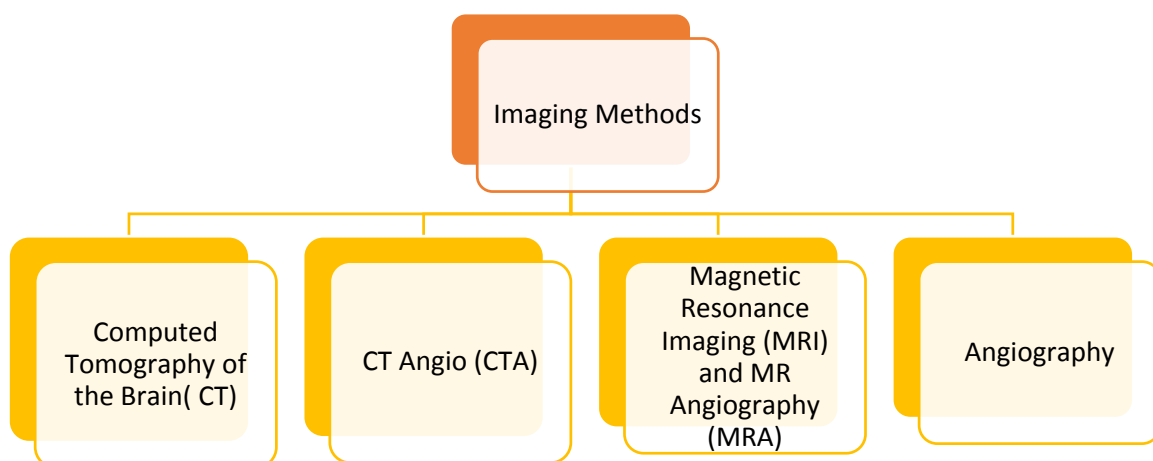
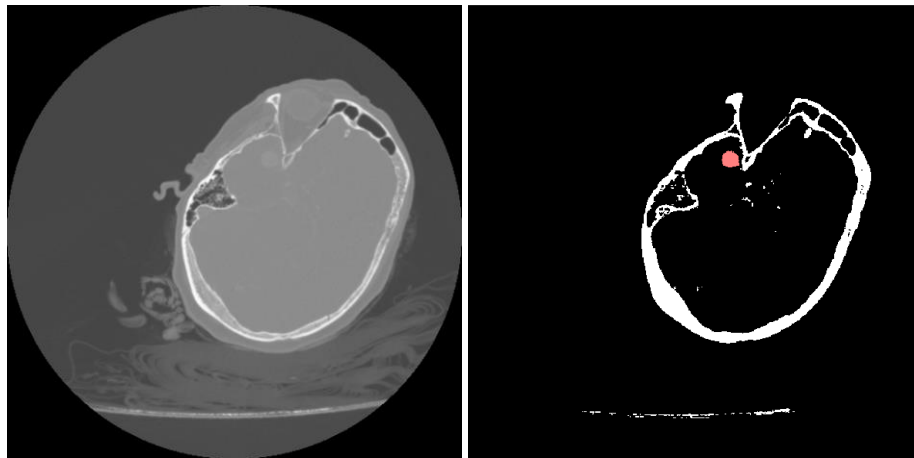


Figure 5. Imaging Methods

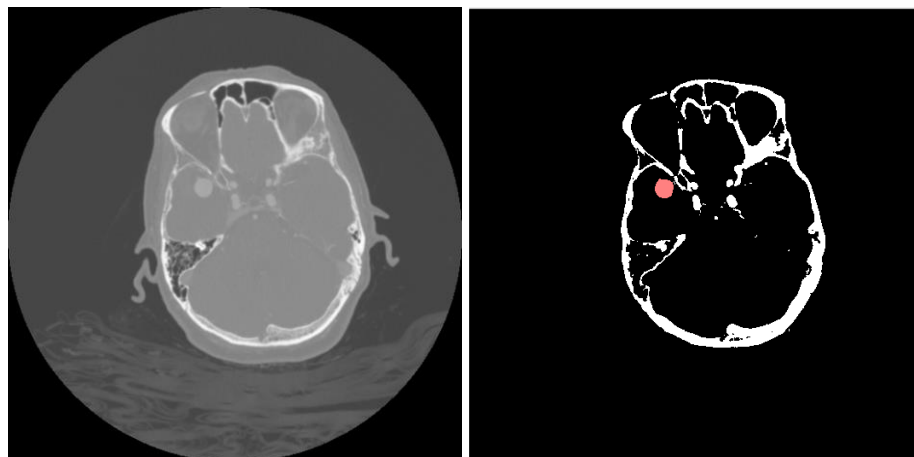
The study consists of two stages. Firstly, a preoperative and postoperative computed tomography angiography (CTA) image data pool was created for the patient with a ruptured aneurysm. CTA is an effective approach in detecting brain aneurysms by providing contrast imaging of cerebral vessels, especially in the emergency department. This imaging method helps to see the projection, size, lobules, locus of the aneurysm dome, the width of the neck, stenosis, thickness and calcification (ÖZSOY et al. 2007). Brain aneurysms vary in size from a few millimeters to several centimeters and can occur in different locations within the brain (Wu et al. 2020). In the second stage, ruptured and non-ruptured medical images in different time periods were examined by applying image processing techniques.

2. Image Processing: Case Study

In the study, 0.5 mm thin-slices coronal images of the CTA of the brain taken during the surgical treatment of a patient with ruptured brain aneurysm were examined. The diagnosis of ruptured aneurysm was made by clinical findings, neurological examination and computed tomography (CT). CTA image for diagnosed ruptured aneurysm was analyzed using image processing techniques. 3D CTA images taken from two different preoperative and three different postoperative periods were transferred to the Matlab program and processed. The 3D medical image of the BTA is [512x512x693]. Then the image was squeezed and converted to binary form. As a result of 3D medical image filtering, segmentation process was applied and regional analysis was performed. CTA image and filtering result image for the patient with brain aneurysm. Figure 3 is given.



a)



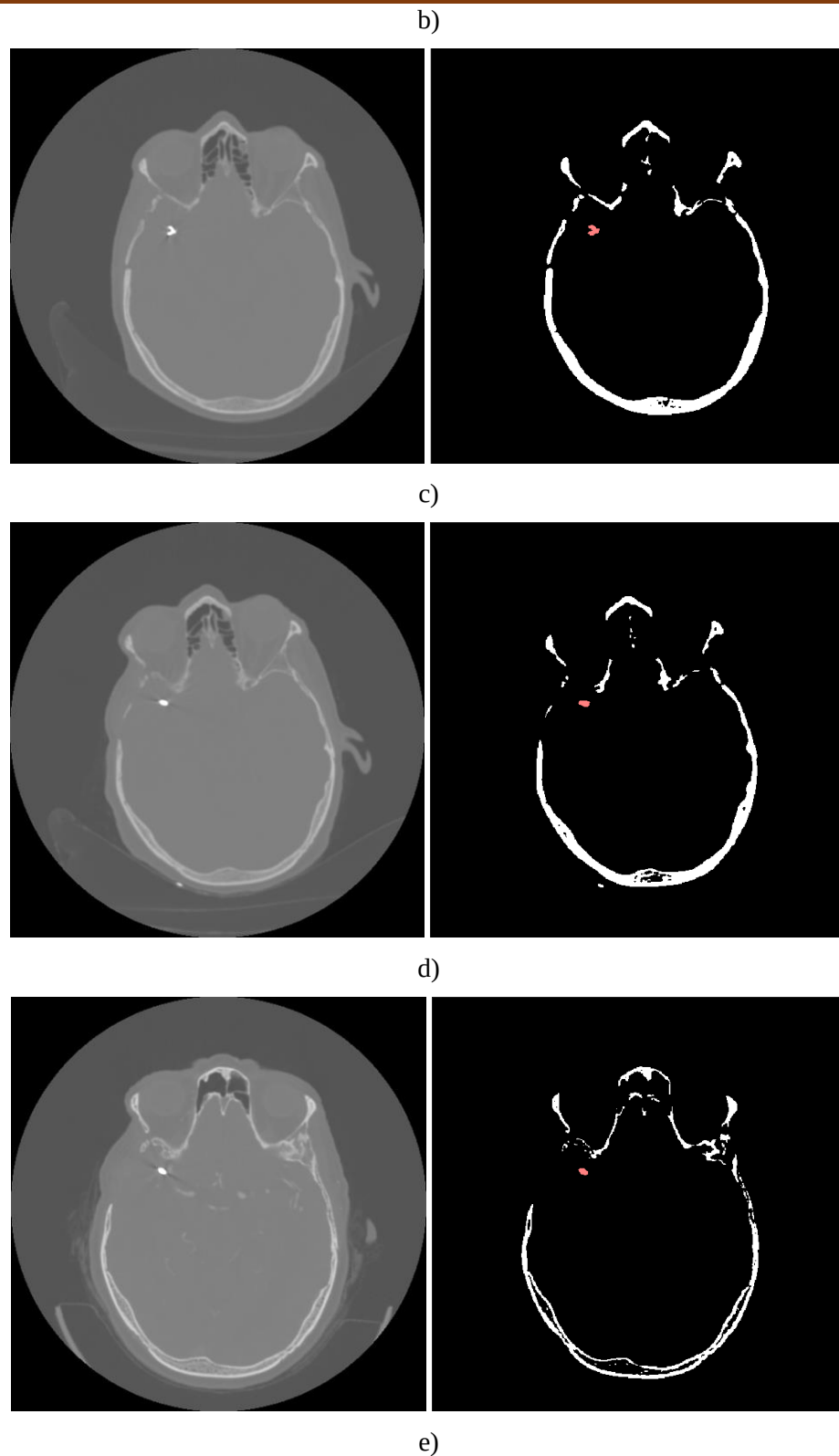


Figure 6.3D CTA Image of Brain Aneurysm-Binary Representation of Filtering (a,b; Pre-op - c,d,e; Post-op)

Here, the values of the aneurysm area, perimeter, maximum and minimum axis length before and after the operation are determined and given in Table-1.

Table 3. Regional Numerical Analysis Values for Ruptured Aneurysm

Image No.	Image Date	Area	Major Axis Length	Minor Axis Length	Eccentricity	Orientation	Euler Number	Equivalent Diameter	Perimeter
a	12.11.201	287	20.285	18.305	0.4310	-29.0334	1	19.1160	63.4080
b	02.01.201	357	21.835	20.973	0.2782	-82.6884	1	21.3201	65.7230
c	01.02.201	119	14.089	13.208	0.3481	-38.3089	1	12.3092	48.4220
d	21.06.201	87	14.376	7.9578	0.8328	-8.5562	1	10.5248	33.6100
e	17.12.201	76	12.647	7.7620	0.7895	-30.0588	1	9.8370	29.6820

3. Conclusion

In the study, CTA coronal image information of a patient with ruptured aneurysm who underwent clipping, one of the surgical treatment methods applied in middle cerebral artery aneurysms, was examined. In preoperative images, the area value for a ruptured middle cerebral artery aneurysm increases from 287 units to 357 units. Similarly, environmental values increase from 63.4080 units to 65.7230 units. However, the area value for middle cerebral artery aneurysm after surgery decreases to 119 units, 87 units and finally 76 units. Similarly, the environmental values are decreasing to 48.4220 units, 33.6100 units and the latest 29.6820 units. Area and perimeter values for aneurysm are predicted to be effective parameters in surgical treatment. The study will guide the evaluation and comparison of regional analysis data for aneurysm types with different locations and morphologies in future studies.

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**IDENTITY PROCESSING STYLE AND LIFE VALUES OF STUDENTS AND THEIR
PARENTS**

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Abstract

Identity processing style refers to relatively stable differences in how individuals process identity-relevant information to negotiate identity conflicts. The relationship between students' identity processing style and their life values as well as the congruence of values between parents and their college-aged children is still relatively unexplored, especially in the new complex societal circumstances of their maturation. The goals of this study were to determine the relationship between students' identity processing styles and their life values, as well as the relationship with their parents' life values. The participants were 160 female students and their parents, of which 54 were students, 54 were mothers and 52 were fathers. Identity Style Inventory was used to assess the identity style of students and Portrait Value Questionnaire to measure the importance of the ten life values of parents and students. The diffuse-avoidant identity style of students significantly positively correlated with the value of power and negatively with the value of self-direction. Informational identity style of students significantly positively correlated with self-direction and universalism. Normative identity style significantly positively correlated with the values of security, conformity and tradition and negatively with the value of stimulation. Students' identity style significantly positively correlated only with tradition and negatively with self-direction of their mothers. The results show a significant positive correlation of the mother-student relation on the values of self-direction, power, tradition and universalism, as well as a significant positive correlation of the father-student relation on the values of hedonism, achievement, tradition, benevolence and universalism. Individual differences in identity processing style and similarities and differences in certain values of parents and students were also discussed within the Schwartz theoretical model.

Keywords: values, identity, students, parents

INTRODUCTION

Adolescents search for a sense of self and personal identity; they explore and question the values they adopted as children. Both parents and adolescents renegotiate the asymmetrical authority of earlier periods. What appears to be an influence process viewed from the parent's perspective is a process of identity formation from the adolescent's perspective. In this process, the value system is a key element in the adolescent's emerging identity (Knafo and Schwartz, 2004). Relationship between students' identity processing style and their life values as well as the congruence of values between parents and their college-aged children is still relatively unexplored, especially in the new complex societal circumstances of their maturation.

American psychological association (APA, 2022) defines personal identity as an individual's sense of self defined by a set of physical, psychological, and interpersonal characteristics that is not wholly shared with any other person and a range of affiliations and social roles. Identity involves a sense of continuity, or the feeling that one is the same person today that one was yesterday or last year (despite physical or other changes). According to Erikson's (1968) psychosocial theory, the process of forming an individualized, well-integrated sense of identity plays a central role in personality development over the lifespan. Erikson suggested that the main psychosocial challenge of adolescence is to move from identity diffusion to achievement of a firm identity. Marcia (1966) developed the identity status paradigm to operationally define Eriksonian identity formation through crisis (self-exploration,

elaboration of potential identity alternatives) and commitment (decision to accept alternatives as part of the self). Crisis considers how much an adolescent explores different alternatives to their values and beliefs; and determination how much an adolescent lives their values and beliefs. By crossing high and low levels of self-exploration and commitment, Marcia (1993; Berzonsky et al., 2013) identified four identity types or statuses: (1) identity achievement, (2) identity moratorium (limited commitment), (3) identity foreclosure (limited self-exploration), and (4) identity diffusion (limited commitment, not engaged in self-exploration). Over the decades, identity research has mostly been based on or inspired by this status paradigm.

Since there are differences in the social-cognitive strategies individuals use to construct, preserve and reconstruct a sense of identity, investigators focused more directly on the process by which identity is formed. Berzonsky and Barclay (1981) hypothesized that Marcia's (1966) four statuses reflected three process identity styles; three different ways of dealing with or managing to avoid identity-relevant conflicts and issues: (1) an informational, rational orientation; (2) a more automatic, normative, or conforming orientation; and (3) a procrastinating, diffuse-avoidant orientation (Berzonsky et al., 2013). Identity style refers to relatively stable differences in the social-cognitive strategies and differences in how individuals process identity relevant information to negotiate identity conflicts (Berzonsky et al., 2013). From a parental influence perspective, the degree of parent-child value congruence is determined by a two-step process of internalization (Grusec and Goodnow, 1994): if children perceive their parents' values accurately and then accept rather than reject them, value congruence should be high, but value transmission can succeed or fail at either step. Accuracy of perception and acceptance are both low among identity-diffused adolescents (Knafo and Schwartz, 2004).

There is consensus in literature that values fulfill five criteria: (1) they are beliefs, (2) they pertain to desirable end states or behaviors, (3) they transcend specific situations, (4) they guide selection or evaluation of behavior and events, and (5) they are ordered by relative importance (Schwartz 1992; Schwartz and Bilsky 1987; Schwartz, 2012). Rokeach (1973) distinguished personal and social values, considering values as multiple standards that govern social actions, attitudes and ideologies, evaluations, and comparison of oneself with others. Values direct the selection and evaluation of behavior, they are important to individuals, groups, and societies and they ensure the integration and maintenance of a society (Schwartz and Bilsky 1987; Schwartz 1994; Ferić 2007; Mrnjaus, 2008).

Schwartz's model (1992, 2012) defines values in terms of the motivational goals that serve as guiding principles in peoples' lives. People discriminate among ten motivationally distinct values, organized in a circular structure which forms two higher-order bipolar value domains: (Schwartz, 1992; Bardi and Schwartz, 2003; Hitlin, 2003; Knafo and Schwartz, 2004): (1) Conservation (security, conformity, tradition) vs. Openness to change (self-direction, stimulation); and (2) Self-enhancement (power, achievement) vs. Self-transcendence (universalism, benevolence). Hedonism values share elements of openness and self-enhancement. Brief definitions of these values in terms of their central goals describe: Power as social status, dominance over people and resources; Achievement as personal success according to social standards; Hedonism as pleasure or gratification; Stimulation as excitement, challenge and novelty; Self-direction as independence of thought and action; Universalism as understanding, tolerance and concern for the welfare of all people and nature; Benevolence as preserving and enhancing the welfare of people to whom one is close; Tradition as respect and commitment to cultural or religious customs and ideas; Conformity as restraining actions and impulses that may harm others or violate social expectations; Security as safety and stability of society, relationships and self. Values are acquired both through socialization to dominant group values and through the unique learning experiences of individuals. They are valuable predictors of behavior, and they motivate it (Hoblaj, 2007; Bolčević, Novak and Mrnjaus, 2020), but the relation between values and behaviors may stem from social norms, i.e. normative pressures to perform certain behaviors. They determine the cultural identity of the society and every social community (Wan et al., 2007; Reić et al., 2010; Miliša et al., 2015; Visković, 2013).

The goals of this study were to determine the relationship between students' identity processing styles and their life values, and the relationship with their parents' life values. In addition, the aim was to determine the relationship between the expressiveness of ten motivationally distinct types of values of

adolescents and their parents. We expect significant positive relationships between normative, conformed students' orientation with their values within the conservation domain (conformity, tradition and security) and positive relationship between informational adolescents' orientations with the openness to change domain. Since diffused adolescents do not view parental values as an essential model for themselves, we do not expect relationships of this identity style with conservation domain of values, but it is difficult to predict the relationship between the parents' motivational values relationships and the students' identity style as well as their values concordance and differences in relationship patterns related to parents' gender.

MATERIALS AND METHODS

A total of 160 female students from the University of Zagreb, Croatia, and their parents participated in the study in 2018/2019. Analyses of identity style and life values were based on 54 families; on 54 mother–student dyads and 52 father–student dyads. The students were in their late adolescence: 30 were attending the second year of undergraduate studies, 15 were in the first and nine in the second year of their graduate program. 31 female students lived together with their parents, while the rest lived independently or with one parent. Mothers' ages ranged from 43 to 65 years, and fathers' ages from 42 to 67. Partnership status comprised of 51 married couple, one divorced couple, and two widowed mothers. Regarding the educational level, 1.9% of fathers did not finish elementary school, 48.1% of fathers and 51.9% of mothers finished secondary school, 38.5% of fathers and 40.7% of mothers finished an undergraduate/graduate program, 11.54% of fathers and 7.4% of mothers finished postgraduate studies. Socioeconomically, 33.3% of families assessed their status as above average, 59.24% as average, 5.6 as below average and 1.9% as far below average.

If students agreed to participate in the study, they filled out pencil-paper questionnaires during the course and took envelopes to their parents in their homes. Students were asked to copy the code that was on the envelope onto their own questionnaires so that questionnaires could be matched in later analyses. The research was voluntary and anonymous, and codes were used only for matching the data. The questionnaire had informed consent forms with a version for both students and parents. Students returned their parents' questionnaires in envelopes into a sealed box at the faculty or handed them to the professors in whose lectures they filled out the questionnaire. The majority of the students volunteered for extra course credit. The percentage of returned questionnaires was 40%.

Participants completed a self-report questionnaire that included a socio-demographic section and measures to assess process identity style and life values. *Identity Style Inventory 5 (ISI-5)* developed by Berzonsky et al. (2013) assessed three process identity styles: informational style scale, normative style and diffuse-avoidant style scale. Participants responded to the items on a 1 (not at all like me) to 5 (very much like me) scale; the theoretical range for each subscale is from 1 to 5. A higher score on a certain subscale indicates a higher expression of the identity style to which that subscale belongs. The dominant identity style is the style with the higher average among participants. Sample items and reliability for subscale: "I handle problems in my life by actively reflecting on them" for the 9-item informational scale ($\alpha = 0.77$); "I think it is better to adopt a firm set of beliefs than to be open-minded" for the 9-item normative scale ($\alpha = 0.75$); and "Who I am changes from situation to situation" for the 9-item diffuse–avoidant style scale ($\alpha = 0.79$; Berzonski et. al, 2013). A fluent English speaker and a professor of English language translated the scale from English into Croatian separately; a native English speaker back translated it into English to establish their comparability.

Portrait Value Questionnaire 40, PVQ 40, Schwartz et al., 2001) assessed ten value orientation of students or their parents: self-direction (4 items), stimulation (3), hedonism (3), achievement (4), power (3), security (5), conformism (4), tradition (4), benevolence (4) and universalism (6 items). A higher score on the scale of a particular subscale indicates that the value associated with the subscale is more important to the participant. The theoretical range for each subscale is from 1 to 6. The scale was translated into Croatian by Ferić (2007) where Cronbach alpha reliability coefficient ranges from 0.58 to 0.83. Good convergent and discriminant validity of the subscales of 10 motivational types was established.

RESULTS

Descriptive statistic and bivariate correlations for identity style and value orientations of students and their parents were calculated. The results presented in Table 1. showed that the dominant style of process identity among the female students is informational identity style. The Kolmogorov-Smirnov test indicates that the data of all three identity styles in the sample are normally distributed. For the informational identity style, 80% of the participants circled that the statements describe them extremely (4 and 5), and only 20% circled that the statements describe them partly. For both the normative and diffuse-avoidant style, only 9.1% of the participants circled that the statements strongly describe them.

Table 1. Descriptives for students' Identity style (N=54).

Identity style	M, Sd	Min Max	K-S
Diffuse - avoidant	2,2 0,58	1,1 4,0	0,73
Informational	4,2 0,38	2,9 4,9	0,75
Normative	2,3 0,52	1,0 3,6	0,90

The values of self-direction, stimulation, hedonism, achievement, benevolence, and universalism are highly expressed and the most expressed in students (Table 2.). Security, conformity, and tradition are moderately expressed, while the value of power is low among students. The Kolmogorov-Smirnov test determined that only self-direction is not normally distributed and that the number of higher results of those students is greater than expected in a normal distribution.

The values of self-direction, security, conformity, benevolence, and universalism are highly expressed in mothers. The values of hedonism, achievement, power and tradition are moderately expressed, and stimulation is low. The sample of fathers shows a high expression of the values of self-direction, benevolence, and universalism. Values of stimulation, hedonism, achievement, security, conformity, and tradition are moderately expressed. Power is the least expressed value in fathers. The Kolmogorov-Smirnov test indicates a normal distribution for all ten values for both mothers and fathers (Table 2.).

Table 2. Descriptives for Value orientations (N=54 mothers, N=52 fathers)

Values	Students			Mothers			Fathers		
	M	Min	K-S	M	Min	K-S	M	Min	K-S
	Sd	Max		Sd	Max		Sd	Max	
Self-direction	4,8 0,80	2,5 6,0	1,50*	4,5 0,86	1,8 6,0	0,86	4,5 0,83	2,3 6,0	0,82

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Stimulation	4,0 1,28	1,0 6,0	0,76	2,9 1,03	1,0 5,3	1,05	3,2 0,92	1,0 6,0	0,86
Hedonism	4,4 0,99	2,0 6,0	0,88	3,3 1,07	1,0 5,7	1,04	3,7 1,27	1,0 6,0	0,73
Achievement	4,1 0,87	1,8 5,8	0,96	3,6 1,00	4,5 5,3	1,14	3,5 1,06	1,5 6,0	0,58
Power	2,7 0,81	1,3 4,7	1,02	3,3 0,89	1,3 5,3	1,04	2,7 1,03	1,3 5,7	1,28
Security	3,8 0,80	2,2 5,6	1,12	4,0 0,80	2,2 5,8	0,98	3,9 0,92	2,2 5,8	0,60
Conformity	3,9 0,81	1,8 5,3	1,22	4,2 0,80	2,8 5,8	0,65	3,7 1,05	1,3 6,0	0,67
Tradition	3,0 0,96	1,3 5,0	1,08	3,7 1,11	1,5 5,8	0,79	3,4 1,01	1,0 5,3	0,78
Benevolence	5,0 0,80	2,0 6,0	1,14	4,8 0,76	2,8 6,0	1,05	4,2 0,80	2,5 6,0	0,70
Universalism	4,8 0,64	3,0 5,8	0,80	4,9 0,73	3,2 6,0	1,12	4,5 0,85	2,7 6,0	0,64

Table 3. shows the relationship between the expressiveness of the students' identity style and their values as well as relationships between the expressiveness of their identity style and their parents' values. The diffuse-avoidant processing identity style of students significantly positively correlated with their value of power and negatively with the value of self-direction. Informational processing identity style of students significantly positively correlated with self-direction and universalism. Normative processing identity style significantly positively correlated with security, conformity and tradition and negatively with the value of stimulation. Most of correlations were low to moderate; relatively strong. Motivational tradition value of mothers had moderate positive correlation with students' normative identity style and mothers' self-direction had weak negative correlation with this students' identity style. None of fathers' values correlated with students' identity styles.

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Table 3. Correlation between students' Identity style and students' and their parents' Values

VALUES	Students' identity style and students' values			Students' identity style and mothers' values			Students' identity style and fathers' values		
	Dif-avoid	Info	Norm	Dif-Avoid	Info	Norm	Dif-avoid	Info	Norm
Self-direction	- 0,34*	0,42*	-0,22	0,05	0,15	- 0,28*	0,16	0,03	-0,20
Stimulation	0,08	0,20	- 0,32*	0,08	0,16	-0,06	0,09	-0,11	-0,04
Hedonism	0,14	0,24	0,02	0,01	0,13	-0,11	-0,01	0,09	-0,13
Achievement	0,20	0,21	0,09	-0,03	0,08	0,22	0,21	-0,06	-0,05
Power	0,35*	-0,14	0,18	0,05	0,15	0,10	0,08	-0,17	-0,13
Security	0,12	0,21	0,46*	-0,14	0,12	0,07	-0,05	0,07	0,14
Conformity	-0,06	-0,02	0,43*	0,08	-0,17	0,10	-0,15	-0,02	-0,01
Tradition	0,03	-0,23	0,41*	-0,26	-0,03	0,32*	-0,08	-0,13	0,19
Benevolence	-0,13	0,24	-0,03	-0,09	0,16	-0,16	-0,01	0,07	-0,19
Universalism	-0,03	0,29*	-0,01	-0,02	0,04	-0,26	0,01	0,09	-0,23

**p < 0,01; *p < 0,05

Table 4. shows Pearson's correlations between the expression of values between students and their mothers and students and their fathers. The data revealed significant positive low to moderate correlation of the mother-student relation on the values of self-direction, power, tradition, and universalism, as well as a significant positive low to moderate correlation of the father-student relation

on the values of hedonism, achievement, tradition, benevolence, and universalism. In other dyads, no significant correlations were established. All correlations between the students and parents are positive, the more pronounced the values are among students, the more pronounced they are among the parents and vice versa.

Table 4. Correlation between students' and mothers' Values (r_{SM} , N=54) and students' and fathers' Values (r_{SF} , N=52)

Values	r_{SM}	r_{SF}
Self-direction	0,31*	0,18
Stimulation	0,12	0,19
Hedonism	0,09	0,35*
Achievement	0,25	0,29*
Power	0,27*	0,23
Security	0,12	0,17
Conformity	0,14	0,05
Tradition	0,39**	0,30*
Benevolence	0,08	0,41**
Universalism	0,31*	0,29*

**p < 0,01; *p < 0,05

DISCUSSION

Informational identity style is the dominant style in students; almost all had the highest answers on the corresponding items (80 %). Individuals with an informational identity style are self-disciplined and have a clear sense of commitment and direction. This style coincides with Marcia's achieved or moratorium identity status when the other identity styles are significantly less expressed (Berzonsky et al., 2013). Lacković Grgin (2006) states that 63% of students are in a state of achieved identity, while 14% of students are in a state of diffuse identity. Although informational style, which corresponds to

achieved identity, is extremely dominant in this study, these results are consistent with the literature, especially since the participants were female students. According to Meeus et al. (1999) identity status with high commitment prevail in females. Still, 20% of the participants do not express informational identity style. We could assume they are in transitional states of identity, which is in accordance with the data of Kroger, Martinussen and Marcia (2010), where diffuse identity fluctuates during the schooling period.

The most expressed values among students in this sample are benevolence and universalism, values within the self-transcendence domain, and self-direction, a value related to openness to change domain. Power and tradition were the lowest expressed, which was expected considering the dominant informational identity style in this sample. Similar results were obtained in another Croatian sample (Ferić, 2007), with an exception in the values of security and hedonism, which are less expressed in this study. Benevolence, universalism, and self-direction are highly expressed, both in mothers and fathers, while benevolence follows self-direction and universalism in fathers. The least expressed are stimulation for mothers and power in fathers. These patterns almost completely follow the hierarchy of values posited by Schwartz (2012) revealed at the cross-cultural level. In a study conducted in Croatia, Bolčević Novak and Mrnjauš (2020) investigated the differences in the values of students and their parents on a bigger sample and found the same results for students and parents in terms of the highest (first three values) and the lowest rank (last two values). The third lowest rank for students and parents is slightly different (the results for security and conformism differ by one decimal point), but the data for parents are uncomparable since they are presented for both parents together. All that data confirms what Schwartz (2012) states: that cross-culturally the hierarchy of values is stable and can be used as a baseline for comparison with specific samples.

The first goal of the study was to determine the relationship between students' current identity processing styles and their motivational life values. As expected, students' normative processing identity style moderately positively correlated with all three values of the conservation domain: security, conformity, and tradition. Additionally, it negatively correlated with the value of stimulation, which is a value within the domain opposite to change/conservation. Informational processing identity style of students moderately correlated with self-direction and low, but positively, with universalism, a value within the domain of self-transcendence. Most of the relationships with students' values confirm data from previous research since people with a normative identity style tend towards conformist values. The normative identity style is characterized by the tendency to conserve existing self-constructions rather than to reshape them with new information or ideas while the informational identity style is associated with high openness to experience (Knafo and Schwartz 2004). In the research of Berzonsky and Papinia (2014), normative style is negatively related to hedonism and values of universalism. Such a result was not obtained in our study. Instead, there is a negative correlation only with the stimulation. Berzonsky and Papini (2014) emphasize that the informational style of identity relates to values of universalism and openness and self-direction. In our study, the same positive correlation with both was determined. The diffuse-avoidant processing identity style of students low to moderately positively correlated with the value of power and negatively with the value of self-direction. Students more dominant in this identity style more frequently seek social status and dominance over people and resources and show less independence of thought and action. That is also in accordance with previous data, where identity diffusion is associated with the tendency to avoid dealing directly with personal problems and basic identity questions (Berzonsky, 1981; Knafo and Schwartz 2004).

That part confirmed theoretical assumptions about connections between the values and the identity style of adolescents from the previous literature, in this sample of university students in Croatia. Next part will reveal possible interconnectedness of parents' values with students' identity style and values. As part of the exploration process within the developmental process of identity formation, identity-achieved adolescents are likely to question old truths, including parental values. They are likely to gather information about the values and ideas of role models. Such exploration does not characterize the other statuses to the same extent (Knafo and Schwartz, 2004). Therefore, we explored the relationship of parents' values with students' identity style. Data revealed that only mothers' tradition values had weak positive correlation with students' normative style as well as negative correlation of self-direction value with this style. The greater the expression of mothers' tradition values and the less

pronounced their self-direction, the greater the expression of the students' normative identity, and vice versa. None of the fathers' values correlate with students' identity styles. Knafo and Schwartz (2004) reported that foreclosure adolescents might fasten on a particular view of their parents' values without exploration and their perception may be inaccurate. Findings in this study confirm theoretically expected correlations between values and identity style for normative orientation at mothers, but also for other styles, since there is no tendency to seek to understand their parents' values within diffused adolescences so correlation was not expected. This indicates possible greater role of mothers than fathers related to normative style (foreclosed identity) and transgenerational transmission of values.

The findings examined connections between students' and parents' values and distinguished values relevant in student - mother dyad from values in student - father dyad. There is congruence between student and parents' values from both bipolar domains of Swartz's value model. Almost all significant relationships between student - parent values are within the self enhancement - self transcendence domain (power with mothers, benevolence and achievement with fathers, universalism with both mother and fathers). Within openness to change versus conservation domain there are several significant relationships (self-direction with mothers, hedonism for fathers, tradition with both) and no significant student - parent correlations are present on security, conformity, and stimulation. Albert and Ferring (2012) determined parent - child correlations from $r=-0.36$ to $r=0.77$. The correlations in our research are lower than the average correlations in the samples of Albert and Ferring (2012) and Barni et al. (2011). Bolčević, Novak and Mrnjauš (2020) investigated differences in the values of students and their parents in Croatia using analysis of variance, hence comparison with our correlations is limited. The extent of congruence is often determined through processes of parental communication of values, adolescents' accurate perception of these values, and adolescents' acceptance of the values they perceive (Knafo and Schwartz, 2004). It was not possible to identify associations in dyads of values separately, within each of students' dominant identity style in this study, because of the small sample. In future research it would be interesting to examine if students' values are similar to their parents' in single-parent families or to examine students who live with their parents as opposed to those who live alone, or research employed and/or late adolescents not attending a university. Influences on process identity style other than the parental should be further explored, since value acquisition is possible through other potential value models in addition to parents: through genetic heritage, but also through social environment.

The advantage of this research is the use of the identity model of Brezonski et al. (2013), which relies on identity style, not on status, and is less represented in the area of value and identity research. The possibility of generalization of the research is limited considering the size of the sample and the fact that the sample includes almost exclusively female psychology students in Croatia. One way to reduce high selection of respondents in the data collection process is to offer rewards to students who agree to participate in the research, so that the envelopes are returned from all members of the family and the sampling is more successful. Another method is to digitalize the entry data collection process so that students and parents have access to a web link with the same code. However, there is no guarantee that this would improve data entry, since this approach could further reduce current relative control over completing the questionnaire by paper-pencil method in university context.

CONCLUSION

This research confirmed theoretical assumptions about individual differences in identity processing style of students related to values within the Schwartz theoretical model. The study emphasized the importance of learning about the differences in the congruence of values with mothers and fathers and their specific contribution in the transgenerational transmission of those values. Findings support the influence of socialization and different roles of parents' gender in the process of forming values and identity of their children, especially related to certain values, and indicate greater role of mothers than fathers related to normative style of female students. It would be worthwhile to conduct research on male students to determine the patterns of these associations separately for girls and boys since children influence their parents and act as their perceivers and evaluators. Additionally, this could encourage

further research of value orientations in terms of a more comprehensive understanding of identity orientations, values, and behavior of adolescents.

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**EVALUATION OF CONTAINER USE IN ARCHITECTURE ON FLEXIBILITY
PARAMETERS**

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Abstract

Flexible structures, one of the requirements of sustainable architecture, are used together with the concepts of reuse and recycling. One of the best examples of this is container architecture, which has been used frequently in recent years. Examples of architectural use of containers have increased day by day. Containers have been components used in various areas of life, from the smallest scale to the construction of more complex structures. Practical, rational, and creative solutions can be built by reusing containers to create architectural products. Re-evaluation and use of containers in different functions is a sustainable approach but also provides many opportunities in terms of flexibility. Containers turn into a building component that allows flexible use with its features such as modular structure, easy transportation, disassembly, and assembly. In the study, the use of containers in creating an architectural product was discussed through the flexibility approach and it is aimed to reveal the use of containers through this approach. In this direction, the study consisted of three stages. In the first stage, a theoretical background was created by making a literature review on container architecture and flexibility. In the second stage, flexibility parameters were created based on the literature. At this second stage, the parameters used in the studies on flexibility were used. In this context, flexibility parameters were discussed under five headings; mobility, extensibility, adaptability, modularity, and multi-purpose. In the third stage of the study, the use of containers in architecture was examined in line with the flexibility parameters determined. Therefore, the relationship between the use of containers as a building component and the flexibility approach, which is a requirement of sustainable architecture, has been revealed. It is hoped that the research, which deals with the use of containers in architecture through the flexibility approach, will guide other research.

Keywords: Container, flexible structure, sustainability, flexibility parameters.

Özet

Günümüzde sürdürülebilir mimarinin gerekliliklerinden biri olan esnek yapılar, sürdürülebilir ve ekolojik mimarinin bir diğer gerekliliği olan yeniden kullanım ve geri dönüşüm kavramları ile birlikte kullanılmaktadır. Bunun en iyi örneklerinden biri de son yıllarda sıklıkla karşılaştığımız konteyner mimarisidir. Konteynerlerin mimaride kullanım örnekleri her gün giderek artmaktadır. En küçük ölçekten daha kompleks yapıların inşa edilmesine kadar geniş bir ölçekte kendine yer bulabilen konteynerler yaşamın çeşitli alanlarında faydalanan öğeler olmuştur. Konteynerlerin mimari ürünler oluşturmak amacıyla yeniden kullanımı ile pratik ve akılcı çözümler yaratılabilmektedir. Konteynerlerin yeniden değerlendirilerek farklı işlevlerde kullanılması sürdürülebilir bir yaklaşım olmakla birlikte, sürdürülebilirliğin bir diğer unsuru olan esneklik yaklaşımı açısından da çeşitli imkanlar sağlamaktadır. Modüler yapısı, kolay taşınabiliyor olması, sökülüp birleştirilebiliyor olması

gibi özellikleri ile konteynerler, esnek kullanımlara imkan veren bir yapı elemanı haline dönüştürmektedir. Çalışmada konteynerlerin mimari bir ürün oluşturmada kullanımını esneklik yaklaşımı üzerinden ele almak amaçlanmaktadır. Bu doğrultuda çalışma üç aşamadan oluşmaktadır. İlk aşamada konteyner mimarlığı ve esneklik konularına ilişkin literatür taraması yapılarak kuramsal altyapı oluşturulmuştur. İkinci aşamada literatüre bağlı olarak esneklik parametreleri oluşturulmuştur. Bu aşamada esneklik konusuna ilişkin yapılmış olan çalışmalarda kullanılan alt parametrelerden yararlanılmış ve çalışma kapsamında esneklik parametreleri mobilite, genişletilebilirlik, uyarlanabilirlik, modülerlik ve çok amaçlı kullanım olmak üzere beş başlıkta ele alınmıştır. Çalışmanın üçüncü aşamasında ise konteynerlerin mimaride kullanımı belirlenen esneklik parametreleri doğrultusunda irdelenmiştir. Böylece konteynerlerin mimari ürün oluşturmada bir yapı elemanı olarak kullanımının, sürdürülebilir mimarlığın bir gerekliliği olan esneklik yaklaşımı ile ilişkisi ortaya konmuştur. Mimaride konteyner kullanımını esneklik yaklaşımı üzerinden ele alan araştırmanın konuya ilişkin yapılacak diğer araştırmaların önünü açması çalışmanın hedeflediği en önemli yararlar arasındadır.

Anahtar Kelimeler: Konteyner, esnek yapılar, sürdürülebilirlik, esneklik parametreleri.

INTRODUCTION

One of the indispensable requirements of contemporary design is “flexibility” and it is a universal design criterion used in a wide range of areas including theory, practice, planning, and even urban design (İslamoğlu & Usta, 2018). The basis of flexibility is based on the understanding of designing mechanisms to support different uses (Hertzberger, 1991). Flexibility is defined by Bayazit as “*the ability to revert to its original shape after being deformed under the influence of an external force*” (Bayazit, 1979). Okutan (2010) defined flexibility as making controversial the existence of a border. The quality of the border changes with permeability, variability, transformability, adaptation, and redefinition, and becomes open to new possibilities through flexibility (Okutan, 2010). Similarly, Weeks (1964) describes flexibility as “undefined architecture”. According to Turan (1974), it is the capacity to reorganize and expand while preserving the general order of the structural components. In the literature, flexibility is generally accepted as the ability of spaces to change, adapt and reorganize themselves (Hagy & Balay, 2014). According to Schmidt et al (2010), flexibility means versatility.

Flexibility, a product of the Modern Movement in architecture, has increased in importance since the 1950s. It has brought the concepts of “time” and “unknown” to the design concept and also brought a new breath to functional architecture (Colquhoun, 1990; Forty, 2000; İslamoğlu ve Usta, 2018). Flexibility in architecture is one of the ways to design sustainable buildings. Flexible buildings can be considered as spaces suitable for creating different organizations as well as meeting the needs of today and the future.

Flexible buildings are also used together with the concepts of reuse and recycling, which are the requirements of sustainable and ecological architecture. Container architecture is one of the most important examples of flexible buildings and has been used frequently in recent years. It provides practical, rational, and creative solutions with the reuse of containers for architectural purposes. Containers turn into a building component that allows flexible use with its features such as modular structure, easy transportation, disassembly, and assembly. In the study, the architecture of the containers was evaluated through the flexibility approach. In the literature research conducted, it was determined that the flexibility approach is handled with some concepts. Flexibility parameters were considered as mobility, extensibility, adaptability, modularity, and multi-purpose within the scope of the study. These parameters were determined based on research on flexibility in architecture. Afterward, container architecture was examined in line with flexibility parameters. Therefore, the relationship between the use of containers as a building component in architecture and the flexibility approach was revealed.

CONTAINER ARCHITECTURE

The use of containers has a history of about 60 years. Containers have brought convenience to loading and transportation processes thanks to their size, and they have also taken an important place in transportation thanks to their durability (Bingöl and Gök, 2017). Containers generally consist of 6 sections (top, bottom, and side surfaces), and support bars that enable to carry of the loads. However, there are also different types and sizes of containers (Figure 1). Standard containers can be produced in fixed sizes as 2.4 m in width and 2.6 m in height, but depending on the load in different length sizes such as 6.1 m or 12.2 m, 13.7 m, 14.6 m, and 16.2 m (Bingöl and Gök, 2017). In addition, there are varieties such as open top container, open top and side container, tank container, refrigerated container, collapsible container and flat container. Currently, the most commonly used containers are standard type containers with sizes of 6.08 m and 12.2 m.



Figure1. Container Types of Various Sizes and Shapes (URL-1).

Container architecture can often be defined as the reuse of steel shipping containers as a building component. According to Tavşan and Bektaş (2021), container architecture is a type of construction system characterized by architectural components for human activity for a specific function. The first use of containers in buildings was for temporary needs such as storage and shelter. Over time, it was used as military accommodation in America, England, and Finland, and then began to be used as permanent structures in rural settlements of North America (Bingöl ve Gök, 2017). Containers were initially used for limited functions in architecture and over time used for a variety of functions in many parts of the world. Containers have become very important a building component in recent years with their features such as easy installation, low cost, modular structure, easy portability, and durability, and have been used for purposes both functional and aesthetic. Containers generally have a weatherproof structure, and this feature is another reason why containers are used in architecture (Madkour and Manzlawy, 2018). Formal, technical, and mechanical properties have transformed containers into architectural components used for different purposes, apart from being a steel box used only for transportation.

The use of containers in architecture provides a sustainable approach and a great reduction of the energy required for raw materials. When containers are reused for home, office, and similar functions, it also provides sustainable solutions in terms of insulation, flexibility, etc. (Tavşan and Bektaş, 2021). The use of containers in architecture offers various advantages such as reducing the time during construction, reducing costs, reducing safety problems at construction sites, easy installation, and less labor requirement. However, it requires preliminary preparation and construction process for needs such as interior planning, heating, and insulation.

MATERIALS AND METHODS

The study consists of three stages. In the first stage of the study, a theoretical background was created by a literature review on container architecture and flexibility.

In the second stage, flexibility parameters were created based on the literature. In this context, parameters used in studies on flexibility were used. Kronenburg (2011) discussed flexibility as adaptation, mobility, transformation, and interaction. According to Geraedts (2008), flexibility is evaluated under four headings: partitionability, adaptability, extensibility and multifunctionality. It was discussed by Kızmaz (2015) as transformation, adaptation, mobility, modularity and change. Islamoğlu and Usta (2018) expressed flexibility approaches as adding-removing, mobility, modularity, neutral areas, combining-dividing, multi-purpose, and different plan types. Blackstad (2001) defines flexibility in terms of detachability, reconfigurability, adjustability, interchangeability, changeability, mobility, formability, and modularity. Okutan (2020), on the other hand, examined it under five headings as

transformation, adaptability, modularity, mobility and inclusiveness. Based on all this literature, within the scope of the study, flexibility parameters are discussed under five headings: mobility, extensibility, adaptability, modularity and multi-purpose.

In the third stage of the study, the use of containers in architecture was evaluated in line with the flexibility parameters determined in the second stage and explained through examples.

RESULTS - CONTAINER USE AND FLEXIBILITY IN ARCHITECTURE

In this part of the study, the use of containers in architecture is evaluated in the context of flexibility parameters (mobility, extensibility, adaptability, modularity, multi-purpose).

Mobility

The concept of mobility is expressed as a movement from one place to another, a state of portability or a transition from one state to another. Mobility in architecture is used to mean the portability of the building or building components (Geraedts, 1998; Manewa et al., 2013). The use of prefabricated building components contributes to the portability and mobility of buildings (Abdullah and Al-Alwan, 2019).

Containers are portable units that can be produced in different sizes and can be easily transported depending on the transportation and logistics infrastructure today. Container technology, which creates a flexible usage area for mobility, is still developing today. At this point, the container can be produced in different sizes and comes into prominence with its practical installation and usage (Figure 2). The mobility of the parts of the containers and the ability to fold into each other is another feature that allows their flexible use.



Figure2. Images for the Mobility of Containers (URL-2, URL-3).

Extensibility

Extensibility allows installation systems to be added and simply expanded by adding more or new installation components with structural or functional extensions (Geraedts, 2008). According to the changing and increasing needs in the building, some new organization can be made in the dimensions of the container space by combining or dividing. According to Blackstad (2001), extensibility is the ability of a building to expand or disassemble horizontally or vertically. While the building area can be expanded by making combinations to the building, the building area also can be narrowed by making divides (Larssen and Bjornberg, 2004). The geometric forms of the containers can be easily replaced side by side or on top of each other and allow extension. Containers can also offer creative solutions with different designs and arrangements. The Container Stack Pavilion, built in China in 2015, is an example of the expansion of containers by adding them together horizontally and vertically. The use of containers by sliding has provided a visual richness to the building. The endpoints of each container in the building are designed to allow sight lines throughout the entire building. The Container Stack Pavilion is a temporary building that can be disassembled (Figure 3).



Figure3. Exterior and Interior Views and Plans of the Container Stack Pavilion (URL-4).

Adaptability

Adaptability enables buildings to meet different requirements and be used for different functions. At this point, buildings should consist of open spaces and shells in order to meet the different requests of the user (Berdan, 2010). These adaptation features allow users to easily change their needs within the existing building (Kronenburg, R., 2007). Adaptability contributes to a simple installation system and simple transformation of space into different spatial units. It increases the adaptability of the space by allowing it to be rearranged, partitioned or combined (Geraedts, 2008).

Containers allow prefabricated installation with their structures, floors and covering materials. Containers can be arranged practically by easily adding or partitioning for different interior needs through their formal and dimensional features. This aspect, it creates flexibility in usage. High floor-to-ceiling heights and large service spaces also increase the adaptability level of the space (Maccleanor, 2008). When necessary increasing the space width by adding a new container is another advantage in terms of adapting the containers. At this point, it can be defined that the advantages of containers on the "extensibility principle of flexibility" also contribute in terms of "adaptability".

Modularity

Modularity is a special type of design that creates a high degree of independence or "free assembly" by standardizing the interface between parts (Sanchez et al., 1996). A modular system consists of parts (modules) that are designed independently but function as a whole (Demirtolla and Atilla, 2013). There is a certain standardization between component sizes in modularity (Ross et al., 2016). Modularity brings together modules in a particular system, technique or hierarchy. It is an approach that is frequently used and provides flexibility in architecture and design-related disciplines. Modular design allows for change, transformation, and innovation.

It is known that containers are produced in standard sizes. This makes the containers a useful modular building component in the field of architecture (Tavşan and Bektaş, 2021). The use of containers as a module can also be used to create a building structure or be used as a building component. Containers can be seen as a tool in the creation of flexible spaces with their modular forms. With the containers used as modular, both easy assembly and construction and a low-cost process can be realized. Containers provide flexible usage possibilities through their modular structures (Figure 4).



Figure4. Examples of containers used as modules - "Manhattan Mall", "Quadrum Ski and Yoga Resort" and "Dock Inn" (URL-5).

Multi-purpose

Multipurpose is the use of installation systems to serve different purposes (Geraedts, 2008). Multi-purpose use allows a space to be used for more than one function. This is a design that enables the space to be used by different users for various purposes, in a different periods or at the same time. At the same time, it is also a strategy that enables a component or element with a function to meet a different function (Islamoglu & Usta, 2018). The usability of a system for various purposes is important for flexibility in design approaches.

The formal features of the containers can be used for various purposes in architecture rather than limiting the design and function. Containers can be used to create spaces for various functions such as offices, residences, store, restaurants or exhibition stands. It can also be used to create vertical circulation in a building such as stairs and elevators. Although it is seen in the examples that the containers are generally used to create the mass of the building, there are also applications where they are used indoors (Figure 5).



Figure5. Examples of the use of the container in the exhibition stand (URL 6), stairs (URL 7), and indoors (URL 8).

CONCLUSION

Examples of the use of containers in architecture are increasing day by day. Containers have been used in various areas of life. It has started to be used in the construction of structures from the smallest scale to more complex. It is a sustainable approach to re-evaluate containers and use them in different functions. In addition, containers provide various opportunities in terms of flexibility, which is another element of sustainability. The features of containers allow flexible solutions to be created in architecture such as the ease of transportation and installation of containers, the possibility of various arrangements as a modular, the possibility of creating larger areas, the ability to be easily partitioned, and the use for various functions and purposes. In addition to its functional advantages, containers can contribute to the interior and exterior design of the building in terms of aesthetics and different designs. Despite the advantages that containers provide in terms of flexibility, there are also disadvantages in terms of insulation and heating. For this reason, design decisions have an important place in the use of containers in architecture.

The use of containers in architectural design meets the flexible design criteria, which is an important criterion in terms of sustainability. Further to that, the use of containers in architectural design provides interchangeability, adaptability, ecology, recycling, free design, customization, and economic benefits. The study aims to pave the way for research on the subject of the research, which deals with the use of containers in architecture through the flexibility approach.

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Abstract

Developments in the field of autonomous vehicle technologies have gained great momentum in recent years. The development of autonomous vehicles utilizing advanced artificial intelligence and software has brought with it some potential risks and cybersecurity challenges. With a Vehicle-to-Everything (V2X) vehicle, especially essential for the deployment of autonomous vehicles, all components that can affect or be affected by the vehicle further increase security risks as they greatly expand the potential attack surface and attack vectors. Although these vehicles, which work with artificial intelligence-based software, increase driver safety and comfort, the risk of causing loss of life and property due to external cyber attacks is very high. For this reason, it becomes extremely important to identify and analyze the threats and cyber security risks related to autonomous vehicles and to put forward security measures. Within the scope of the paper, potential threats and cyber attack risks for autonomous vehicles; In-vehicle network attacks, GPS spoofing attacks, Location tracking attacks, Nearest vulnerability attacks (Bluetooth, Tire Pressure Monitoring, Message forgery, Key and Keyless hijacking), Infrastructure attacks. In the paper, threat and cyber security requirements related to autonomous vehicles are defined according to the basic concepts of Confidentiality, Data integrity/consistency, Authentication, Usability and Non-Repudiation. The paper covers the determination, analysis and necessary security measures of the basic requirements that are dynamic, sensitive to threats, defensible against threats and take early precautions against threats in order for autonomous vehicles to drive safely and successfully.

Keywords: autonomous vehicles, cyber security, artificial intelligence, V2x protocols

INTRODUCTION

Autonomous vehicles do not need a driver, thanks to the hardware and software systems they have on them; They are vehicles that can travel without the intervention of the driver by detecting information about the road, traffic flow and its environment. Autonomous vehicles, which make the journey between two desired points without human intervention, make many contributions to issues such as safety, comfort and energy saving (González et al, 2016). and uses artificial intelligence systems to transmit.

Many companies have tested or are constantly on the road testing of highly automated vehicle prototypes whose capabilities are rapidly evolving due to advanced sensor processing technologies, adaptive algorithms, high-definition mapping, and in some cases the deployment of vehicles. From a technical standpoint, the current technology for highly automated driving in controlled environments is highly advanced. These vehicles use state-of-the-art sensors (radar, lidar, GPS and camera vision systems) as shown in Figure 1, with high-precision maps that allow the on-board systems to identify obstacles and associated signage, as well as suitable navigation paths.

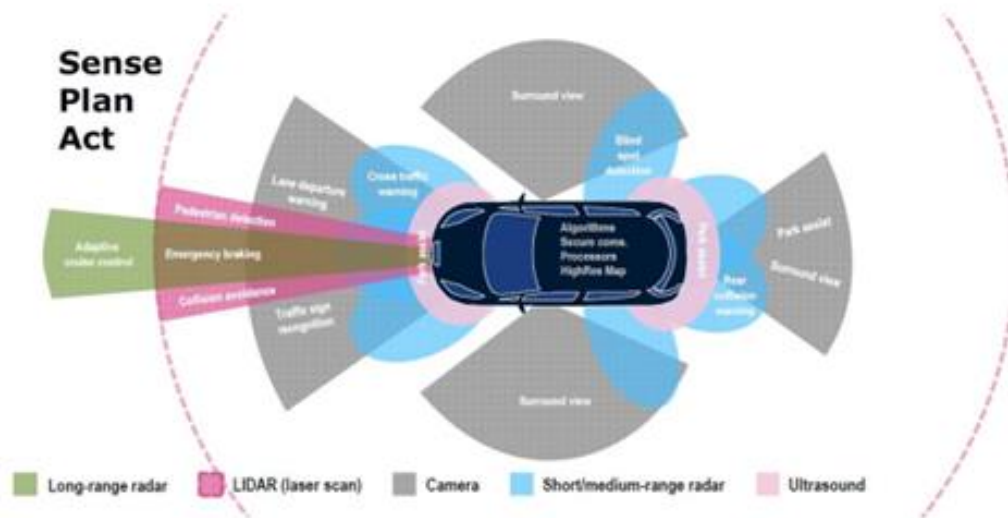


Figure 1. Autonomous vehicle technologies

The most important difference between smart vehicles and conventional vehicles is that the smart vehicle supports the driver in vehicle control and control or takes full control. While doing this, smart vehicles use not only their control units and sensors, but also communication opportunities with wireless communication networks, satellites, other vehicles and the city's infrastructure. For this reason, it is thought that autonomous vehicle technologies will bring some potential safety problems. The risk of cyber-attacks on autonomous vehicles, sharing personal information of passengers such as their location and destination with smart transportation systems is also seen as an important security concern.

Automotive safety is a complex issue; it depends on vehicle, infrastructure, environment and human factors (Dixit et al., 2016). In many studies in the literature, the safety factor is shown as the most important factor for the adoption of autonomous vehicles (Casley et al., 2013; Kyriakidis et al., 2015; Howard and Dai, 2014; Gkartzonikas and Gkritza, 2019). Relying on new technology and various concerns about autonomous vehicles are sub-parameters that make up the safety factor. In the article, threat and cyber security requirements related to autonomous vehicles are defined according to the basic concepts of Confidentiality, Data integrity/consistency, Authentication, Availability and Non-Repudiation.

In the study, brief information about autonomous vehicles is given. The classification of cyber attacks includes the classification of the basic requirements and necessary security measures that are sensitive to threats, defensible against threats, and take early precautions against threats in order for autonomous vehicles to drive safely and successfully.

CLASSIFICATION OF CYBER ATTACKS FOR AUTONOMOUS VEHICLES

Attacks on autonomous cars are carried out over wired and wireless connections to which the system is connected. The purpose of cyber attacks is to reduce the use of the system from the user and the administrator. Attacks are usually software that will block the system, such as stopping the system, terminating it, not working again, or attacks to eavesdrop on the system (Schmittner et al., 2016).

Vehicle processor networks were control units that were difficult for hackers to reach, and control was not possible without physical interaction (McAfee, 2016). However, nowadays it has become possible to access these networks without physical access. In the study, in order for autonomous vehicles to drive safely and successfully;

- ✓ In-vehicle network attacks,
- ✓ GPS spoofing attacks,
- ✓ Location tracking attacks,
- ✓ Closest vulnerability attacks
- ✓ Infrastructure attacks

classified as. The purpose of the classification is to determine the basic requirements that are dynamic, sensitive to threats, defensible against threats, and enabling early measures to be taken against threats.

In-Vehicle Network Attacks

To defend in-vehicle network attacks, different strategies can be suggested according to the types of these attacks. To defend against remote sensor attacks;

Authentication: Authentication technology provides access control for systems by checking that a user's credentials match those of authorized users in a database or a data authentication server.

Consistency check: It provides recalculation of the consistency of counters and automatic calculations when inconsistent records are encountered in the database.

Sensor combination: In order to evaluate the information from multiple sensors and make a decision, it is necessary to combine it in one of three different ways. These are: Serial merging (Sensor information from more than one classifier is serially combined. If the data from one of them is incorrect, no result can be obtained. All classifiers must produce correct information), Parallel fusion (Information from the classifier is combined in parallel. It is not very effective in decision making), Mixed aggregation (Information from the classifier is combined both in parallel and serially. The part of the classifiers carrying important data is combined in series with the part carrying supporting information in parallel. The classifiers must be correctly interpreted so that the whole system can produce meaningful data).

GPS Spoofing Attacks

To defend against GPS spoofing attacks;

Bias estimation range control: Bias estimation or sensor registration is an important step in ensuring the accuracy of global traces in multisensor-multitarget tracking. Most algorithms for bias estimation rely on local measurements in traces in centralized or distributed systems, with additional information such as covariances, filter gains, or opportunity targets.

Speeds consistency check: This check verifies the consistency of the link speed across all physical network adapters used in autonomous vehicles. Inconsistent connection speed can cause performance issues. It recommends that the connection speed of the physical network adapters used by the tools on each host system be consistent.

Statistical testing: Critical systems rely on software and logic components at the point of security. In reliability evaluation processes, software features are not as well designed as hardware features. Currently, official evidence and statistical testing methods are important techniques that have the potential to quantitatively assess software reliability.

Least absolute shrinkage and selection operator: It is a popular high-dimensional data analysis method that can be used for autonomous vehicle data because it can improve both prediction accuracy and interpretation, and can perform editing and variable selection simultaneously.

Global navigation satellite system augmentation: Vehicle navigations have several challenges in terms of computational complexity and loop closure. An inertial navigation system combines accelerometers, gyroscopes, and other sensors with global positioning systems and other position references to predict an object's position, velocity, and direction in space.

Location Tracking Attacks

To defend location tracking attacks;

k-anonymity; Introduced in 1998 to information security and privacy. It is built on the idea that by combining datasets with similar attributes, identifying information about any of the contributors to that

data can be hidden. k-Anonymization is often referred to as the power of 'hiding in the crowd'. Individuals' data is collected in a larger group, i.e. the information in the group can correspond to any member, thus hiding the identity of the individual or individuals in question.

mix zone; Location privacy is ensured by changing nicknames in areas called mix zones. A mixed zone is effective at anonymizing the trajectory of mobile nodes if the enemy cannot predict with high precision the relationship between mobile nodes entering and leaving the mixed zone.

Software defined networks; It can be expressed as the physical separation of the network control plane from the routing-data plane and the area where a control plane controls several devices. Its most important feature is its high bandwidth and architecture. This architecture has low cost, dynamic, manageable and extensible features. The ability to program the network control directly in the architecture separates the network control and routing functions required for the infrastructure to be abstracted.

Location perturbation and perturbation-hidden; The evolution of smart networks is an important factor in solving privacy issues in location-based services. It provides links to these tools. In terms of location privacy, geo-indistinguishability is a common privacy pattern for location-based services.

The Closest Vulnerabilities

Various strategies can be proposed to defend the nearest vulnerabilities, including encryption and cryptographic checksum.

Bluetooth; Several secure Bluetooth protocols have been developed with cryptographic techniques. These security protocols use cryptographic algorithm to establish trust. In addition, updating all software and passwords, turning off the Bluetooth connection when not in use, Not using public networks, Using a virtual protected network (VPN).

For Tire Pressure Monitoring System; Several methods can be suggested that can improve the reliability and security of TPMS. First, software running on TPMS must adhere to basic reliable design principles. Second, TPMS packets must be encrypted with a simple cryptographic algorithm. Also, an extra sequence number field should be added to the package to keep the package up-to-date. Also, to prevent Message forgery, an extra cryptographic checksum should be added before the Cyclic Redundancy check checksum.

For Key and Keyless seizures; When the key fob is activated, the driver must ensure that the lights are flashing to indicate that the vehicle has received the signal. In autonomous vehicles, a new key should be added to the system if the attacker gains physical access to the vehicles.

Network Segmentation; CAN (Controller Area Network), is the first vehicle communication network to enter mass production in the automotive industry. It is an easy way to provide security for the CAN bus. Today, it has become standardized and even used in many different fields from automation technologies to biomedical products. This is because it is both low cost and reliable. CAN is used in many different areas, from engine management to air conditioning, from charging systems in hybrid vehicles to power steering. Of course, the data rate required by each area is different. For example, the communication in the engine requires being faster than the communication in comfort. Therefore, CAN network communication for each system is integrated with different data transfer rate. Thus, critical and non-critical actions are separated. The enemy cannot easily access critical applications.

DoS and DDoS attacks; It is one of the oldest and most common attack types of wireless communication. In this attack type, successful results are mostly obtained in favor of the attackers, since the vulnerabilities of network protocols, applications or system resources are used.

Infrastructure Attacks

While internal sensors such as yaw rate and wheel speed sensor provide information about the interior perception of the vehicle, external sensors such as radar, lidar and GPS transmit the vehicle's external perception to the decision mechanism (Matzka and Altendorfer, 2009). While internal sensors determine the vehicle's orientation (sway, yaw, etc.), speed and acceleration, external sensors determine

its localization with respect to the external environment. The raw data from the sensors is interpreted during the detection phase and meaningful information is generated about the location of the vehicle, road and existing obstacles (Aufrère et al., 2003; Lozano-Perez et al., 1984). In addition, the vehicle is in constant communication with other vehicles (V2V), existing infrastructure (V2I) and other traffic components (V2X) (Nagel et al., 2007).

To defend against infrastructure attacks such as communication systems, Vehicle-vehicle, vehicle-infrastructure, vehicle-everything communications (Bansal and Kockelman, 2016) and Digital infrastructure and private lane allocation (Shabanpour, 2018); Several strategies can be recommended, including cybersecurity architecture, secure aggregation, software-defined security, and authentication. Additionally;

- ✓ The cloud-based method is used to detect and mitigate cyber attacks on the infrastructure of autonomous vehicles.
- ✓ Software-defined security can be used to protect the infrastructure of autonomous vehicles by abstracting security mechanisms from the hardware layer to a software layer.
- ✓ Network segmentation can prevent access to the rest of the network, especially in critical units.
- ✓ Authentication or authorization must be implemented for any component connected via the CAN bus.
- ✓ It is recommended to implement anomaly detection mechanisms in the CAN bus. Countermeasures can potentially be activated when any deviation from baseline is analysed.
- ✓ Antivirus software is a security solution that scans files to detect, block and remove malware from the system. Anti-malware uses heuristics, public and private signatures to detect known and unknown malware.

CONCLUSION

Autonomous vehicles save people from driving difficulties and change their relationship with vehicles. Since they have artificial intelligence that can communicate with objects, it is an expected result that autonomous vehicles will minimize the errors caused by the driver. Thus, it will be possible to significantly reduce traffic accidents, to make transportation safer and to have the potential to use the road infrastructure much better thanks to integrated smart technologies.

The aim of the study is to identify, classify and present the necessary precautions against potential threats and cyber attacks that threaten the use of autonomous vehicles working with artificial intelligence-based software. Thus, in the face of unexpected attacks, it is to ensure that autonomous vehicles are dynamic, sensitive to threats, defensible against threats and take early precautions against threats.

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**DESIGN AND MANUFACTURING RESEARCH OF THE INFORMATION
PROCESSING EQUIPMENT FOR APPLICABLE IN TECHNICAL SAFELY SUPERVISION
OF THE FISHING VESSEL'S DIESEL ENGINES**

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Abstract

The technical condition of the fishing vessel's diesel engine often changes in the direction of deterioration during use due to many causes such as weakness, abrasion, metal fatigue, the aging process of parts, sub-assemblies, and systems, the mode of improper operation. If the engine is in a low-powered state because the technical safety test parameters are substandard, don't continue working. If there is a part of a sub-assemblies, a particular system that does not work stably is damaged and cannot work, that engine is in a state of breakdown or damage that needs maintenance and repair. To detect these phenomena early, the implementation of supervising is a meaningful requirement, so it is necessary to use equipment to manage the technical status of the engine while in operation and to notify and warn of broken. On that basis, promptly adjust the operating mode of the engine or stop the working so that there is no problem. This paper presents the design and manufacture of a central processing unit, connected to the receiver and transmitter components to form a technical safety supervision device for the fishing vessel's diesel engines (offline and online). There, the receiver unit will record the data from the sensor measuring the supervision parameters. And the transmitter will warn by at place sound and warn via the phone wave to the phone of the user fishing vessel management (technical experts, a center of the machine operation consulting, and exploit) when the supervision parameters exceed the allowable limits. Research results have designed and manufactured a supervision device, recording basic working parameters of the engine, warning by sound and warning via phone waves, successfully applied on Fisherman's fishing vessel, with high reliability, stable working.

Keywords: fishing vessel, diesel engine, supervision, warning, central processing unit.

I. INTRODUCTION

The development of machine-building technology and other industries has created a great impetus for changes in the design, manufacturing, exploitation, maintenance, and repair of equipment and machine systems [13]. The common feature of the machinery and equipment systems is the integration of technologies for automation control, process monitoring, automatic fault detection, automatic protection, and isolation of the system when there is a fault in the system production. Before advances in information technology have allowed performing the above tasks easy [14].

Monitoring and checking the engine's technical status is becoming increasingly urgent, indispensable, and sometimes legally required, making a significant contribution to the reliable and efficient exploitation of the machinery and equipment system, including the ship's dynamics system [10].

Because control and automation technology are being widely applied in many fields, to serve people's lives and socio-economic development. So companies in electronics and automation have produced many products that are convenient in application [11].

the power block must be large enough to ensure enough power and anti-interference for the whole board.

The position of the analog input AI block must be located near the source block and in front of the MCU to ensure the correct sampling signal, the voltage divider resistors must have enough capacity to not generate heat and loss on each resistor.

The digital input (DI) block uses Opto to isolate the signal from the MCU and reverse the signal polarity, the perceived voltage range from 5Vdc to 28Vdc.

The digital output (DO) block has relay outputs placed close together, and 4 DO are connected to 1 COM to isolate and reduce the load for each cluster.

The communication block is designed symmetrically with the source block and away from the position of the DO and has status indicator lights to ensure that the transmitted signal is not disturbed and the position is not confused when connecting with other elements.

The MCU is located centrally and close to the communication block to collect data, ensure the shortest transmission, minimize delay in signal processing and protect against external physical impacts.

Use UART TTL IC and USB type C port to easily load code and debug on board.

After designing and manufacturing CPU equipment, it will be connected to other components, forming a technical safety monitoring system for fishing boats. Signals from the sensors will be processed and compared with the set value limits (the set value limit ensures that the dynamic system works safely and has suitable standards for the engine).

When the measured current values exceed the set value limit, the system will alarm through the light, combined with the LED display showing the monitoring parameter. At the same time, the signal from the sensors is transmitted through the 4G network. The collected data will be stored in the ECU memory with a 10-minute (or custom) recording period.

II. RESEARCH CONTENT

A theoretical study of the technical requirements of each data connection element between Atmega2560 and other elements and an experiment on a test board to draw the principle of CPU board manufacturing. The program “Altium Designer” version 2021 [9] is used to design software for schematic diagrams and layout boards. The entire project is designed and deployed as shown in Fig. 3.

Power: The power of the circuit is provided from 5 ÷ 24Vdc, is taken from industrial power supplies or portable power supplies, and is flexible in the supply voltage range, the source is designed to resist high voltage spikes, and stabilize the power supply, voltage supply for microprocessor and analog IC.

The source is GND isolating low voltage, which protects the sensor modules attached to the measuring devices. Isolating connected devices into a network, so that when one device fails, it does not affect the general network due to isolation.

Power isolation protects users, protects the system, protects communication equipment, and prevents damage from spreading when a power failure occurs.

ADC decoder IC for analog input: Analog signal is an analog signal that is transmitted continuously without interruption. Signals are used to transmit information from sensors to microcontrollers, PLC, and Scada... these signals must be transmitted continuously without interruption. The purpose is to monitor the operation of machines and automation systems (Fig. 4) [12].

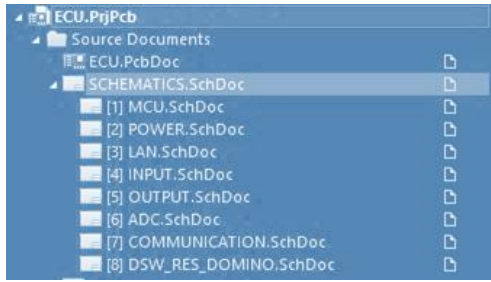


Fig. 3. Design program in Altium Designer

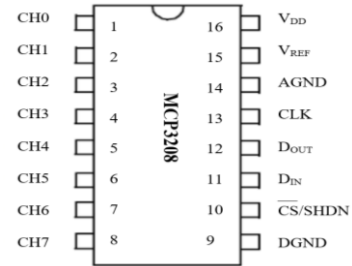


Fig. 4. MCP3208 IC pinout

Where: 12 - bit resolution:

- ± 1 LSB max DNL(differential nonlinearity)
- ± 1 LSB max INL (integral nonlinearity MCP3204/3208-B)
- ± 2 LSB max INL (integral nonlinearity MCP3204/3208-C)
- MCP3208 8 channels ADC
- Measure setting in individual channel mode or compare voltage difference between 2 different channels
- SPI communication (modes 0.0 or 1.1)
- Operating voltage: $2.7V \div 5.5V$
- Maximum measurement speed 100 ksps when $VDD = 5V$
- Maximum measuring speed 50 ksps when $VDD = 2.7V$
- Low power CMOS technology:
 - 500 nA typical standby current, 2 μ A max
 - 400 μ A max active current at 5V
- Operating temperature range: $-40^{\circ}C$ to $+85^{\circ}C$

The data reading from the MCP3208 is shown in Table 1.

Table 1. Configuration bits for the MCP3208 [12]

Control bit selections				Input configuration	Channel selection
<u>Single/diff</u>	D2	D1	D0		
1	0	0	0	Single-ended	CH0
1	0	0	1	Single-ended	CH1
1	0	1	0	Single-ended	CH2
1	0	1	1	Single-ended	CH3
1	1	0	0	Single-ended	CH4
1	1	0	1	Single-ended	CH5
1	1	1	0	Single-ended	CH6

1	1	1	1	Single-ended	CH7
0	0	0	0	differential	CH0=IN + CH1=IN-
0	0	0	1	differential	CH0=IN + CH1=IN-
0	0	1	0	differential	CH2=IN + CH3=IN-
0	0	1	1	differential	CH2=IN + CH3=IN-
0	1	0	0	differential	CH4=IN + CH5=IN-
0	1	0	1	differential	CH4=IN + CH5=IN-
0	1	1	0	differential	CH6=IN + CH5=IN-
0	1	1	1	differential	CH6=IN + CH5=IN-

Where: CH0-CH7: ADC input channel

- VDD: Source 2.7 ÷ 5.5V
- Vref: Comparator voltage
- AGND: The GND pin of the ADC input is usually connected to DGND through a 0 - 10 Ohm resistor. The purpose is to limit interference and isolate.
- CLK: Clock pulse of the SPI
- Dout: Output data SPI
- Din: Input data SPI
- CS/SHDN: SPI chip selection
- DGND: Power pin GND

Digital input (DI): The digital inputs are optically isolated, using an optocoupler to protect the input/output MCU signals from voltage shock and the internal microprocessor. The input is effective against signal interference in cases where the system is not grounded or the probes are floating.

Chip Atmega2560:

The Atmega2560 chip is a powerful microprocessor chip that can develop the ability to write complex programs. The first feature is a large I/O system design with 16 analog and 54 digital converters supporting UART and other communication modes (Fig. 5) [5].

Connect and communicate with other devices and with the network. The communication ports on the board are designed with three common communication standards:

RS232 via DB9 port: RS232 is also known as a COM port, RS232 is used to communicate with other devices. RS232 uses 3 wires Tx (transmit), Rx (receive signal), and GND (ground). RS232 works on the voltage difference between Tx, Rx, and GND. RS232 can not transmit signals long distances, because the signal loss cannot be recovered, and the RS232 standard connection can only communicate between two devices (point-to-point), so the number of devices is limited on the network.

Modbus TCP/IP via RJ45 port: On the board is arranged 1 RJ45 port to connect to LAN, and communicate with computers according to TCP/IP protocol.

Terminal RS485: The RS485 standard only transmits on 2 wires A and B, using the voltage difference between A and B according to logic 0 or 1. This ensures the signal transmission far, because if there is a voltage drop, both wires are voltage drop, so the signal still ensures logic 1 or 0.

Modbus communication protocol:

Modbus is an industrial communication protocol standard, developed by Modicon (now owned by Schneider Electric), and used to communicate between devices in SCADA (supervisory control and data acquisition) system. Modbus became a standard communication protocol standard, because of its high stability, simplicity, and ease of use [6-8].

Modbus protocol is divided into several types: Modbus RTU, Modbus ASCII, and Modbus TCP/IP. Each type will be suitable for a particular application. The common point of these protocols is based on the master-slave principle, when the master device sends a request to the slave device, that device will respond. All devices will be connected to a transmission line (Fig. 6) [7].

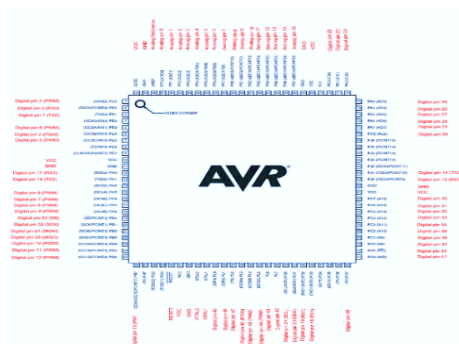


Fig. 5. Pinout Atmega2560

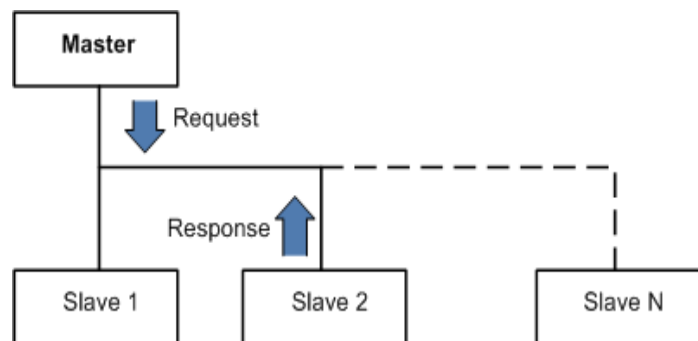


Fig. 6. Modbus protocol

With the Modbus protocol types, the Modbus RTU protocol is a serial communication protocol. In which, sensors or actuators often take on the role of slaves; devices such as computers, PLC, microcontrollers, HMI devices, etc can be master devices, but sometimes they can also act as slaves [4]. The Modbus RTU protocol is shown in Fig. 7 [8].

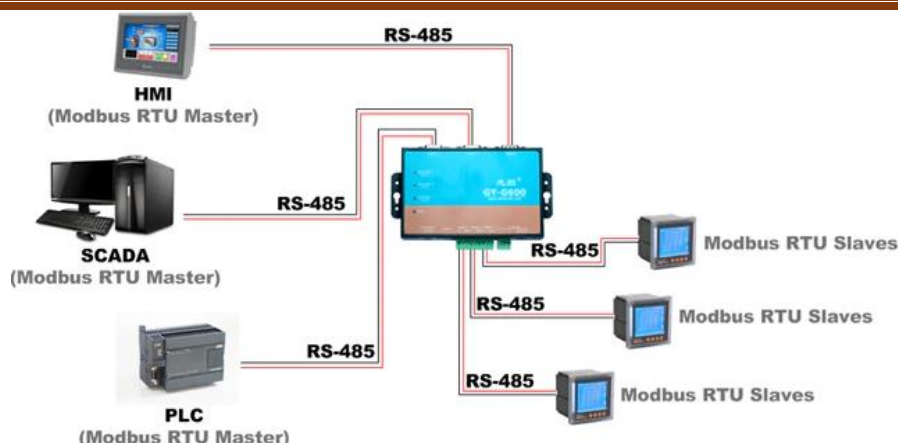


Fig. 7. Modbus RTU protocol

Where RS485 is a transmission line similar to RS232. However, due to some outstanding features over RS232, the Modbus RTU protocol mainly uses RS485 transmission. It has some of the following characteristics:

Used with multipoint networks, can connect many master devices and many slave devices.

There are two transmission modes: Half-duplex transmission mode with only one pair of A-B symmetric wires; full-duplex transmission mode requires two pairs of wires A-B, X-Y. The Modbus protocol uses a half-duplex transmission mode, which allows only one device in the network to transmit data at a time.

The signal wires are twisted together, so if there is interference, it will occur simultaneously on the wires. At the same time, it uses a balanced transmission system, so the voltages between the two wires will be opposite and the logic level will be determined based on the voltage difference between the wire pairs (eg A and B), so the resistance good noise [3].

Digital output:

Digital output uses relay output contacts to easily control electromagnetic contacts, control opening and closing (reversing motor), with contacts that can withstand currents up to 7A and can easily open and close devices. Using voltage levels, to supply many different types of loads: 220Vac, 110Vac, 48Vdc, 24Vdc, 5Vdc.

III. RESEARCH RESULTS AND DISCUSSION

Based on the CPU board designed in Altium Designer software. The CPU printed circuit is shown in Fig. 8. To proceed with manufacturing, the first set of coordinates refers to the position of components on the board. Then proceed to export the Gerber file to make manufacturing as shown in Fig. 9.

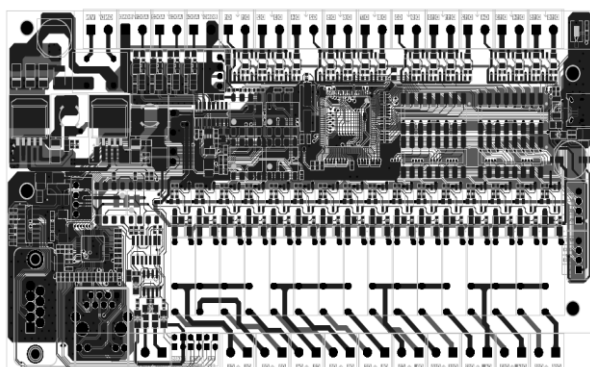


Fig. 8. CPU printed circuit

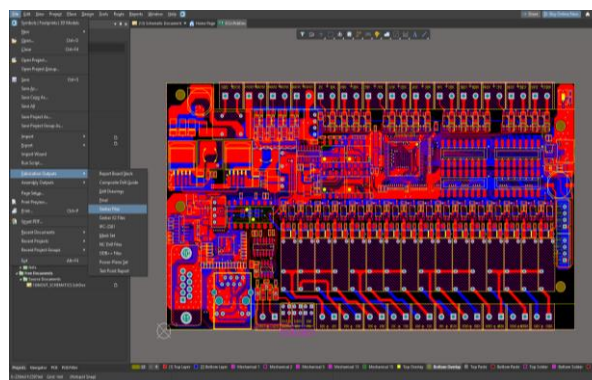


Fig. 9. Exporting Gerber files to manufacture

The CPU board after manufacturing is shown as shown in Fig. 10.

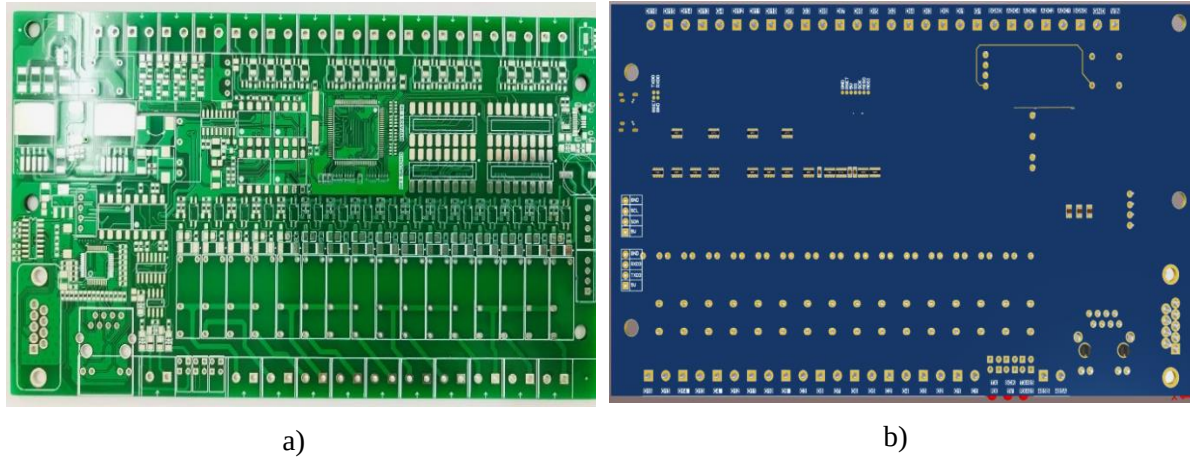


Fig. 10. CPU board after manufacturing, front (a), back (b)

Before assembling the components with the board, the 3D layout on Altium Designer software is performed, to evaluate the accuracy of the standard dimensions (Fig. 11).

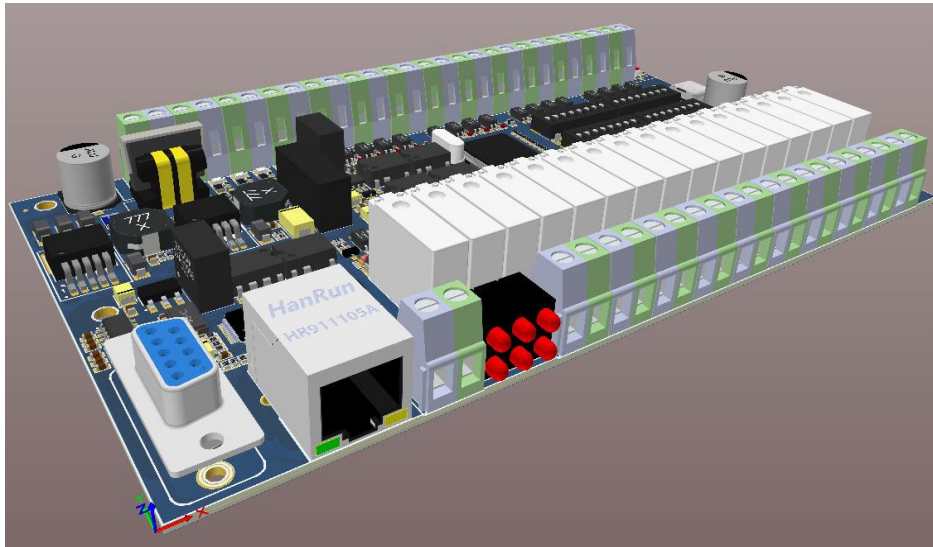


Fig. 11. CPU board 3D layout

With the advantage of low cost, easy to replace when there is a problem, replaced by Terminal with each Input/Output Tagname, the CPU board can meet the moisture-proof specifications (the board is sprayed with dehumidifying spray, anti-moisture, and anti-moisture). water), the board's operating temperature is $< 60^{\circ}\text{C}$, and the temperature of the wire coils on the board is not hot, serving to connect with the elements to form the monitoring system.

Each board has a maximum of 16 digital input (16DI), 4 analog input (4AI), and 16 digital output (16DO) enough to meet the amount of IO needed at a small and medium level. However, when the number of IOs exceeds 16DI/16DO/4AI, multiple boards can be connected, and each board will be addressed from 1 to 255, up to a maximum of 255 connecting boards, respectively (2^8-1) board, because the board uses dipSW to address the board. Each board is a Slave in the system and uses a Modbus RTU line. If using the Modbus TCP protocol, there is no limit to the number of boards connecting to collect data. On that basis, the CPU board after installing the actual assembly is shown in Fig. 12.

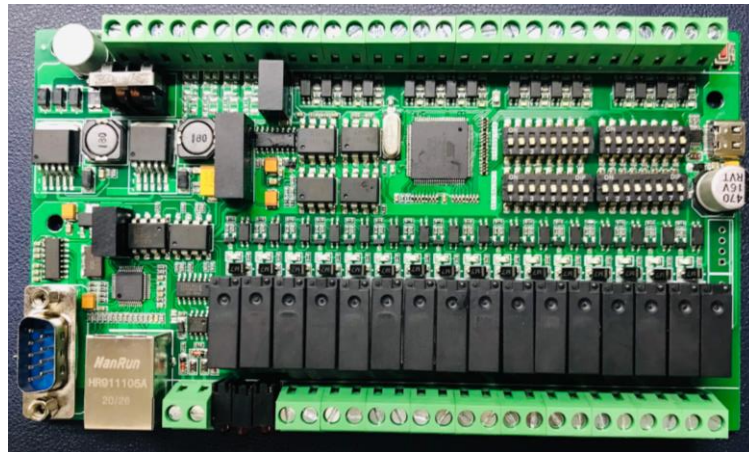


Fig. 12. The CPU board is applied in the technical safety monitoring of fishing vessel engines

IV. CONCLUSION

Based on the actual data to be processed and the characteristics of the designed equipment, the CPU board used to process information, applied in the technical safety monitoring system for the engine of the fishing vessel, has been manufactured successfully, and has the following characteristics:

Connect multiple boards to the same system, collect multiple data at the same time, control multiple devices, and reduce the number of data transmission lines.

The CPU board is designed according to industry standards, connecting many devices with less number of wires, so the board can adjust the firmware as required, and can run Modbus on 3 transmission lines: ModbusIP and Modbus RTU run on an RS232 transmission line; Modbus RTU runs on the RS485 transmission line.

The CPU board has been used in a supervision device, recording basic working parameters of the engine, warning by sound and warning via phone waves, successfully applied on Fisherman's fishing vessel, with high reliability, stable working.

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**YENİ TİP İKİ BOYUTLU BERNSTEIN SCHURER OPERATÖRLERİ
A NEW TYPE BIVARIATE BERNSTEIN SCHURER OPERATORS**

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Özet

Bu çalışma yaklaşım teorisi alanında hazırlanmıştır. Yaklaşım teorisi, günlük yaşam ve mühendislik, tıp gibi alanlarda ortaya çıkan problemlerin çözümünde önemli bir araçtır. Çalışması zor ve karmaşık fonksiyonlar yerine basit ve kullanışlı fonksiyon operatörleri gibi araçların kullanılmasına dayanmaktadır. Birçok araştırmacı yeni lineer pozitif operatörler tanımlamış ve bunların yaklaşım özellikleri Korovkin–Volkov tipi teoremi yardımıyla incelenmiştir. Bu çalışmada, Bernstein Schurer operatörünün bir genellemesi iki boyutlu uzaya taşınacak ve önemli yaklaşım özellikleri incelenecektir. İki değişkenli fonksiyonlar için gerekli test fonksiyonlarının sağladığı denklemler elde edilerek kısmi süreklilik modülü yardımı ile yakınsama hızı hesabı yapılacaktır.

Anahtar Kelimeler: Bernstein Schurer operatörü, Volkov teoremi, doğrusal pozitif operatörler.

Abstract

This study is prepared in the field of approximation theory. Approximation theory is an important tool in solving problems that arise in fields such as daily life and engineering, medicine. It is based on using tools such as simple and useful function operators instead of difficult and complex functions to work with. Many researchers have defined new linear positive operators and their approximation properties have been studied with the help of Korovkin–Volkov type theorem. In this study, a generalization of the Bernstein Schurer operator will be carried into two-dimensional space and important approximation properties will be examined. By obtaining the equations provided by the test functions required for the functions of two variables, calculation of rate of convergence was made with the help of the partial modulus of continuity.

Keywords: Bernstein Schurer operator, Volkov theorem, linear positive operators.

GİRİŞ

Yaklaşım teorisi; özellikle fonksiyonel analizde ortaya çıkan problemlerin çözümünde önemli bir araçtır. Sürekli fonksiyonların yaklaşım problemi ilk olarak 1885'te Weierstrass tarafından çalışılmıştır. Weierstrass, kapalı bir $[a,b]$ aralığında sürekli olan fonksiyonlara düzgün yakınsayan polinomların varlığını göstermiştir. Bu teorem daha sonra Bernstein tarafından kendi adıyla anılan $[0,1]$ aralığındaki polinomların yardımıyla kanıtlandı (Bernstein, 1912).

1952'de Bohman ve 1953'te Korovkin, lineer pozitif operatörlerin sürekli fonksiyonlara düzgün yakınsaklığı hakkında çok önemli bir teoremi kanıtladı. Bu teorem ile kapalı ve sınırlı bir aralık üzerinde operatörün düzgün yakınsaklığını sağlamak için sadece üç koşulun araştırılmasının yeterli olduğu kanıtlanmıştır.

Daha sonra birçok araştırmacı tarafından yeni lineer pozitif operatörler tanımlanmış ve bunların yaklaşım özellikleri Korovkin tipli teoremler yardımıyla incelenmiştir. (Buyukyazici and Ibikli, 2006), (Bilgin and Coşkun, 2018), (Karateke et all. 2019), (Acar and Izgi, 2021), (Bozma and Bars, 2022). Bu operatörlerden bazıları şunlardır: Bernstein operatörleri, Bernstein Chlodowsky operatörleri, Szasz operatörleri, Meyer-König ve Zeller operatörleri vb.

Bir diğer önemli operatorde Bernstein Schurer operatörüdür. 1962 yılında Schurer, Bernstein polinomlarını modifiye etmiş ve yaklaşım özelliklerini incelemiştir (Schurer, 1965). Son zamanlarda, tek değişkenli ve iki değişkenli Bernstein Schurer operatörlerine ilişkin değişik genellemeler birçok yazar tarafından incelenmiştir. (Barbosu, 2004) iki değişkenli Bernstein-Schurer operatörlerinin yaklaşımı ve yaklaşım hızına ilişkin çalışmalar yapmıştır. (Aslan and Izgi, 2021) de simetrik mobil bir aralık üzerinde tek değişkenli Bernstein Schurer tipi operatörleri tanımlayarak Voronovskaya tipi bir teorem kanıtlamışlardır. (Mohiuddine, 2020) da iki değişkenli Bernstein-Schurer operatörünün bir genelleştirmesi ve GBS operatörüne ilişkin özellikler incelenmiştir. (Sucu et. all. 2014) da Schurer-Stancu tipi polinomların yaklaşım özellikleri verilmiştir. (Gonul Bilgin and Eren, 2022) de sınırları değişken olan bir simetrik aralıkta Bernstein polinomları ile Bernstein Schurer operatörüne ilişkin çalışmaların bir sentezi yapılarak Bernstein Schurer operatörünün bir genellemesi tanımlanmış ve daha sonra bu operatörün Kantorovich tipli bir genellemesi yapılmıştır. Bu operatörün yapılan diğer bazı genellemelerine örnek olarak (Çetin, 2021), (Çetin and Acu, 2021) ve (Fărcas, 2009) verilebilir.

q ve (p, q) analizin ortaya çıkışı ile operatör teorisin de birçok tek boyutlu operatörün q ve (p, q) genellemesi yapılmıştır. Örneğin; (Muraru, 2011), (Kantar and Yuksel, 2022), (Mursaleen et. all, 2015), (Mursaleen et. all., 2016). İki boyutlu operatörler ve bazı (p, q) genellemelerine ise şu çalışmalar örnek olarak verilebilir: (Bilgin and Ozgur, 2019), (Mursaleen et. all, 2020), (Bilgin and Eren, 2021), (Bilgin and Eren, 2023).

Bu çalışmada; (Gonul Bilgin and Eren, 2022) tarafından tanımlanan; genelleştirilmiş Bernstein-Schurer operatörünün iki değişkenli hali tanımlanarak önemli yaklaşım özellikleri incelenmiştir.

MATERYAL VE METOT

Tanım 1. Her $0 \leq \xi \leq \psi$, $t_1, t_2 \in \mathbb{N}_0$, $n_1, n_2 \in \mathbb{N}$ için $x, y \in \left[-\frac{n+\xi}{n+\psi}, \frac{n+\xi}{n+\psi}\right] \times \left[-\frac{n+\xi}{n+\psi}, \frac{n+\xi}{n+\psi}\right]$ ve $f \in C\left[-\frac{n+\xi}{n+\psi}, \frac{n+\xi}{n+\psi}\right] \times \left[-\frac{n+\xi}{n+\psi}, \frac{n+\xi}{n+\psi}\right]$ olsun.

$$\check{N}_{n_1, k_1}(x, y) = \binom{n_1 + t_1}{k_1} \left(x + \frac{n_1 + \xi}{n_1 + \psi}\right)^{k_1} \left(\frac{n_1 + \xi}{n_1 + \psi} - x\right)^{n_1 + t_1 - k_1}$$

$$\check{N}_{n_2, k_2}(x, y) = \binom{n_2 + t_2}{k_2} \left(y + \frac{n_2 + \xi}{n_2 + \psi}\right)^{k_2} \left(\frac{n_2 + \xi}{n_2 + \psi} - y\right)^{n_2 + t_2 - k_2}$$

olmak üzere

$$\begin{aligned} \check{L}_{n_1, n_2}(f; x, y) &= \frac{1}{2^{n_1 + t_1}} \frac{1}{2^{n_2 + t_2}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1 + t_1} \left(\frac{n_2 + \psi}{n_2 + \xi}\right)^{n_2 + t_2} \sum_{k_1=0}^{n_1 + t_1} \sum_{k_2=0}^{n_2 + t_2} \check{N}_{n_1, k_1}(x, y) \check{N}_{n_2, k_2}(x, y) \\ &\times f\left(\frac{n_1 + \xi}{n_1 + \psi} \left(\frac{2k_1}{n_1 + t_1} - 1\right), \frac{n_2 + \xi}{n_2 + \psi} \left(\frac{2k_2}{n_2 + t_2} - 1\right)\right) \end{aligned}$$

şeklinde tanımlı operatöre genelleştirilmiş iki değişkenli Bernstein-Schurer operatörü adı verilir.

Uyarı 1. Açıkça $\check{L}_{n_1, n_2}(f; x, y)$ operatörü doğrusal ve pozitif bir operatördür.

Önerme 1. Her $x, y \in D = \left[-\frac{n+\xi}{n+\psi}, \frac{n+\xi}{n+\psi}\right] \times \left[-\frac{n+\xi}{n+\psi}, \frac{n+\xi}{n+\psi}\right]$ için Tanım 1. de verilen operatör

i. $\check{L}_{n_1, n_2}(1; x, y) = 1$,

ii. $\check{L}_{n_1, n_2}(u_1; x, y) = x,$

iii. $\check{L}_{n_1, n_2}(u_2; x, y) = y,$

iv. $\check{L}_{n_1, n_2}(u_1^2; x, y) = \left(1 - \frac{1}{n_1 + t_1}\right)x^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2,$

v. $\check{L}_{n_1, n_2}(u_2^2; x, y) = \left(1 - \frac{1}{n_2 + t_2}\right)y^2 + \left(\frac{1}{n_2 + t_2}\right)\left(\frac{n_2 + \xi}{n_2 + \psi}\right)^2,$

vi. $\check{L}_{n_1, n_2}(u_1^2 + u_2^2; x, y) = \left(1 - \frac{1}{n_1 + t_1}\right)x^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_2 + \psi}\right)^2$
 $+ \left(1 - \frac{1}{n_2 + t_2}\right)y^2 + \left(\frac{1}{n_2 + t_2}\right)\left(\frac{n_2 + \xi}{n_2 + \psi}\right)^2$

eşitliklerini sağlar.

Kanıt Operatörün tanımından açıkça

i. $\check{L}_{n_1, n_2}(1; x, y) = \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1+t_1} \left(\frac{n_2 + \psi}{n_2 + \xi}\right)^{n_2+t_2} \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} 1 \check{N}_{n_1, k_1}(x, y) \check{N}_{n_2, k_2}(x, y)$
 $= 1$

eşitliği bulunur.

ii. Benzer şekilde

$$\begin{aligned} \check{L}_{n_1, n_2}(u_1; x, y) &= \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1+t_1} \left(\frac{n_2 + \psi}{n_2 + \xi}\right)^{n_2+t_2} \\ &\times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} f\left(\frac{n_1 + \xi}{n_1 + \psi} \left(\frac{2k_1}{n_1 + t_1} - 1\right), \frac{n_2 + \xi}{n_2 + \psi} \left(\frac{2k_2}{n_2 + t_2} - 1\right)\right) \check{N}_{n_1, k_1}(x, y) \check{N}_{n_2, k_2}(x, y) \\ &= \left[\frac{1}{2^{n_1+t_1-1}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1+t_1-1} \sum_{k_1=1}^{n_1+t_1} \binom{n_1+t_1-1}{k_1-1} \left(x + \frac{n_1 + \xi}{n_1 + \psi}\right)^{k_1} \left(\frac{n_1 + \xi}{n_1 + \psi} - x\right)^{n_1+t_1-k_1} \right. \\ &\quad \left. - \frac{1}{2^{n_1+t_1}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1+t_1-1} 2^{n_1+t_1} \left(\frac{n_1 + \xi}{n_1 + \psi}\right)^{n_1+t_1} \right] \frac{1}{2^{n_2+t_2}} \left(\frac{n_2 + \psi}{n_2 + \xi}\right)^{n_2+t_2} 2^{n_2+t_2} \left(\frac{n_2 + \xi}{n_2 + \psi}\right)^{n_2+t_2} \\ &= \frac{1}{2^{n_1+t_1-1}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1+t_1-1} \\ &\times \sum_{k_1=0}^{n_1+t_1-1} \binom{n_1+t_1-1}{k_1} \left(x + \frac{n_1 + \xi}{n_1 + \psi}\right)^{k_1+1} \left(\frac{n_1 + \xi}{n_1 + \psi} - x\right)^{n_1+t_1-k_1-1} - \left(\frac{n_1 + \xi}{n_1 + \psi}\right) \\ &= \frac{1}{2^{n_1+t_1-1}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1+t_1-1} \left(x + \frac{n_1 + \xi}{n_1 + \psi}\right) 2^{n_1+t_1-1} \left(\frac{n_1 + \xi}{n_1 + \psi}\right)^{n_1+t_1-1} - \left(\frac{n_1 + \xi}{n_1 + \psi}\right) \\ &= \left(x + \frac{n_1 + \xi}{n_1 + \psi}\right) - \left(\frac{n_1 + \xi}{n_1 + \psi}\right) = x \end{aligned}$$

eşitliği sağlanır.

iii. $\check{L}_{n_1, n_2}(u_2; x, y) = \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1+t_1} \left(\frac{n_2 + \psi}{n_2 + \xi}\right)^{n_2+t_2}$

$$\begin{aligned}
& \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right) \tilde{N}_{n_1,k_1}(x,y) \tilde{N}_{n_2,k_2}(x,y) \\
& = \left[\frac{1}{2^{n_2+t_2-1}} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2-1} \sum_{k_2=1}^{n_2+t_2} \binom{n_2+t_2-1}{k_2-1} \left(y + \frac{n_2+\xi}{n_2+\psi}\right)^{k_2} \left(\frac{n_2+\xi}{n_2+\psi} - y\right)^{n_2+t_2-k_2} \right. \\
& \quad \left. - \frac{1}{2^{n_2+t_2}} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2-1} 2^{n_2+t_2} \left(\frac{n_2+\xi}{n_2+\psi}\right)^{n_2+t_2} \right] \frac{1}{2^{n_1+t_1}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} 2^{n_1+t_1} \left(\frac{n_1+\xi}{n_1+\psi}\right)^{n_1+t_1} \\
& = \frac{1}{2^{n_2+t_2-1}} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2-1} \left(y + \frac{n_2+\xi}{n_2+\psi}\right) 2^{n_2+t_2-1} \left(\frac{n_2+\xi}{n_2+\psi}\right)^{n_2+t_2-1} - \left(\frac{n_2+\xi}{n_2+\psi}\right) \\
& = \left(y + \frac{n_2+\xi}{n_2+\psi}\right) - \left(\frac{n_2+\xi}{n_2+\psi}\right) = y. \\
\text{iv. } L_{n_1,n_2}(u_1^2; x, y) &= \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
& \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right)^2 \tilde{N}_{n_1,k_1}(x,y) \tilde{N}_{n_2,k_2}(x,y) \\
& = \frac{1}{2^{n_1+t_1}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \frac{1}{2^{n_2+t_2}} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left(\frac{4k_1^2}{(n_1+t_1)^2} - \frac{4k_1}{n_1+t_1} + 1\right) \\
& \times \left(\frac{n_1+\xi}{n_1+\psi}\right)^2 \tilde{N}_{n_1,k_1}(x,y) \tilde{N}_{n_2,k_2}(x,y) \\
& = \frac{1}{2^{n_1+t_1-2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1-2} \frac{(n_1+t_1)(n_1+t_1-1)}{(n_1+t_1)^2} \sum_{k_1=2}^{n_1+t_1} \frac{k_1(k_1-1)}{(n_1+t_1)(n_1+t_1-1)} \binom{n_1+t_1}{k_1} \\
& \times \left(x + \frac{n_1+\xi}{n_1+\psi}\right)^{k_1} \left(\frac{n_1+\xi}{n_1+\psi} - x\right)^{n_1+t_1-k_1} \\
& + \frac{1}{2^{n_1+t_1-2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1-2} \frac{n_1+t_1}{(n_1+t_1)^2} \sum_{k_1=1}^{n_1+t_1} \frac{k_1}{n_1+t_1} \binom{n_1+t_1}{k_1} \left(x + \frac{n_1+\xi}{n_1+\psi}\right)^{k_1} \\
& \times \left(\frac{n_1+\xi}{n_1+\psi} - x\right)^{n_1+t_1-k_1} \\
& - \frac{1}{2^{n_1+t_1-2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1-2} \frac{n_1+t_1}{n_1+t_1} \sum_{k_1=1}^{n_1+t_1} \frac{k_1}{n_1+t_1} \binom{n_1+t_1}{k_1} \left(x + \frac{n_1+\xi}{n_1+\psi}\right)^{k_1} \left(\frac{n_1+\xi}{n_1+\psi} - x\right)^{n_1+t_1-k_1} \\
& + \frac{1}{2^{n_1+t_1}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1-2} 2^{n_1+t_1} \left(\frac{n_1+\xi}{n_1+\psi}\right)^{n_1+t_1} \\
& = \frac{1}{2^{n_1+t_1-2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1-2} \frac{(n_1+t_1-1)}{n_1+t_1} \left(x + \frac{n_1+\xi}{n_1+\psi}\right)^2 2^{n_1+t_1-2} \left(\frac{n_1+\xi}{n_1+\psi}\right)^{n_1+t_1-2} \\
& + \frac{1}{2^{n_1+t_1-2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1-2} \frac{1}{n_1+t_1} \left(x + \frac{n_1+\xi}{n_1+\psi}\right) 2^{n_1+t_1-1} \left(\frac{n_1+\xi}{n_1+\psi}\right)^{n_1+t_1-1}
\end{aligned}$$

$$\begin{aligned}
& -\frac{1}{2^{n_1+t_1-2}} \left(\frac{n_1+\psi}{n_1+\xi} \right)^{n_1+t_1-2} \left(x + \frac{n_1+\xi}{n_1+\psi} \right) 2^{n_1+t_1-1} \left(\frac{n_1+\xi}{n_1+\psi} \right)^{n_1+t_1-1} + \left(\frac{n_1+\xi}{n_1+\psi} \right)^2 \\
& = \frac{(n_1+t_1-1)}{n_1+t_1} \left(x + \frac{n_1+\xi}{n_1+\psi} \right)^2 + 2 \frac{1}{n_1+t_1} \left(x + \frac{n_1+\xi}{n_1+\psi} \right) \left(\frac{n_1+\xi}{n_1+\psi} \right) \\
& - 2 \left(x + \frac{n_1+\xi}{n_1+\psi} \right) \left(\frac{n_1+\xi}{n_1+\psi} \right) + \left(\frac{n_1+\xi}{n_1+\psi} \right)^2 \\
& = \left(1 - \frac{1}{n_1+t_1} \right) x^2 + \left(\frac{1}{n_1+t_1} \right) \left(\frac{n_1+\xi}{n_1+\psi} \right)^2. \\
\text{v. } \check{L}_{n_1, n_2}(u_2^2; x, y) &= \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi} \right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2} \\
& \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} f \left(\frac{n_1+\xi}{n_1+\psi} \left(\frac{2k_1}{n_1+t_1} - 1 \right), \frac{n_2+\xi}{n_2+\psi} \left(\frac{2k_2}{n_2+t_2} - 1 \right) \right)^2 \check{N}_{n_1, k_1}(x, y) \check{N}_{n_2, k_2}(x, y) \\
& = \left[\frac{1}{2^{n_2+t_2-2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \sum_{k_2=0}^{n_2+t_2} \frac{k_2^2}{(n_2+t_2)^2} \binom{n_2+t_2}{k_2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right)^{k_2} \left(\frac{n_2+\xi}{n_2+\psi} - y \right)^{n_2+t_2-k_2} \right. \\
& - \frac{1}{2^{n_2+t_2-2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \sum_{k_2=0}^{n_2+t_2} \frac{k_2}{n_2+t_2} \binom{n_2+t_2}{k_2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right)^{k_2} \left(\frac{n_2+\xi}{n_2+\psi} - y \right)^{n_2+t_2-k_2} \\
& + \left. \frac{1}{2^{n_2+t_2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \sum_{k_2=0}^{n_2+t_2} \binom{n_2+t_2}{k_2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right)^{k_2} \left(\frac{n_2+\xi}{n_2+\psi} - y \right)^{n_2+t_2-k_2} \right] \\
& \times \frac{1}{2^{n_1+t_1}} \left(\frac{n_1+\psi}{n_1+\xi} \right)^{n_1+t_1} \sum_{k_1=0}^{n_1+t_1} \check{N}_{n_1, k_1}(x, y) \\
& = \frac{1}{2^{n_2+t_2-2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \frac{(n_2+t_2-1)}{(n_2+t_2)} \sum_{k_2=0}^{n_2+t_2-2} \binom{n_2+t_2-2}{k_2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right)^{k_2+2} \\
& \times \left(\frac{n_2+\xi}{n_2+\psi} - y \right)^{n_2+t_2-k_2-2} \\
& + \frac{1}{2^{n_2+t_2-2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \frac{1}{n_2+t_2} \sum_{k_2=0}^{n_2+t_2-1} \binom{n_2+t_2-1}{k_2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right)^{k_2+1} \\
& \times \left(\frac{n_2+\xi}{n_2+\psi} - y \right)^{n_2+t_2-k_2-1} \\
& - \frac{1}{2^{n_2+t_2-2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \sum_{k_2=0}^{n_2+t_2-1} \binom{n_2+t_2-1}{k_2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right)^{k_2+1} \left(\frac{n_2+\xi}{n_2+\psi} - y \right)^{n_2+t_2-k_2-1} \\
& + \left(\frac{n_2+\xi}{n_2+\psi} \right)^2 \\
& = \frac{1}{2^{n_2+t_2-2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \frac{(n_2+t_2-1)}{n_2+t_2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right)^2 2^{n_2+t_2-2} \left(\frac{n_2+\xi}{n_2+\psi} \right)^{n_2+t_2-2}
\end{aligned}$$

$$\begin{aligned}
 & + \frac{1}{2^{n_2+t_2-2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \frac{1}{n_2+t_2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right) 2^{n_2+t_2-1} \left(\frac{n_2+\xi}{n_2+\psi} \right)^{n_2+t_2-1} \\
 & - \frac{1}{2^{n_2+t_2-2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2-2} \left(y + \frac{n_2+\xi}{n_2+\psi} \right) 2^{n_2+t_2-1} \left(\frac{n_2+\xi}{n_2+\psi} \right)^{n_2+t_2-1} + \left(\frac{n_2+\xi}{n_2+\psi} \right)^2 \\
 & = \frac{(n_2+t_2-1)}{n_2+t_2} y^2 + 2 \frac{(n_2+t_2-1)}{n_2+t_2} \left(\frac{n_2+\xi}{n_2+\psi} \right) y + \frac{(n_2+t_2-1)}{n_2+t_2} \left(\frac{n_2+\xi}{n_2+\psi} \right)^2 \\
 & + 2 \left(\frac{1}{n_2+t_2} - 1 \right) \left(\frac{n_2+\xi}{n_2+\psi} \right) y - 2 \left(1 - \frac{1}{n_2+t_2} \right) \left(\frac{n_2+\xi}{n_2+\psi} \right)^2 + \left(\frac{n_2+\xi}{n_2+\psi} \right)^2 \\
 & = \frac{(n_2+t_2-1)}{n_2+t_2} y^2 + 2 \left(\frac{(n_2+t_2-1)}{n_2+t_2} + \frac{1}{n_2+t_2} - 1 \right) \left(\frac{n_2+\xi}{n_2+\psi} \right) y \\
 & + \left(\frac{n_2+t_2-1}{n_2+t_2} + \frac{2}{n_2+t_2} - 2 + 1 \right) \left(\frac{n_2+\xi}{n_2+\psi} \right)^2 \\
 & = \left(1 - \frac{1}{n_2+t_2} \right) y^2 + \left(\frac{1}{n_2+t_2} \right) \left(\frac{n_2+\xi}{n_2+\psi} \right)^2
 \end{aligned}$$

eşitliği elde edilir. Üstteki iki eşitlikten

$$\begin{aligned}
 \check{L}_{n_1,n_2}(u_1^2 + u_2^2; x, y) &= \check{L}_{n_1,n_2}(u_1^2; x, y) + \check{L}_{n_1,n_2}(u_2^2; x, y) \\
 &= \left(1 - \frac{1}{n_1+t_1} \right) x^2 + \left(\frac{1}{n_1+t_1} \right) \left(\frac{n_1+\xi}{n_2+\psi} \right)^2 \\
 &+ \left(1 - \frac{1}{n_2+t_2} \right) y^2 + \left(\frac{1}{n_2+t_2} \right) \left(\frac{n_2+\xi}{n_2+\psi} \right)^2
 \end{aligned}$$

olur. Böylece istenilen eşitlikler gösterilmiş olur.

Teorem 1. Gerçel eksenin tamamında sınırlı $C(D)$ uzayının elemanı olan her f fonksiyonu için

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1,n_2}(f; x, y) - f(x, y)\|_{C(D)} = 0$$

eşitliği sağlanır.

Kanıt Kanıt için Volkov (Volkov, 1957) teoreminin koşullarının sağlandığını göstermek yeterlidir. Açıkça

$$\check{L}_{n_1,n_2}(1; x, y) - 1 = 1 - 1 = 0$$

eşitsizliğine ulaşılır.

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1,n_2}(1; x, y) - 1\|_{C(D)} = 0$$

ve

$$\check{L}_{n_1,n_2}(u_1; x, y) - x = x - x = 0$$

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1,n_2}(u_1; x, y) - x\|_{C(D)} = 0$$

$$\check{L}_{n_1,n_2}(u_2; x, y) - y = y - y = 0$$

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1,n_2}(u_2; x, y) - y\|_{C(D)} = 0$$

eşitlikleri sağlanır.

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2\|_{C(D)}$$

limitini hesaplamak için norm tanımı kullanılarak, öncelikle ifadenin maksimum değerini araştırmak için türevden yararlanılacaktır. Daha sonra aralığın uç noktaları kullanılarak maksimum değeri incelenecektir.

$$|\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2| = \left| \left(1 - \frac{1}{n_1 + t_1}\right)x^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2 - x^2 \right|$$

$$(\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2)' = -2 \frac{1}{n_1 + t_1} x$$

$$(\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2)' = 0$$

durumu $x = 0$ olmasını gerektirir. Böylece $x = 0$, $|\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2|$ ifadesinde yerine yazılırsa

$$|\check{L}_{n_1, n_2}(u_1^2; 0, 0) - 0| = \left| \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2 \right|$$

eşitliği bulunur. Son olarak

$$\max_{x, y \in D} |\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2| = \left| \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2 \right|$$

eşitliği yardımıyla

$$\lim_{n_1, n_2 \rightarrow \infty} \max_{x, y \in D} |\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2| = \lim_{n_1, n_2 \rightarrow \infty} \left| \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2 \right| = 0$$

eşitliği gösterilmiş olur.

Şimdi de aralığın uç noktası $|\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2|$ ifadesinde yerine yazılırsa

$$\begin{aligned} \max_{x, y \in D} |\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2| \\ = \left| -\frac{1}{n_1 + t_1} \left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2 \right| = 0 \end{aligned}$$

olup

$$\lim_{n_1, n_2 \rightarrow \infty} \max_{x, y \in D} |\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2| = 0$$

olduğundan aranan

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1, n_2}(u_1^2; x, y) - x^2\|_{C(D)} = 0$$

eşitliği gösterilmiş olur. Benzer işlemlerle

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1, n_2}(u_2^2; x, y) - y^2\|_{C(D)} = 0$$

eşitliği gösterilebilir.

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1, n_2}(u_1^2 + u_2^2; x, y) - (x + y)^2\|_{C(D)} = 0$$

olduğunu gösterelim.

$$\|\check{L}_{n_1, n_2}(u_1^2 + u_2^2; x, y) - (x + y)^2\| = \max_{x, y \in D} |\check{L}_{n_1, n_2}(u_1^2; x, y) + \check{L}_{n_1, n_2}(u_2^2; x, y) - x^2 - y^2|$$

$$\begin{aligned}
 &= \max_{x,y \in D} \left| \left(1 - \frac{1}{n_1 + t_1} \right) x^2 + \left(\frac{1}{n_1 + t_1} \right) \left(\frac{n_1 + \xi}{n_1 + \psi} \right)^2 \right. \\
 &\quad \left. + \left(1 - \frac{1}{n_2 + t_2} \right) y^2 + \left(\frac{1}{n_2 + t_2} \right) \left(\frac{n_2 + \xi}{n_2 + \psi} \right)^2 - x^2 - y^2 \right| \\
 &= \left| \left(-\frac{1}{n_1 + t_1} \right) x^2 + \left(\frac{1}{n_1 + t_1} \right) \left(\frac{n_1 + \xi}{n_1 + \psi} \right)^2 + \left(-\frac{1}{n_2 + t_2} \right) y^2 + \left(\frac{1}{n_2 + t_2} \right) \left(\frac{n_2 + \xi}{n_2 + \psi} \right)^2 \right| \\
 &\leq \left| \left(-\frac{1}{n_1 + t_1} \right) \left(\frac{n_1 + \xi}{n_1 + \psi} \right)^2 + \left(\frac{1}{n_1 + t_1} \right) \left(\frac{n_1 + \xi}{n_1 + \psi} \right)^2 \right. \\
 &\quad \left. + \left(-\frac{1}{n_2 + t_2} \right) \left(\frac{n_2 + \xi}{n_2 + \psi} \right)^2 + \left(\frac{1}{n_2 + t_2} \right) \left(\frac{n_2 + \xi}{n_2 + \psi} \right)^2 \right| \\
 &= 0
 \end{aligned}$$

yardımla

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1, n_2}(u_1^2 + u_2^2; x, y) - (x + y)^2\|_{C(D)} = 0$$

eşitliği gösterilebilir. Böylece Volkov teoremin koşulları sağlandığından her $f \in C(D)$ için

$$\lim_{n_1, n_2 \rightarrow \infty} \|\check{L}_{n_1, n_2}(f; x, y) - f(x, y)\|_{C(D)} = 0$$

eşitliği elde edilir.

Önerme 2. $\check{L}_{n_1, n_2}(f; x, y)$ operatörünün momentleri için

- i. $\check{L}_{n_1, n_2}((1 - x)^0; x, y) = 1,$
- ii. $\check{L}_{n_1, n_2}((u_1 - x)^1; x, y) = 0,$
- iii. $\check{L}_{n_1, n_2}((u_2 - y)^1; x, y) = 0,$
- iv. $\check{L}_{n_1, n_2}((u_1 - x)^2; x, y) = -\frac{1}{n_1 + t_1} x^2 + \left(\frac{1}{n_1 + t_1} \right) \left(\frac{n_1 + \xi}{n_1 + \psi} \right)^2,$
- v. $\check{L}_{n_1, n_2}((u_2 - y)^2; x, y) = -\frac{1}{n_2 + t_2} y^2 + \left(\frac{1}{n_2 + t_2} \right) \left(\frac{n_2 + \xi}{n_2 + \psi} \right)^2,$
- vi. $\check{L}_{n_1, n_2}(((u_1 + u_2) - (x + y))^2; x, y) = \left(-\frac{1}{n_1 + t_1} \right) x^2 + \left(\frac{1}{n_1 + t_1} \right) \left(\frac{n_1 + \xi}{n_1 + \psi} \right)^2$
 $+ \left(-\frac{1}{n_2 + t_2} \right) y^2 + \left(\frac{1}{n_2 + t_2} \right) \left(\frac{n_2 + \xi}{n_2 + \psi} \right)^2$

eşitlikleri geçerlidir.

Kanıt Açıkça

$$i. \check{L}_{n_1, n_2}((1 - x)^0; x, y) = \check{L}_n(1; x, y) = 1.$$

Benzer şekilde

$$ii. \check{L}_{n_1, n_2}((u_1 - x)^1; x, y) = \check{L}_{n_1, n_2}(u_1; x, y) - x \check{L}_{n_1, n_2}(1; x, y) = x - x = 0$$

ve

$$iii. \check{L}_{n_1, n_2}((u_2 - y)^1; x, y) = \check{L}_{n_1, n_2}(u_2; x, y) - y \check{L}_{n_1, n_2}(1; x, y) = y - y = 0$$

eşitliği kolayca elde edilir.

iv. Kanıt için $\check{L}_{n_1, n_2}(u_1^2; x, y)$ ve $\check{L}_{n_1, n_2}(u_1; x, y)$ için Önerme 1 de bulunan eşitlikler kullanılırsa

$$\begin{aligned}\check{L}_{n_1, n_2}((u_1 - x)^2; x, y) &= \check{L}_{n_1, n_2}(u_1^2; x, y) - 2x\check{L}_{n_1, n_2}(u_1; x, y) + x^2\check{L}_{n_1, n_2}(1; x, y) \\ &= \left(1 - \frac{1}{n_1 + t_1}\right)x^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2 - 2x^2 + x^2 \\ &= -\frac{1}{n_1 + t_1}x^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2\end{aligned}$$

ifadesi elde edilir. Benzer işlemlerle

$$v. \check{L}_{n_1, n_2}((u_2 - y)^2; x, y) = -\frac{1}{n_2 + t_2}y^2 + \left(\frac{1}{n_2 + t_2}\right)\left(\frac{n_2 + \xi}{n_2 + \psi}\right)^2$$

bulunur.

$$\begin{aligned}vi. \check{L}_{n_1, n_2}(((u_1 + u_2) - (x + y))^2; x, y) &= \check{L}_{n_1, n_2}((u_1 - x)^2; x, y) + \check{L}_{n_1, n_2}((u_2 - y)^2; x, y) \\ &= \left(-\frac{1}{n_1 + t_1}\right)x^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2 + \left(-\frac{1}{n_2 + t_2}\right)y^2 + \left(\frac{1}{n_2 + t_2}\right)\left(\frac{n_2 + \xi}{n_2 + \psi}\right)^2\end{aligned}$$

elde edilir.

Tanım 2. f fonksiyonu D karesinde sürekli bir fonksiyon, δ pozitif bir sayı olmak üzere,

$$\omega(f; \delta) = \max_{\rho(M_1, M_2) \leq \delta} |f(x_1, y_1) - f(x_2, y_2)|, \quad M_1, M_2 \in D$$

fonksiyonuna f fonksiyonunun tam süreklilik modülü denir. Burada

$$\rho(M_1, M_2) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2}$$

dir. Bu süreklilik modülünün özellikleri bilinen süreklilik modülünün özellikleriyle aynıdır.

Tanım 3. f fonksiyonu D karesinde sürekli bir fonksiyon, δ pozitif bir sayı olmak üzere,

$$\omega^{(1)}(f; \delta) = \max_{(x_1, y), (x_2, y) \in D} \max_{|x_1 - x_2| \leq \delta} |f(x_1, y) - f(x_2, y)|$$

ve

$$\omega^{(2)}(f; \delta) = \max_{(x, y_1), (x, y_2) \in D} \max_{|y_1 - y_2| \leq \delta} |f(x, y_1) - f(x, y_2)|$$

fonksiyonlarına sırasıyla f fonksiyonunun x değişkenine göre ve y değişkenine göre kısmi süreklilik modülleri denir.

Teorem 2. $C(D)$ uzayının elemanı olan her f için

$$\|\check{L}_{n_1, n_2}(f; x, y) - f(x, y)\|_{C(D)} \leq 2\omega\left(f; \sqrt{\delta_{n_1} + \delta_{n_2}}\right)$$

eşitsizliği geçerlidir.

$$\textbf{Kanıt} \quad |\check{L}_{n_1, n_2}(f; x, y) - f(x, y)| \leq \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2}$$

$$\times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left| f\left(\frac{n_1+\xi}{n_1+\psi} \left(\frac{2k_1}{n_1+t_1} - 1\right), \frac{n_2+\xi}{n_2+\psi} \left(\frac{2k_2}{n_2+t_2} - 1\right)\right) - f(x, y) \right|$$

$$\times \check{N}_{n_1, k_1}(x, y) \check{N}_{n_2, k_2}(x, y)$$

$$\delta_{n_1, n_2} = \sqrt{\left(\frac{n_1 + \xi}{n_1 + \psi} \left(\frac{2k_1}{n_1 + t_1} - 1\right) - x\right)^2 + \left(\frac{n_2 + \xi}{n_2 + \psi} \left(\frac{2k_2}{n_2 + t_2} - 1\right) - y\right)^2}$$

alırsak tam süreklilik modülünün tanımından

$$\begin{aligned} & \left| f\left(\frac{n_1 + \xi}{n_1 + \psi} \left(\frac{2k_1}{n_1 + t_1} - 1\right), \frac{n_2 + \xi}{n_2 + \psi} \left(\frac{2k_2}{n_2 + t_2} - 1\right)\right) - f(x, y) \right| \\ & \leq \omega(f; \delta_{n_1, n_2}) \left(1 + \frac{1}{\delta_{n_1, n_2}} \sqrt{\left(\frac{n_1 + \xi}{n_1 + \psi} \left(\frac{2k_1}{n_1 + t_1} - 1\right) - x\right)^2 + \left(\frac{n_2 + \xi}{n_2 + \psi} \left(\frac{2k_2}{n_2 + t_2} - 1\right) - y\right)^2} \right) \end{aligned}$$

dir. Bu değeri yukarıda yerine yazarsak

$$|\check{L}_{n_1, n_2}(f; x, y) - f(x, y)| \leq \omega(f; \delta_{n_1, n_2}) \left[1 + \frac{1}{\delta_{n_1, n_2}} \left(\check{L}_{n_1}((u_1 - x)^2; x) + \check{L}_{n_2}((u_2 - y)^2; y) \right)^{1/2} \right]$$

olur. $\delta_{n_1, n_2} = \sqrt{\check{L}_{n_1}((u_1 - x)^2; x) + \check{L}_{n_2}((u_2 - y)^2; y)}$ alınırsa

$$|\check{L}_{n_1, n_2}(f; x, y) - f(x, y)| \leq 2\omega\left(f; \sqrt{\check{L}_{n_1}((u_1 - x)^2; x) + \check{L}_{n_2}((u_2 - y)^2; y)}\right)$$

olup $\delta_{n_1} = \check{L}_{n_1}((u_1 - x)^2; x)$ ve $\delta_{n_2} = \check{L}_{n_2}((u_2 - y)^2; y)$ dersek

$$|\check{L}_{n_1, n_2}(f; x, y) - f(x, y)|_{C(D)} \leq 2\omega\left(f; \sqrt{\delta_{n_1} + \delta_{n_2}}\right)$$

bulunur. Burada;

$$\delta_{n_1} = \left(-\frac{1}{n_1 + t_1}\right)x^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2$$

ve

$$\delta_{n_2} = \left(-\frac{1}{n_2 + t_2}\right)y^2 + \left(\frac{1}{n_2 + t_2}\right)\left(\frac{n_2 + \xi}{n_2 + \psi}\right)^2$$

olup $n_1, n_2 \rightarrow \infty$ için $\delta_{n_1}, \delta_{n_2} \rightarrow 0$ dir.

Teorem 3. $f \in C(D)$ ve $\omega, \omega^{(1)}$ ve $\omega^{(2)}$, f fonksiyonunun tam ve kısmi süreklilik modülleri olsun. O halde $\forall (x, y) \in D$ için

$$|\check{L}_{n_1, n_2}(f; x, y) - f(x, y)|_{C(D)} \leq 2\left(\omega^{(1)}(f; \delta_{n_1}) + \omega^{(2)}(f; \delta_{n_2})\right)$$

eşitsizliği geçerlidir.

$$\begin{aligned} \textbf{Kanit} \quad & \check{L}_{n_1, n_2}(f; x, y) - f(x, y) = \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\ & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left(f\left(\frac{n_1 + \xi}{n_1 + \psi} \left(\frac{2k_1}{n_1 + t_1} - 1\right), \frac{n_2 + \xi}{n_2 + \psi} \left(\frac{2k_2}{n_2 + t_2} - 1\right)\right) - f(x, y) \right) \\ & \times \check{N}_{n_1, k_1}(x, y) \check{N}_{n_2, k_2}(x, y) \\ & = \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \end{aligned}$$

$$\begin{aligned}
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left[f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right) - f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), y\right) \right] \\
 & \times \check{N}_{n_1,k_1}(x,y) \check{N}_{n_2,k_2}(x,y) + \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left[f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), y\right) - f(x,y) \right] \check{N}_{n_1,k_1}(x,y) \check{N}_{n_2,k_2}(x,y) \\
 & = \mu_1 + \mu_2
 \end{aligned}$$

elde edilir. Buradan

$$\begin{aligned}
 & |\check{L}_{n_1,n_2}(f; x, y) - f(x, y)| \leq |\mu_1| + |\mu_2| \\
 & \leq \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left| f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right) - f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), y\right) \right| \\
 & \times \check{N}_{n_1,k_1}(x,y) \check{N}_{n_2,k_2}(x,y) + \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left| f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), y\right) - f(x,y) \right| \check{N}_{n_1,k_1}(x,y) \check{N}_{n_2,k_2}(x,y)
 \end{aligned}$$

bulunur. μ_1 ve μ_2 ayrı ayrı hesaplanırsa;

$$\begin{aligned}
 |\mu_1| &= \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left| f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right) - f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), y\right) \right| \\
 & \times \check{N}_{n_1,k_1}(x,y) \check{N}_{n_2,k_2}(x,y) \\
 & \leq \frac{1}{2^{n_1+t_1}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \frac{1}{2^{n_2+t_2}} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \omega^{(2)}\left(f; \left|\frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right) - y\right|\right) \check{N}_{n_1,k_1}(x) \check{N}_{n_2,k_2}(y) \\
 & \leq \omega^{(2)}(f; \delta_{n_2}) \left[1 + \frac{1}{\delta_{n_2}} \left(\frac{1}{2^{n_1+t_1}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \frac{1}{2^{n_2+t_2}} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \right. \right. \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \check{N}_{n_1,k_1}(x) \check{N}_{n_2,k_2}(y) \left. \left| \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right) - y \right| \right] \\
 & = \omega^{(2)}(f; \delta_{n_2}) \left[1 + \frac{1}{\delta_{n_2}} \left(\check{L}_{n_2}((u_2 - y)^2; y) \right)^{1/2} \right]
 \end{aligned}$$

ifadesine ulaşılır. $\delta_{n_2} = \check{L}_{n_2}((u_2 - y)^2; y)$ olduğundan

$$|\mu_1| \leq 2\omega^{(2)}(f; \delta_{n_2})$$

dır. Benzer şekilde $|\mu_2|$ hesaplanırsa

$$|\mu_2| \leq 2\omega^{(1)}(f; \delta_{n_1})$$

olur. Bu eşitsizlikler birleştirilerek

$$\begin{aligned} |\check{L}_{n_1, n_2}(f; x, y) - f(x, y)| &\leq |\mu_1| + |\mu_2| \\ &\leq 2[\omega^{(1)}(f; \delta_{n_1}) + \omega^{(2)}(f; \delta_{n_2})] \end{aligned}$$

olur. Burada

$$\delta_{n_1} = \left(-\frac{1}{n_1 + t_1}\right)x^2 + \left(\frac{1}{n_1 + t_1}\right)\left(\frac{n_1 + \xi}{n_1 + \psi}\right)^2$$

ve

$$\delta_{n_2} = \left(-\frac{1}{n_2 + t_2}\right)y^2 + \left(\frac{1}{n_2 + t_2}\right)\left(\frac{n_2 + \xi}{n_2 + \psi}\right)^2$$

olup $n_1, n_2 \rightarrow \infty$ için $\delta_{n_1}, \delta_{n_2} \rightarrow 0$ dır.

Tanım 4. Eğer D karesinde tanımlı f fonksiyonu (x_1, y) ve (x_2, y) bu karenin keyfi noktaları olmak üzere,

$$|f(x_1, y) - f(x_2, y)| \leq M|x_1 - x_2|^\rho, \rho \in (0, 1]$$

koşulunu sağlıyorsa o zaman f fonksiyonu bu karede x değişkenine göre Lipschitz koşulunu sağlar veya x değişkenine göre Lip_ρ sınıfındandır denir ve $f \in Lip_{x, \rho}$ biçiminde gösterilir.

Benzer şekilde (x, y_1) ve (x, y_2) bu karede keyfi noktalar olmak üzere,

$$|f(x, y_1) - f(x, y_2)| \leq M|y_1 - y_2|^\rho, \rho \in (0, 1]$$

koşulunu sağlarsa, f fonksiyonu y değişkenine göre Lipschitz koşulunu sağlar veya y değişkenine göre Lip_ρ sınıfındandır denir ve $f \in Lip_{y, \rho}$ biçiminde gösterilir.

Tanım 5. f, D karesinde tanımlı bir fonksiyon $x = (x_1, x_2)$, $t = (t_1, t_2)$ ve $\|x\| = \sqrt{x_1^2 + x_2^2}$ olmak üzere

$$|f(x_1, x_2) - f(t_1, t_2)| \leq M\|x - t\|^\rho, \rho \in (0, 1]$$

ise f bu karede M sabitine göre ρ . mertebeden Lipschitz sınıfındandır denir ve $f \in Lip_{2M, \rho}$ biçiminde gösterilir.

Teorem 4. $x, y \in D = \left[-\frac{n+\xi}{n+\psi}, \frac{n+\xi}{n+\psi}\right] \times \left[-\frac{n+\xi}{n+\psi}, \frac{n+\xi}{n+\psi}\right]$ olsun. Bu durumda her $f \in Lip_{y, \rho} \cap Lip_{x, \eta}$ için

$$i. |\check{L}_{n_1, n_2}(f; x, y) - f(x, y)| \leq M_1(\delta_{n_1})^{\rho/2} + M_2(\delta_{n_2})^{\eta/2}, \rho, \eta \in (0, 1]$$

ii. $f \in Lip_{2M, \rho}$ için

$$|\check{L}_{n_1, n_2}(f; x, y) - f(x, y)| \leq M(\delta_{n_1} + \delta_{n_2})^{\rho/2}, \rho \in (0, 1]$$

eşitsizliği geçerlidir.

Kanıt i. $f \in Lip_{y, \rho} \cap Lip_{x, \eta}$ için

$$\check{L}_{n_1, n_2}(f; x, y) - f(x, y) = \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1 + \psi}{n_1 + \xi}\right)^{n_1+t_1} \left(\frac{n_2 + \psi}{n_2 + \xi}\right)^{n_2+t_2}$$

$$\begin{aligned}
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left(f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right) - f(x, y) \right) \\
 & \times \tilde{N}_{n_1, k_1}(x, y) \tilde{N}_{n_2, k_2}(x, y) \\
 & = \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left[f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right) - f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right)\right) \right] \\
 & \times \tilde{N}_{n_1, k_1}(x, y) \tilde{N}_{n_2, k_2}(x, y) + \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left[f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right)\right) - f(x, y) \right] \tilde{N}_{n_1, k_1}(x, y) \tilde{N}_{n_2, k_2}(x, y) \\
 & = \mu_1 + \mu_2
 \end{aligned}$$

Yani

$$\begin{aligned}
 & |\tilde{L}_{n_1, n_2}(f; x, y) - f(x, y)| \leq |\mu_1| + |\mu_2| \\
 & \leq \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left| f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right) - f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right)\right) \right| \\
 & \times \tilde{N}_{n_1, k_1}(x, y) \tilde{N}_{n_2, k_2}(x, y) + \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left| f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right)\right) - f(x, y) \right| \tilde{N}_{n_1, k_1}(x, y) \tilde{N}_{n_2, k_2}(x, y) \\
 & |\mu_1| = \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi}\right)^{n_2+t_2} \\
 & \times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left| f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right), \frac{n_2+\xi}{n_2+\psi}\left(\frac{2k_2}{n_2+t_2}-1\right)\right) - f\left(\frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right)\right) \right| \\
 & \times \tilde{N}_{n_1, k_1}(x) \tilde{N}_{n_2, k_2}(y) \\
 & \leq M_1 \frac{1}{2^{n_1+t_1}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \sum_{k_1=0}^{n_1+t_1} \tilde{N}_{n_1, k_1}(x) \left| \frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right) - x \right|^p
 \end{aligned}$$

olur. $p = \frac{2}{\rho}$ alırsak $\frac{1}{p} + \frac{1}{q} = 1$ den $q = \frac{2}{2-\rho}$ alınarak Hölder eşitsizliğinden

$$|\mu_1| \leq M_1 \left(\frac{1}{2^{n_1+t_1}} \left(\frac{n_1+\psi}{n_1+\xi}\right)^{n_1+t_1} \sum_{k_1=0}^{n_1+t_1} \tilde{N}_{n_1, k_1}(x) \left| \frac{n_1+\xi}{n_1+\psi}\left(\frac{2k_1}{n_1+t_1}-1\right) - x \right|^\rho \right)^{\rho/2}$$

$$\times \left(\frac{1}{2^{n_2+t_2}} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2} \sum_{k_2=0}^{n_2+t_2} \check{N}_{n_2,k_2}(y) \right)^{2/2-\rho}$$

$$= M_1 \left(\check{L}_{n_1}((u_1-x)^2; x) \right)^{\rho/2}$$

ve

$$\check{L}_{n_1}((u_1-x)^2; x) = \delta_{n_1} = \left(-\frac{1}{n_1+t_1} \right) x^2 + \left(\frac{1}{n_1+t_1} \right) \left(\frac{n_1+\xi}{n_1+\psi} \right)^2$$

seçilirse

$$|\mu_1| \leq M_1(\delta_{n_1})^{\rho/2}, \rho \in (0,1]$$

olur. Benzer şekilde

$$\check{L}_{n_2}((u_2-y)^2; y) = \delta_{n_2} = \left(-\frac{1}{n_2+t_2} \right) y^2 + \left(\frac{1}{n_2+t_2} \right) \left(\frac{n_2+\xi}{n_2+\psi} \right)^2$$

ve

$$|\mu_2| \leq M_2(\delta_{n_2})^{\eta/2}, \eta \in (0,1]$$

olup;

$$|\check{L}_{n_1,n_2}(f; x, y) - f(x, y)| \leq |\mu_1| + |\mu_2|$$

$$\leq M_1(\delta_{n_1})^{\rho/2} + M_2(\delta_{n_2})^{\eta/2}, \rho, \eta \in (0,1]$$

eşitsizliği gösterilmiş olur.

ii. $f \in Lip_{2M\rho}$ için

$$|\check{L}_{n_1,n_2}(f; x, y) - f(x, y)| \leq \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi} \right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2}$$

$$\times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left| f \left(\frac{n_1+\xi}{n_1+\psi} \left(\frac{2k_1}{n_1+t_1} - 1 \right), \frac{n_2+\xi}{n_2+\psi} \left(\frac{2k_2}{n_2+t_2} - 1 \right) \right) - f(x, y) \right|$$

$$\times \check{N}_{n_1,k_1}(x, y) \check{N}_{n_2,k_2}(x, y)$$

$$\leq M \frac{1}{2^{n_1+t_1}} \frac{1}{2^{n_2+t_2}} \left(\frac{n_1+\psi}{n_1+\xi} \right)^{n_1+t_1} \left(\frac{n_2+\psi}{n_2+\xi} \right)^{n_2+t_2}$$

$$\times \sum_{k_1=0}^{n_1+t_1} \sum_{k_2=0}^{n_2+t_2} \left(\left(\frac{n_1+\xi}{n_1+\psi} \left(\frac{2k_1}{n_1+t_1} - 1 \right) - x \right)^2 + \left(\frac{n_2+\xi}{n_2+\psi} \left(\frac{2k_2}{n_2+t_2} - 1 \right) - y \right)^2 \right)^{\rho/2}$$

bulunur. Burada $p = \frac{2}{\rho}$ alırsak $\frac{1}{p} + \frac{1}{q} = 1$ den $q = \frac{2}{2-\rho}$ alınarak Hölder eşitsizliğinden

$$|\check{L}_{n_1,n_2}(f; x, y) - f(x, y)| \leq M \left[\left(\check{L}_{n_1}((u_1-x)^2; x) \right) + \left(\check{L}_{n_2}((u_2-y)^2; y) \right) \right]^{\rho/2}$$

dır. Burada

$$\check{L}_{n_1}((u_1-x)^2; x) = \delta_{n_1} = \left(-\frac{1}{n_1+t_1} \right) x^2 + \left(\frac{1}{n_1+t_1} \right) \left(\frac{n_1+\xi}{n_1+\psi} \right)^2$$

ve

$$\tilde{L}_{n_2}((u_2 - y)^2; y) = \delta_{n_2} = \left(-\frac{1}{n_2 + t_2}\right)y^2 + \left(\frac{1}{n_2 + t_2}\right)\left(\frac{n_2 + \xi}{n_2 + \psi}\right)^2$$

olduğundan

$$|\tilde{L}_{n_1, n_2}(f; x, y) - f(x, y)| \leq M(\delta_{n_1} + \delta_{n_2})^{\rho/2}, \rho \in (0, 1]$$

gösterilmiş olur.

SONUÇLAR

İki değişkenli Bernstein Schurer operatörünün sınırların değişken olduğu karesel bir bölge üzerinde önemli yaklaşım özelliklerinin incelendiği bu çalışma yaklaşım hız hesabı özelliklerini de içermektedir. Çalışmanın farklı operatörler arayan araştırmacılar için yol gösterici nitelikte bir çalışma olduğu düşünülmektedir.

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**ROLE OF MAHATMA GANDHI NATIONAL RURAL EMPLOYMENT
GUARANTEE ACT-2005 (MGNREGA) TO COMBAT TRIBAL MIGRATION IN
HIMACHAL PRADESH: A CASE STUDY OF PANGWALA TRIBE**

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ABSTRACT

Purpose: Mahatma Gandhi National Rural Employment Guarantee Act-2005 (MGNREGA) scheme was launched by the Government of India on 7th September 2005 to provide 100 days of guaranteed manual work to its unskilled workers in rural areas. Migration among tribal communities in search of food is most popular. MGNREGA has provided an opportunity to the tribal communities to generate livelihood at their door steps. The special focus of this study was to analyze the impact of MGNREGA on tribal migration in Himachal Pradesh.

Methodology: To complete the present study Pangwala tribe were taken in to consideration. Pangri Integrated Tribal Development Project (ITDP) was taken as study area, because Pangwala tribe lives in this region. The study was based on secondary data and was analytical in nature.

Results: The results of the study will be helpful to government and policymakers to pay special attention to these vulnerable groups especially tribal communities in Himachal Pradesh.

Conclusion: The movement among tribal communities from hills to plain in search of food is very popular. The problems of tribal people are different than other people of the country. Tribal communities are getting migrated because of less employment opportunities at their origin place, land snatching, construction of power projects and other developmental activities tribal people are losing their agricultural lands, which causes threat to their survival. Agriculture is the primary profession of the tribal communities and because of low agricultural land holding the productivity is also low and they get migrated in search of food.

Keywords: MGNREGA, Tribal Migration, Pangri, Pangwala Tribe, Himachal Pradesh

INTRODUCTION

Mahatma Gandhi National Rural Employment Guarantee Act-2005 (MGNREGA) scheme was launched by the Government of India on 7th September 2005 to provide 100 days of guaranteed manual work to its unskilled workers in rural areas. The act provides legal right to work for Indian citizens. The act is committed towards securing livelihood to the rural people in the country. The scheme was implemented in four phases. In the first phase of its implementation, 200 districts were selected. First phase was covered under the scheme on 2nd February, 2006. Second phase of its implementation was started on 1st April, 2007 by covering 113 more districts of the country. In its third phase 17 more districts were includes on 15th May, 2007. In the fourth and the final phase on 1st April, 2008, this scheme was implemented throughout the country. The Government of India has framed the guidelines to the states and union territories to provide equal facilities to all the citizens of the country.

Implementation of these guidelines is compulsory. States and union territories are free to provide extra facilities and benefits to workers of its states. Under this scheme any adult of the household can demand for manual wage work in a financial year and it is mandatory to the local administration to provide manual work to the applicant within 5 kilometer radius from his house or else 10% of extra wages are payable. There shall be a provision of unemployment allowance by the state government, if employment is not provided within 15 days of application. The allowance will not be less than one-fourth of the wage rate for the first thirty days and not less than one-half of the wage rates for the remaining period of the financial year. To create durable assets and strengthen the livelihood resources of the rural poor are main objectives of this scheme.

Tribal development has been considered as an approach that keeps tribal people at the centre stage. Tribal people are scattered all over the India. They have their own culture and traditions. However, they are still faced with numerous problems that hamper their progress and development such as, poverty, educational problems, land problems, health problems, naxalism, exploitation of children, inefficient administration and Governance which are analysed through this paper. This paper analyses a number of measures that have been suggested and implemented by the Government, such as, Constitutional Provisions and Safeguards, Educational Facilities, Tribe's Advisory Council, Representation in Legislatures and Panchayats, Commission for the Scheduled Tribes, Reservation in jobs, Economic Opportunities, Administration of Scheduled and Tribal Areas, Establishment of Welfare Department in States and Tribal Research Institute. This Article discusses how the socioeconomic status of the tribals of India should improve substantially in order to bring about a positive transformation of the Indian society and nation. This study was conducted in the Pangi Block of Chamba district of Himachal Pradesh was selected as study area, because this area was covered under MGNREGA scheme in first phase of its implementation. This was the only tribal area of Himachal Pradesh which was covered under this scheme in its first phase. The study was conducted with the objective to analyze the role of MGNREGA to combat tribal migration in Himachal Pradesh.

Reverse Migration

Rural India is witnessing a huge reverse migration where the crores of migrant workers who went to cities or other villages in search of livelihoods returned back to their native places due to the loss of employment. The situation is the same in the tribal areas of the country and in the study areas as well. Many heart-breaking stories of workers come across the country. Hundreds of workers died during their travel back home. Fresh troubles are awaiting them with a lack of employment opportunities and forcing them again to migrate. The big question is whether they find their work back at the migration place? This reverse migration has increased the workforce in rural India with decreased opportunities for work. Various reports show that the return of migrant workers has increased the available labour for agriculture work, decreasing the average working days per household and inevitably the wage rates. The situation is more difficult in the tribal areas of the country and in the study areas as well.

Identification of the Research Gap

Several articles, research papers, reports and discussions have been published on Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) since its implementation to continue. Studies related to MGNREGA in tribal areas are limited. With the context of Himachal Pradesh the studies related to MGNREGA and tribal migration are negligible. The researchers consulted extensive literature related to MGNREGA but did not find any literature close to the present problem. It was found that the issue related to tribal migration is has not been explored by the researchers up to the mark. In the study area majority of the workforce is marginal workers. More than half of the workforce is engaged in MGNREGA. As MGNREGA have several success stories not only in tribal areas but other parts of the country. Therefore it is important to relate analyze the role of MGNREGA in combating tribal migration. The present research will contribute to exploring the area of MGNREGA and tribal migration. The present study will provide a theoretical background, methodological idea and set of data base to the researchers and policy makers as well.

Research Methodology

Study Area: The Pangri Integrated Tribal Development Project of Chamba District was selected as the study area. This area includes the Pangwala tribe. This is one of the hard and remote areas of Himachal Pradesh. They are far away from the district quarter of Chamba. Other tribal people of Himachal Pradesh are much better than the Pangwala tribes in terms of transportation, finance, livelihoods, approachable from their respective district headquarters, connectivity, and accessibility to the basic facilities, etc.

Scope of the Study: The Pangri Integrated Tribal Development Project of Chamba District comprises 19 small administrative units and institutions of grass-root democracy in India (Gram Panchayats). The whole Pangri Integrated Tribal Development Project was covered under the study as study area. Other Integrated Tribal Development Projects such as Bharmour, Lahaul, Spiti and Kinnaur were excluded from the study.

Selection of the Problem: The present study deals with the Role of Mahatma Gandhi National Rural Employment Guarantee Act-2005 (MGNREGA) to Combat Tribal Migration. The study is with reference to Pangwala Tribe of Himachal Pradesh. MGNREGA has its own success stories especially in tribal areas. Tribal people are getting migrated due to several reasons. In this regard MGNREGA could be an important step to combat their migration.

Data Collection and Tools: Secondary data was used for the study as the study was analytical in nature. Different websites, online libraries and previous studies were consulted to collect the secondary data. Baseline data were collected for impact analysis from secondary sources.

Data Analysis: Collected data through different sources was analyzed. After analysis results of the study were presented.

Relevance of the Study

As social beings, we have a continuous need to understand the reality of our surroundings, environments and individual and social requirements. The human mind seeks knowledge to improve and sustain quality of life. This can be achieved through society centric policies. This research can play a vital role by providing some relevant and evidence-based information to policymakers. The problem considered in this study is directly linked to the community. MGNREGA is a scheme which is providing 100 days of wage employment to the unskilled people. This scheme could be extended throughout the year instead of limited number of days. Special focus has been done on the need of the community. To formulate better policies, policymakers need evidence. This is why local databases and research are important. Policymakers can formulate policies using this information.

Results and Discussion

The results from the analysis of the existing data related to MGNREGA have been presented below. India consists of total 731 districts, 7,152 blocks and 2,69,627 Gram Panchayats. As on 31-07-2022, the total number of job cards issued at national level are 16.39 crore. There are total 30.92 crore workers in MGNREGA at national level. Total number of active job cards are 10.04 crore. There are total 15.3 crore active workers. Total percentage of Scheduled Caste active workers are 19.94 per cent. Percentage of Scheduled Tribe workers against total active workers is 16.01 per cent. The total approved labour budget for financial year 2018-19 was 256.56 crore. For 2019-20 it was 277.63 crore, for 2020-21 it was 385.67 crore, for 2021-22 it was 337.76 and for 2022-23 it is 227.11 at national level. As far as persondays generated so far is concerned it was 267.96 in financial year 2018-19 crore, 265.35 crore in 2019-20, 389.09 crore in 2020-21, 363.43 crore 2021-22, 127.46 crore in 2022-23 at national level. In the financial year 2018-19 the percentage of labour budget was 104.44 per cent, in 2019-20 it was 95.57 per cent, in 2020-21 it was 100.89 per cent, in 2021-22 it was 107.6 per cent and in the financial year 2022-23 it is 56.12 percent.

In the financial year 2018-19 the percentage of Scheduled Caste persondays of the total persondays was 20.77 per cent, in 2019-20 it was 20.38 per cent, in 2020-21 it was 19.87 per cent, in 2021-22 it was 19.17 per cent and in 2022-23 it is 19.82 per cent. In the financial year 2018-19 the percentage of

Scheduled Tribe persondays of the total persondays is 17.42 per cent, in 2019-20 it was 18.51 per cent, in 2020-21 it was 17.95 per cent, in 2021-22 it was 18.32 per cent and in 2022-23 it is 16.69 per cent. In the financial year 2018-19 the percentage of women persondays of the total persondays is 54.59 per cent, in 2019-20 it was 54.78 per cent, in 2020-21 it was 53.19 per cent, in 2021-22 it was 54.67 per cent and in 2022-23 it is 56.07 per cent. The average days of employment provided per household in the financial year 2018-19 was 50.88, in 2019-20 it was 48.4, in 2020-21 it was 51.52, in 2021-22 it was 50.07 and in 2022-23 it is 29.64. The average wage rate per day per person in the financial year 2018-19 was ₹179.13, in 2019-20 it was ₹182.09, in 2020-21 it was ₹200.71, in 2021-22 it was ₹208.85 and in the financial year 2022-23 it is ₹211.66. Total number of household completed 100 days of was employment for the financial year 2018-19 it was 52,59,502. For the financial year 2019-20 it was 40,60,463, for 2020-21 it was 71,97,090 for 2021-22 it was 59,21,970 and for the financial year 2022-23 it is 1,99,147. In the financial year 2018-19 total 5.27 crore households worked. For 2019-20 total 5.48 crore households worked. For 2020-21 total 7.55 crore households worked. For 2021-22 total 7.26 crore households worked and for the financial year 2022-23 total 4.3 crore household are working. In the financial year 2018-19 total 7.77 crore individuals worked. For 2019-20 total 7.88 crore individuals worked. For 2020-21 total 11.19 crore individuals worked. For 2021-22 total 10.62 crore individuals worked and for the financial year 2022-23 total 5.89 crore individuals are working. In the financial year 2018-19 average cost per person per day was ₹247.19. In the financial year it was 2019-20 ₹235.28. For 2020-21 it was ₹266.19. For 2021-22 ₹296.66 and for the financial year 2022-23 it is ₹270.2.

The result of the study area (Pangi) shows that there are 19 Gram Panchayats. The total number of job cards issued in Pangi 6,214. There are total 12,058 workers in MGNREGA in Pangi. Total number of active job cards in Pangi is 5,727. There are total 6,634 active workers in Pangi. Percentage of Scheduled Caste active workers against total active workers are 11.17 per cent. Percentage of Scheduled Tribe workers against total active workers is 86.24 per cent. The total approved labour budget in Pangi for financial year 2018-19, 2019-20, 2020-21, 2021-22 and 2022-23 it is nil. 5,07,418

persondays were generated in Pangi in financial year 2018-19. In the financial year 2019-20 it was 5,03,460. In 2020-21 the number of persondays generated were 5,71,270. In the year 2021-22 it was 5,13,286. In 2022-23 it is 2,34,241. In the financial years 2018-19 to 2022-23 the percentage of total labour budget was nil. In the financial year 2018-19 the percentage of Scheduled Tribe persondays of the total persondays was 85.41 per cent, in 2019-20 it was 85.69 per cent, in 2020-21 it was 86.17 per cent, in 2021-22 it was 85.98 per cent and in 2022-23 it is 85.45 per cent.

The average days of employment provided per household in the financial year 2018-19 was 107.05, in 2019-20 it was 103, in 2020-21 it was 108.01, in 2021-22 it was 95.67 and in 2022-23 it is 45.33. The average wage rate per day per person in the financial year 2018-19 was ₹227.74, in 2019-20 it was ₹229.78, in 2020-21 it was ₹246.95, in 2021-22 it was ₹252.12 and in the financial year 2022-23 it is ₹263.56. Total number of household completed 100 days of was employment for the financial year 2018-19 it was 3,889. For the financial year 2019-20 it was 3,461, for 2020-21 it was 4,453 for 2021-22 it was 3,090 and for the financial year 2022-23 it is only 2. In the financial year 2018-19 in Pangi total 4,740 households worked. For 2019-20 total 4,888 households worked. For 2020-21 total 5,289 households worked. For 2021-22 total 5,365 households worked and for the financial year 2022-23 total 5,167 household are working. In the financial year 2018-19 in Pangi total 4,913 individuals worked. For 2019-20 total 5,070 individuals worked. For 2020-21 total 5,521 individuals worked. For 2021-22 total 5,597 individuals worked and for the financial year 2022-23 total 5,276 individuals are working. In the financial year 2018-19 average cost per day per person was ₹257.76. In the financial year it was 2019-20 ₹242.33. For 2020-21 it was ₹281.91. For 2021-22 ₹288.69 and for the financial year 2022-23 it is ₹284.1.

Several policies and programs have been formulated and implemented for tribal development in the state and country as well. But there is no special focus on tackling of tribal migration. In the study area the wage rate under MGNREGA is INR 266 per day for 100 days, which is very low amount to meet out all the necessary expenses like food, clothing, health, education of their children, etc. The total annual income of a worker from MGNREGA is INR 26600 which is about INR 72-73 per day. In the daily income of INR 72-73 one cannot take care of his family. If an unskilled worker worked other than

MGNREGA in the locality he get INR 500-600 per day and no limitation of working days. Low wage rates causes malnutrition, illiteracy, poverty, illness, migration, lack of access of other necessary basic facilities, etc.

Conclusion

Mahatma Gandhi National Rural Employment Guarantee Act is one of the very important scheme in terms of providing employment not only in tribal areas but also other rural areas of the country. This scheme has played a role in combating migration of unskilled workers from the tribal areas. In the study area the government has decided to provide 120 days (4 months) of wage employment. During winters Pangi (study area) snow bounded and remains close for about 4-6 months. During this the people in this area could not work under this scheme. In the rest of the period of the year they work in their field and grow crops. After that they also get engaged in collecting food and fodder for winters. Therefore the unskilled people remain busy throughout the year. As for as skilled people are concerned, MGNREGA scheme could not stop their migration. Because MGNREGA needs no qualification and no skills, and this is also a labourer work. There is not a particular scheme to stop or minimize the migration of skilled people from tribal areas. Skilled people mostly get migrated from hill areas to plain areas. To restrict the migration of skilled and empowered tribal people government should established a tribal cadre of employees. This strategy will reduce not only the deficiency of staff in different offices in tribal areas but also check the migration of skilled human resource. This strategy will help the health and educational institutions more. Both health and education are more important for people and we cannot ignore both these at any cost. The strategy will provide job opportunities to the local skilled people. Establishment of small scale industries will play an important role in terms of employment generation for skilled and unskilled people as well. It will also help to improve the financial status of the people and development of backward areas. Small scale industries required small amount of capital investments than the large scale industries. Therefore it is easy to establish small scale industries in these areas. People of Pangi are moving towards cultivation of cash crops like potato, peas, apple, etc. For this purpose chips and juice processing like units can be established.

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**KÜÇÜK TEKNE ÜRETİM MALZEMESİ OLARAK KARBON/EPOKSİ KATMANLI
KOMPOZİT PLAKLARIN DÜŞÜK HIZLI DARBE DAVRANIŞININ İNCELENMESİ**

INVESTIGATION OF LOW-VELOCITY IMPACT BEHAVIOUR OF CARBON/EPOXY
LAMINATED COMPOSITE PLATES AS A BOAT BUILDING MATERIAL

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Özet

Kompozit malzemeler gelişen yeni teknoloji ve üretim yöntemleriyle, artan bir ivmeyle deniz araçlarında geniş bir kullanım alanı bulmuştur. Yüksek özgül mukavemet ve yüksek özgül rijitlik oranları kadar korozyon ve yorulma dayanıklılığıyla ayır edilirler. Ayrıca ahşap, çelik ve alüminyum gibi geleneksel malzemelere göre tercih edilirler. Bu artan kullanımla birlikte, deniz araçlarının zorlu deniz koşullarında maruz kaldığı statik ve dinamik etkilere (yüzen bir araçla çarpışma, karaya oturma, dövmeme), düşük hızda limana çarpma etkisine, güverteye cisim düşmesi vb. darbe yükleri sonucunda hasara dayanması ve bekasını sürdürüp görevine devam edebilmesi beklenmektedir.

Bu çalışmada ilk olarak, çok eksenli karbon/epoksi kompozit plakların farklı katman dizilimlerindeki mekanik performansını araştırmak için deneysel bir çalışma yapılmıştır. Vakum destekli reçine infüzyon yöntemiyle, simetrik katmanlı ve farklı katman dizilimlerinde ([0/90/45/-45]s, [90/45/-45/0]s, çok eksenli karbon/epoksi plaklar, [0/90/0/90]s, [45/-45/45/-45]s) üretilmiştir. Ardından, CEAST 9350 Fractovis Plus darbe cihazı üzerinde düşük hızlı darbe (LVI) testleri yapılmıştır. Plaklarda farklı biçimlerde hasarlar gözlemlenmiştir. Sonuç olarak, kompozit plakların düşük hızlı darbe davranışının farklı katman dizilimlerinden önemli ölçüde etkilendiği belirlenmiştir.

Deneysel verilerden elde edilen bilgilerle çalışmanın devamında veri seti genişletilmiş ve ticari sonlu elemanlar yazılımı LS-DYNA ile farklı katman dizileri için sayısal simülasyonlar gerçekleştirilmiş ve optimum dizilimdeki yapılar incelenmiştir. Çalışmadan elde edilen veriler, kompozit teknelerin ön tasarım aşamasında en uygun parametrelerin belirlenmesinde kullanılacaktır. Böylece üretimde işçilik, maliyet ve zamandan tasarruf sağlanacaktır.

Anahtar Kelimeler: Karbon-epoksi kompozit plaklar, düşük hızlı darbe, deneysel çalışma, LS-DYNA

Abstract

Composite materials have been widely used in marine vehicles with newer technology and production methods. They are characterized by their high specific strength and stiffness ratios as well as corrosion and fatigue resistance. Besides they are preferable to traditional materials such as wood, steel and aluminium. Marine vehicles are exposed to severe sea conditions; static and dynamic effects, collision with other floating objects, grounding, slamming, low-speed harbour impact, falling impacts on their decks and impact loads that result in damage, from which they are expected to emerge being able to continue their task.

In this study, firstly, an experimental study was carried out to investigate the mechanical performance of multiaxial carbon/epoxy composite plates in different layer sequences. Multiaxial carbon/epoxy

plates, with vacuum-assisted resin infusion method (VARIM), with symmetrical layers and in different layer sequences ([0/90/45/-45]_s, [90/45/-45/0]_s, [0/90/0/90]_s, [45/-45/45/-45]_s) were produced. Then, low-velocity impact (LVI) tests were carried out on the CEAST 9350 Fractovis Plus impact device. The -different forms of damage were observed on the plates. As a result, it was determined that the low-velocity impact behaviour of the composite plates was significantly affected by the different layer sequences.

With the information obtained from the experimental data, the data set was expanded in the continuation of the study, and numerical simulations for different layer sequences were carried out with commercial finite element software LS-DYNA, and the structures in the optimum array were investigated. The data obtained from the study will be used to determine the most suitable parameters for the preliminary design stage of the composite boats. Thus, labour, cost and time will be saved in production.

Keywords: Carbon-epoxy composite plates, low-velocity impact (LVI), experimental study, LS-DYNA

GİRİŞ

Bu çalışmanın amacı kompozit teknelerin işletme koşullarında maruz kalabileceği deniz ortamından kaynaklanan statik ve dinamik etkilerle birlikte karşılaşacağı çeşitli kazaların sonucunda görevini sürdürebilmesi için teknenin farklı bölgeleri için en uygun laminasyon tiplerinin belirlenerek, teknelerin ön dizayn aşamasında önemli parametrelerin elde edilerek tasarımcılara sunulmasıdır. Çoklu disiplinli çalışma gerektiren bu konunun tasarım, gemi mühendisliği, makine mühendisliği ve malzeme mühendisliği gibi farklı alanların kesişiminde yer alması hedeflenmiştir.

Katmanlı kompozitlerin düzlem dışı darbe etkisine maruz kalması oldukça karmaşık ve çok yönlü bir durumdur. Darbeye tepki kuvveti, çökme ve enerji absorpsiyonu, darbe direnci (hasara direnç) ve darbe toleransı bunların başlıcalarıdır. Abrate'nin bu alandaki başucu çalışmasında deneysel çalışmalar, basitleştirilmiş analizler, düşük hızlı darbe analizleri, ölçeklendirme, darbe hasarının deneysel çalışmaları, malzeme özelliklerinin, katmanlamanın ve hedef geometrinin hasar tahmini yer almaktadır (Abrate, 1998). Denizel ortamdaki kompozit yapıların düşük hızlı darbe etkisindeki davranışlarını deneysel, sayısal ve analitik olarak araştırıldığı literatür inceleme makalelerinde Sutherland 1500 kadar çalışmayı derlemiştir (Sutherland, 2018a, 2018b, 2018c, 2018d).

Baur vd. (2004), tekne üretim süreçlerini geliştirebilmek için, 5.75 m. boyunda cam-polyester kompozit motoryatın tekrarlayan dalga yüklerini simüle ederek, kompozit ve sandviç panellerin darbe etkilerini deneysel olarak incelemişlerdir. Tam ölçekteki tekne düşürme testlerini gerçekleştirmişlerdir. Farklı malzeme konfigürasyonlarının darbe direncine etkilerini araştırmışlardır.

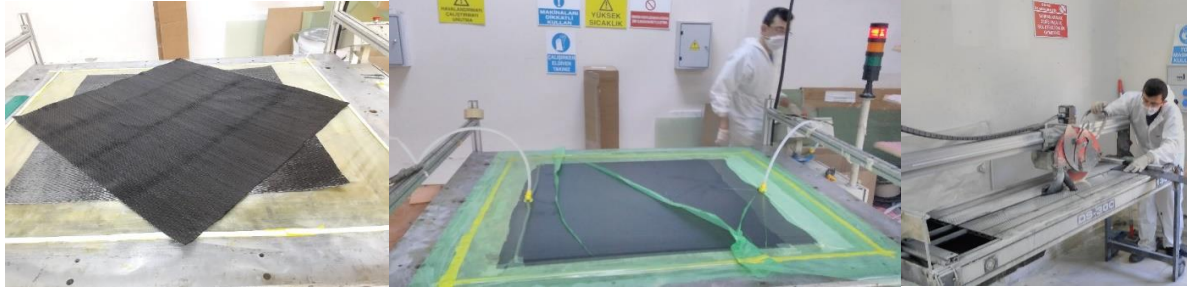
Literatürde kompozit gemi kazalarıyla ilgili yapılmış güncel araştırmalardan Windyari vd.nin çalışmalarında doğal lif-cam elyaf hibrid kompozit balıkçı teknelerinin baş bodoslamadan liman iskelesine çarpışma analizini incelemişlerdir. Deneysel olarak hibrid kompozitlerin mekanik özelliklerini belirleyip ardından tekneyi üç boyutlu modelleyip sonlu elemanlar analizleriyle baş bodoslamadan düşük hızla çarpışmasını farklı hız senaryolarıyla dört farklı laminasyon tipi için teknenin alabora olmasına neden olabilecek muhtemel sızıntılara neden olacak hasara odaklanarak deformasyonları araştırmışlardır (Windyari vd., 2022).

Düşük hızlı darbe enerjisi etkisindeki karbon/epoksi kompozit plakların hasar dayanımını deneysel olarak inceleyen araştırmacılar Caminero vd. plak kalınlığı ve katman dizilimlerinin etkisinin önemli olduğunu ve yarı-izotropik plakların hasar direnci açısından en iyi performansı gösterdiğini saptamışlardır. Çalışmalarında yarı-izotropik (0/90/+45/-45) plakların, çapraz (0/90)_{4s} ve açılı (+45/-45)_{4s} plaklara göre daha düşük temas kuvveti, daha az absorbe edilen enerji ile daha az temas kuvveti süresi sergilediklerini göstermişlerdir. Ayrıca hasarlı çapraz (0/90)_{4s} ve açılı (+45/-45)_{4s} plakların daha fazla çökme miktarına sahip olduklarını tespit etmişlerdir (Caminero vd, 2017).

MATERYAL VE METOT

1. Deneysel Analiz Metodu

Dokuz Eylül Üniversitesi Makine Mühendisliği Kompozit Üretim Laboratuvarında vakum destekli reçine infüzyon metoduyla sıcaklık ve zaman ayarlı özel bir masada (50°C’de 30 dakika ve 80°C’de 8 saat süreyle), takviye malzemesi olarak DowAksa 24K-A42-1600 Tex kodlu tek yönlü 300 gr/m² alansal yoğunluğa sahip karbon fiber kumaş ve reçine malzemesi FBRMAKRES-11564 kodlu epoksi reçine ile sertleştirici kullanılarak plaklar üretilmiştir (Şekil.1).



Şekil1. a Karbon fiber kumaşların serilmesi **b** vakum destekli reçine infüzyon yöntemi ile plakların üretilmesi **c** plaklardan numunelerin kesilerek elde edilmesi

Çalışmada farklı oryantasyon tiplerindeki darbe davranışlarının değişimlerini incelemek için 8 katmandan oluşan simetrik katmanlı [0/90/45/-45]_s, [90/45/-45/0]_s, [0/90/0/90]_s, [45/-45/45/-45]_s dizilimlerinden oluşan farklı plaklar üretildikten sonra darbe testlerinde kullanılmak üzere kesilerek numuneler elde edilmiştir. Numunelerin boyutları 120 x 170 mm ve yaklaşık kalınlığı 2.5 mm’dir.

Dokuz Eylül Üniversitesi Kompozit Araştırma Laboratuvarındaki CEAST 9350 Fractovis Plus ağırlık düşürme darbe test cihazında karbon/epoksi numunelerin darbe testleri gerçekleştirilmiştir. Deneylerde kullanılan darbe vurucu ucu 20 mm çaptaki yarı küresel geometride çelik malzemedendir. Deneyler için tasarlanan mekanik numune sıkma aparatı ile numuneler çarpma sırasında sabitlenmiştir (Şekil.2). Özel olarak tasarlanan aparat ile 120 x 170 mm üretilen test numunelerinin kenarlarından 10’ar mm kısım sıkıştırma aparatları ile sabitlenirken, aparatın iç kısmında kalan darbe etkisindeki numunelerin boyutları 100 x 150 mm olmaktadır. Sensör, darbe ucunun numuneye çarptığı andaki darbe hızını ve zamana bağlı olarak temas kuvvetiyle yer değiştirmesini ölçebilmektedir. Testler sırasında numuneye ikinci kez çarpmayı önlemek için sekmeden koruma (anti-rebounding) sistemi vurucuyu tutmaktadır. Bu çalışmada toplam 5,02 kg kütleli darbe ucu kütlesi kullanılıp, 30 J darbe enerjisi ve 3,45 m/sn darbe ucu hızında testler gerçekleştirilmiştir.



2. Sayısal Analiz Metodu

Deneyisel çalışmada LT12, LT23, LT25 ve LT28 kodlarına sahip 4 farklı laminasyon tipindeki (2 yarı-izotropik, 1 çapraz ve 1 açılı) karbon/epoksi plaklar incelenirken, sayısal analizlerde veri seti genişletilerek 28 farklı çeşitteki (24 yarı-izotropik, 2 çapraz ve 2 açılı) laminasyon tipine sahip karbon/epoksi plakların maksimum deformasyonlarının hesaplanması için analizler ticari sonlu elemanlar yazılımı LS-DYNA ile gerçekleştirilmiştir (Tablo.1).

Tablo1. 28 farklı laminasyon tipindeki karbon/epoksi kompozit plaklar

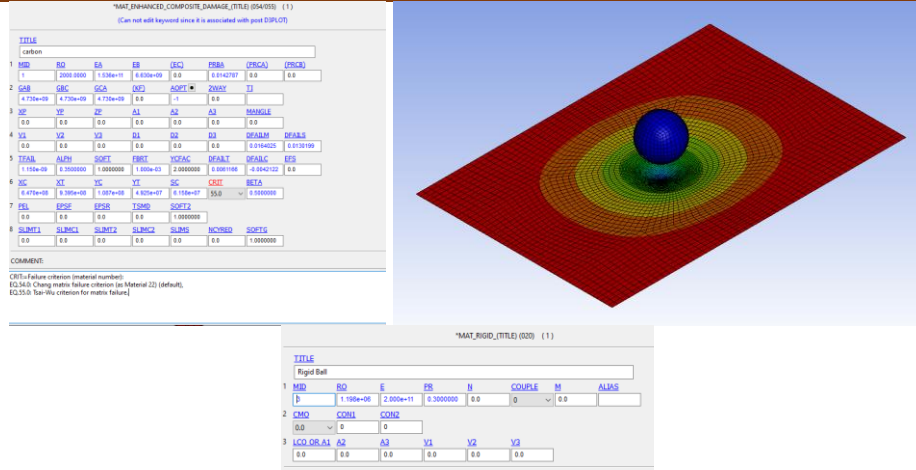
Yarı-izotropik plaklar (quasi-isotropic)							
LT1	[-45/0/45/90] _s	LT7	[0/-45/45/90] _s	LT13	[45/-45/0/90] _s	LT19	[90/-45/0/45] _s
LT2	[-45/0/90/45] _s	LT8	[0/-45/90/45] _s	LT14	[45/-45/90/0] _s	LT20	[90/-45/45/0] _s
LT3	[-45/45/0/90] _s	LT9	[0/45/-45/90] _s	LT15	[45/0/-45/90] _s	LT21	[90/0/-45/45] _s
LT4	[-45/45/90/0] _s	LT10	[0/45/90/-45] _s	LT16	[45/0/90/-45] _s	LT22	[90/0/45/-45] _s
LT5	[-45/90/0/45] _s	LT11	[0/90/-45/45] _s	LT17	[45/90/-45/0] _s	LT23	[90/45/-45/0] _s
LT6	[-45/90/45/0] _s	LT12	[0/90/45/-45] _s	LT18	[45/90/0/-45] _s	LT24	[90/45/0/-45] _s
Çapraz katmanlı plaklar (cross-ply)							
		LT25	[0/90/0/90] _s	LT26	[90/0/90/0] _s		
Açılı katmanlı plaklar (angle-ply)							
		LT27	[-45/45/-45/45] _s	LT28	[45/-45/45/-45] _s		

LS-DYNA yazılımında kompozit katmanlı plaklar için farklı malzeme kartları (MAT22, MAT54, MAT55, MAT58, MAT262 vd.) bulunmaktadır. Bu çalışmada MAT22, MAT54 ve MAT55 malzeme kartları için analizler denenirken darbe testleriyle en iyi benzeşimi sağlayan darbe ucunun numuneye çarpıp geri sektiği MAT55 malzeme kartı kullanılmıştır. MAT55 malzeme kartı içinde karbon/epoksi kompozit numunelerin testlerle bulunan Elastisite modülü, kayma modülü, Poisson's oranı gibi mekanik özellikleri ve bunlara bağlı parametreler tanımlanmıştır. MAT55'te Tsai-Wu hasar teorisine göre analizler yapılmaktadır (LS-DYNA Manual, 2021).

Sayısal analizlerde kullanılacak çelik darbe vurucu kütlelerini modellerken MAT020 rijit malzeme kartında vurucunun yoğunluğu, elastisite modülü ve Poisson oranı girilmektedir. Vurucu kütlelerinin tamamını modellemek yerine, modeli basite indirmek için 20 mm çapında küre geometri olarak modellenmiş, çelik malzemenin yoğunluğu deneydeki vurucu kütlesi olan 5.02 kg'a benzeştirmek için yoğunluğu $1.198 \times 10^6 \text{ kg/m}^3$ olarak girilmiştir.

Sınır koşulları plak kenarlarında ankastre mesnet olarak modellenirken, kontak tanımı olarak nodes_to_surface seçeneği kullanılmıştır. Çarpma hızı olarak 3.45 m/sn seçilirken, kompozit plak için yerçekimi ivme değeri düşey yönde 9.805 m/s^2 girilmiştir.

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Şekil3. Sonlu elemanlar sayısal analiz yazılımı LS-DYNA’da modelleme

ANALİZ SONUÇLARI VE TARTIŞMA

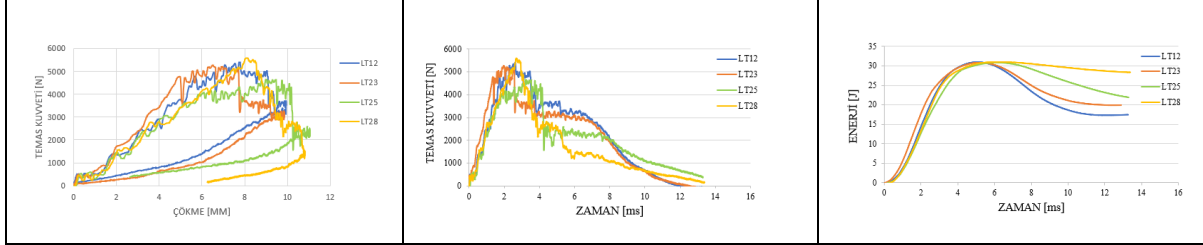
Deneyisel analiz kısmında; dört farklı laminasyon tipi için düşük hızlı darbe testleri gerçekleştirilmiş hasarlı numunelerin alt, üst ve yan yüzlerinin fotoğrafları Şekil.4.’te verilmiştir.

	Ön	Arka	Yan
LT12			
LT23			
LT25			
LT28			

Şekil4. Düşük hızlı darbe testi hasarlı numune fotoğrafları

Darbe testleri sonucunda hiçbir numunede delinme gözlemlenmemiştir ancak numunelerin üst yüzeylerinde darbe sonucu ezilme izi oluşmuştur. Numunelerin alt yüzeylerinde ise darbe yüklemesi sonucu en alt katmanda fiber ayrılması ile delaminasyon hasarları gözlemlenmiştir. Numunelerin alt yüzeylerinde darbe yüklemesi sonucu oluşan hasar çeşitleri, hasar ilerleme yönleri ve hasarlı bölge büyüklükleri laminasyon tiplerine göre değişiklik göstermektedir. Örneğin LT12 kodlu plâgın

([0/90/45/-45]_s) diziliminde en alt yüzeydeki katmanı 0° dir ve bu plakta fiber ayrılması 0° doğrultusunda gözlenmektedir. Benzer eğilim diğer plaklarda da alt yüzeylerde LT23'te ([90/45/-45/0]_s) 90° doğrultusunda, LT25'te ([0/90/0/90]_s) 0° doğrultusunda ve LT28'de ([45/-45/45/-45]_s) 45° doğrultusunda gözlenmiştir.



Şekil5. Deney sonuçları a. Temas Kuvveti-Çökme eğrisi b. Temas Kuvveti-Zaman eğrisi c. Absorbe Edilen Enerji-Zaman eğrisi

Temas kuvveti-çökme grafiğinde aynı darbe enerjisinde farklı laminasyon tiplerinin tamamında darbe vurucusunun (impactor) kompozit plaka numunelerinden geri sektiğini gösteren kapalı tip eğri görülmektedir. Ayrıca dört farklı laminasyon tipinde maksimum çökme değerlerinin farklı olduğu anlaşılmıştır.

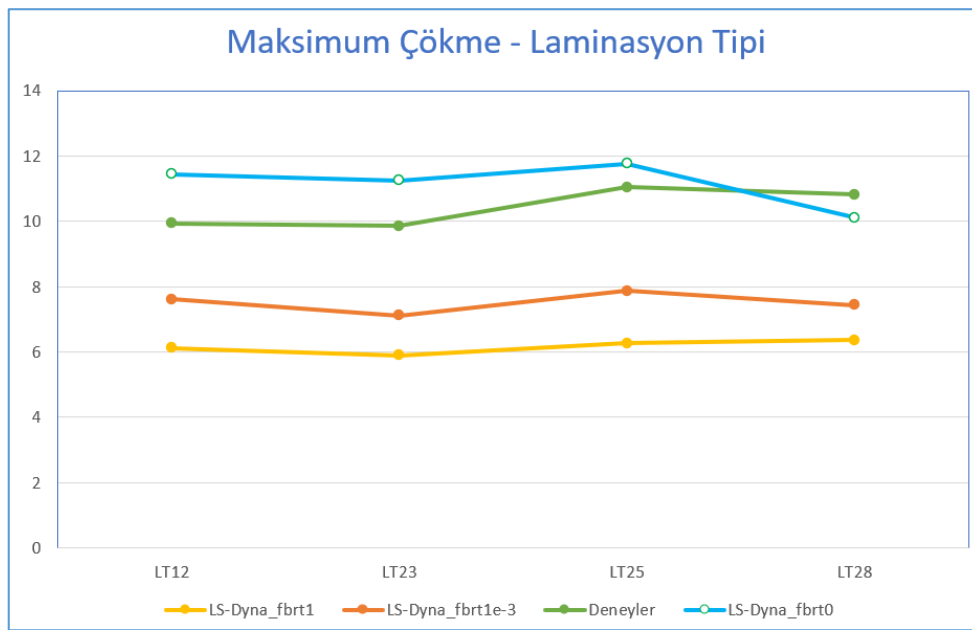
İncelenen numuneler içinde en yüksek maksimum temas kuvveti değeri LT28 kodlu açılı kompozit plakada gözlenirken; bu değer LT12 ve LT23 kodlu yarı-izotropik kompozit plaklar da daha düşük olduğu LT25 kodlu çapraz kompozit plakada ise en düşük değerin olduğu gözlenmiştir. Maksimum çökme değerleri incelendiğinde ise tam tersi durum gözlenmekte en büyük çökme değeri sırasıyla LT25 kodlu çapraz kompozit plakada, LT28 kodlu açılı kompozit plakada, LT12 ve LT23 kodlu yarı-izotropik plaklarda meydana gelmektedir. Ayrıca temas kuvveti-zaman grafiğinden LT12 ve LT23 kodlu yarı-izotropik kompozit plakların, daha az temas kuvveti süresi sergilediklerini görülmektedir. Bu durumlar literatürde yer alan Caminero vd. nin çalışmalarıyla uyumluluk göstermektedir (Caminero vd., 2017).

Enerji-zaman grafiği incelendiğinde; darbe vurucusunun (impactor) enerjisinin tamamı kompozit plaka numunesince plastik olarak absorbe edilemediği ve bu plastik absorbe edilemeyen (elastik) enerjinin darbe vurucusunun kompozit numuneden geri sekmesi için harcadığı gözlenmiştir. Bunun sonucunda enerji-zaman eğrileri yaklaşık 10ms sonrasında sabit bir değerde kalma eğiliminde olmuştur. Bu değer plastik absorbe enerjisi veya absorbe edilen enerji olarak tanımlanabilir. Grafikten LT12 ve LT23 kodlu yarı-izotropik plakların LT25 kodlu çapraz kompozit plaka ve LT28 kodlu açılı kompozit plakalardan daha az enerji absorbe ettikleri görülmektedir. Çalışmadaki enerji-zaman grafiklerine benzer biçimde Caminero vd. nin araştırmalarında inceledikleri farklı dizilimlerdeki kompozit plakalardan elde ettikleri sonuçlar ile uyumlu olduğu gözlenmiştir (Caminero vd., 2017).

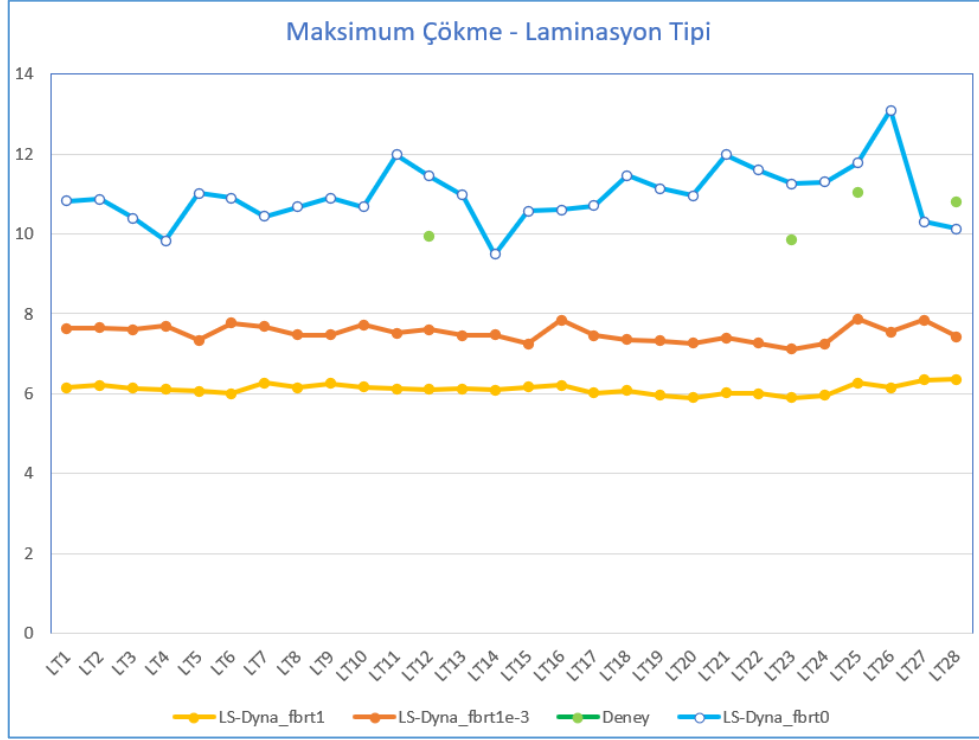
Sayısal analiz kısmında; karbon/epoksi kompozit numunelerin düşük hızlı darbe deneyleri ve sayısal analizlerin karşılaştırılması için öncelikle deney sonuçlarından dört farklı laminasyon tipinin maksimum çökmeleri bulunmuş ve sonlu elemanlar yazılımı LS-DYNA ile bulunan sonuçlarla karşılaştırılmıştır (Şekil.6). Sayısal analizlerde LS-DYNA'da malzeme çeşidi olarak MAT55 kompozit kartında birçok parametre mevcuttur. Literatürde yeralan LS-DYNA ile analizlerde araştırmacılar bütün parametreleri kalibrasyon için değiştirip denemekte oldukları görülmüştür (Feraboli vd., 2011; Fragassa vd., 2019; Rossi vd., 2020; Camargo vd., 2021). Bu çalışmada bütün parametreler varsayılan seçeneklerde bırakılırken sadece FBRT parametresinin değişimlerinin maksimum çökmeye etkisi incelenmiştir. FBRT fiber çekme dayanımını (Xt) yumuşatma parametresi olup 0 ile 1 arasında değişmektedir. Bu çalışmada FBRT parametresinin minimum değeri olan 0, 1×10^{-3} ile maksimum değeri olan 1 için hesaplanmıştır. Bulunan sonuçlar karşılaştırıldığında; deney sonuçları FBRT

değerinin 1×10^{-3} ile 0 değerleri arasında kalırken, eğrilerin eğiliminden Laminasyon Tiplerinin maksimum çökme değerlerinin sıralanması farklı FBRT parametre değerleri için benzer bulunmuştur (Şekil.6).

Dört farklı laminasyon tipi için maksimum çökme değerlerinin deneysel verilerden elde edilenlerle sayısal analizlerin sonuçlarının birbirleriyle uyumlu eğriler biçiminde olduğu görüldükten sonra (Şekil.6), farklı laminasyon tipleri için LS-DYNA yazılımıyla sayısal analizler gerçekleştirilmiştir (Şekil.7). En alt ve en üst limitler FBRT parametresinin 0 ve 1 değerleri için maksimum çökmeler 28 farklı laminasyon tipi için hesaplanarak eğriler çizdirilmiş aynı biçimde ara değer olan 1×10^{-3} değeri için de çözümler ilave edilmiştir. 28 farklı laminasyon tipi için LS-DYNA ile yapılan sayısal analizlerden fiber katman diziliminden maksimum çökme değerlerinin önemli ölçüde etkilendiği görülmüştür.



Şekil6. Maksimum çökme-Laminasyon Tipi grafiği



Şekil7. Maksimum çökme-Laminasyon Tipi grafiği (28 farklı laminasyon tipi için LS-DYNA ile yapılan sayısal analizler)

SONUÇLAR

Kompozit teknelerin farklı bölgelerinde farklı seviyelerde darbe yükleri gerçekleşmektedir. Örneğin teknelerin baş bodoslamasında ve dip bölümlerinde teknenin sudan çıkıp tekrar suya çarpması yani dövünme yükleri oluşabilirken, teknenin bordasından düşük hızla limana ya da yüzen cisimlere çarpması, dip bölümlerinde karaya oturması sonucu darbe etkisi veya güvertesine yük düşmesi gibi farklı senaryoların gerçekleşmesi söz konusu olabilmektedir. Bu darbe yükleri sonucunda kompozit teknelerin aldığı hasara dayanıp denizdeki zorlu ortam koşullarında görevini yapabilmesi beklenir.

Bu çalışmada deniz araçlarının düşük hızlı darbelerle olan hasarlarını simüle etmek için literatürdeki çalışmalar incelenerek 30 J darbe enerji seviyesinin uygun olduğu tespit edilmiştir. Ardından bu enerji seviyesinde 4 farklı laminasyon tipinin darbe testleri yapıp, numunelerin üst ve alt yüzlerindeki meydana gelen hasar tipleri incelenmiştir. Sayısal analizler kısmında ise veri seti genişletilerek 28 farklı laminasyon tipindeki kompozit plakların darbe simülasyonları LS-DYNA sonlu elemanlar analiz yazılımıyla gerçekleştirilerek yapılan analizlerde maksimum çökme değerleri hesaplanmıştır.

Sonlu elemanlar yazılımı LS-DYNA’da kompozit malzemelerin hasarını simüle etmek için çok farklı malzeme kartları bulunmakta ve bu kartların her biri için pek çok farklı parametre seçeneği veri olarak girilebilmektedir. Literatürdeki araştırmalarda LS-DYNA kullanılıp deneysel çalışmalarla karşılaştırma yapılan her çalışmanın kendi özelindeki deneyleri için farklı seçilen bu parametrelerle kalibrasyonların yapılmaya çalışıldığı gözlenmiştir. Bu çalışmada da FBRT katsayısı ile kalibrasyon yapılarak maksimum çökme sonuçlarına etkisi araştırılırken diğer farklı parametrelerin sonuçlara etkileri çalışmanın devamında daha detaylı biçimde incelenecektir.

Ayrıca araştırmanın devamında deneysel ve sayısal analiz kısımları genişletilerek; deneysel çalışmalara deniz suyunun etkisi yaşlandırma deneyleriyle, sayısal analizlere de LS-DYNA yazılımı kullanılarak farklı enerji seviyesi durumları ve farklı kabuk geometrilerinin incelenmesi ilave edilerek tekne tasarımında önemli ön dizayn parametreleri eldesinde çalışma ilerletilecektir.

Deneysel çalışmalar uzun süre alan, emek yoğun ve maliyetli çalışmalardır. Deneylerden elde edilen tecrübelerle yapılacak buna benzer sayısal parametrik analizlerle farklı form ve boyutlardaki teknelerin farklı kısımlarında tercih edilecek mukavim laminasyon tipleri hızlı biçimde belirlenebilecektir. Kompozit teknelerin ön tasarımında bu şekilde elde edilecek tasarım parametrelerinin kullanımı üretimde maliyet, işçilik ve zamandan tasarruf edilmesini sağlayacaktır.

TEŞEKKÜR

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**THE COMPARISON OF THE CHANGE IN SOOT EMISSION CONCENTRATION
OF A DIESEL ENGINE ACCORDING TO FUEL TYPE AND ENGINE LOAD**

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Abstract

Air pollution depends on many factors. However, one of the most important factors of air pollution is the exhaust emissions of vehicles. Pollutants such as soot, particulate matter and harmful emission gases released from the exhaust of diesel engine vehicles contribute to the increase in air pollution. Air pollution causes very important negative consequences such as damage to human health, climate change and global warming, and therefore creates great concern in the world. Petroleum-based fossil diesel fuel and renewable biofuels (which is produced in a laboratory from waste oils, algae, etc.) are used to operate diesel engines. Soot emissions occur as a result of the combustion of fuels in a diesel engine, which is an internal combustion engine. The concentrations of soot emissions obtained as a result of the combustion of diesel and biofuels in a diesel engine can be different. For this reason, the change in soot concentrations according to fuels should be examined and in this context, it is necessary to determine the fuel that is advantageous in terms of its impact on the environment. However, the engine load at which the diesel engine is operating also affects the soot concentration. For this reason, it is of vital importance for human health, air pollution, climate crisis and global warming to reduce the soot emissions released into the environment to the minimum as possible. In this regard, in the present study, the soot concentrations obtained as a result of operating a diesel engine in different fuels and different engine loads are compared and examined in detail.

Keywords: Biofuel; Biodiesel; Diesel fuel; Engine load; Exhaust emission; Soot concentration.

INTRODUCTION

The soot is the general term for a type of particulate pollution called particulate matter (PM) 2.5. Therefore, particulate matter with a diameter of 2.5 micrometers or less is called as soot. The soot consists of fine particles and is about 1/30th the size of a human hair. It consists of a variety of pollutants, including metals, acids, chemicals, dust and soils that remain suspended in the air after emission. Due to its very small dimensions, the soot is harmful to human health. It can easily enter the lungs and bloodstream and thus lead to various diseases. Microscopic particles can enter deep into the lungs and cause very serious health problems such as acute bronchitis, severe asthma, heart attack, stroke and premature death. When its environmental damage is examined, the soot causes various environmental problems such as acidification of rivers and lakes and acid rain (Weidman & Marshall, 2012).

Internal combustion diesel engines have an important share in the vehicle industry. Compared to gasoline engines, diesel engines, which have lower exhaust emissions such as carbon monoxide (CO) and unburned hydrocarbon (HC), have higher soot concentration, particulate matter and nitrogen oxide (NO_x) emissions. (Chandrasekaran et al., 2016; Venkanna & Venkataramana Reddy, 2012) For this reason, various studies are carried out in order to use alternative fuels and improve exhaust emissions. Internal combustion diesel engines release particulate matter and soot from their exhausts to the environment as a result of combustion fossil and renewable fuels (Caliskan & Mori, 2017a, 2017b; Yildiz, 2018; Yildiz et al., 2021).

MATERIALS AND METHODS

The main equipment of the system is an internal combustion 4-cylinder diesel engine, diesel and biodiesel fuels, dynamometer used to measure engine load, and flame ionization analyzer used to obtain soot exhaust concentration values in present study.

The diesel engine is experimentally tested by operating at 100 Nm, 200 Nm and full load (294 Nm). Diesel engine is tested for two fuels separately at 100 Nm, 200 Nm and full load using diesel fuel and biodiesel fuel. As a result of the experimental analysis, the exhaust soot emission concentration values obtained when the diesel engine is operated at different engine loads and different fuel types are used, and the values obtained are analyzed. The general schematic of diesel engine system is illustrated in Figure 1.

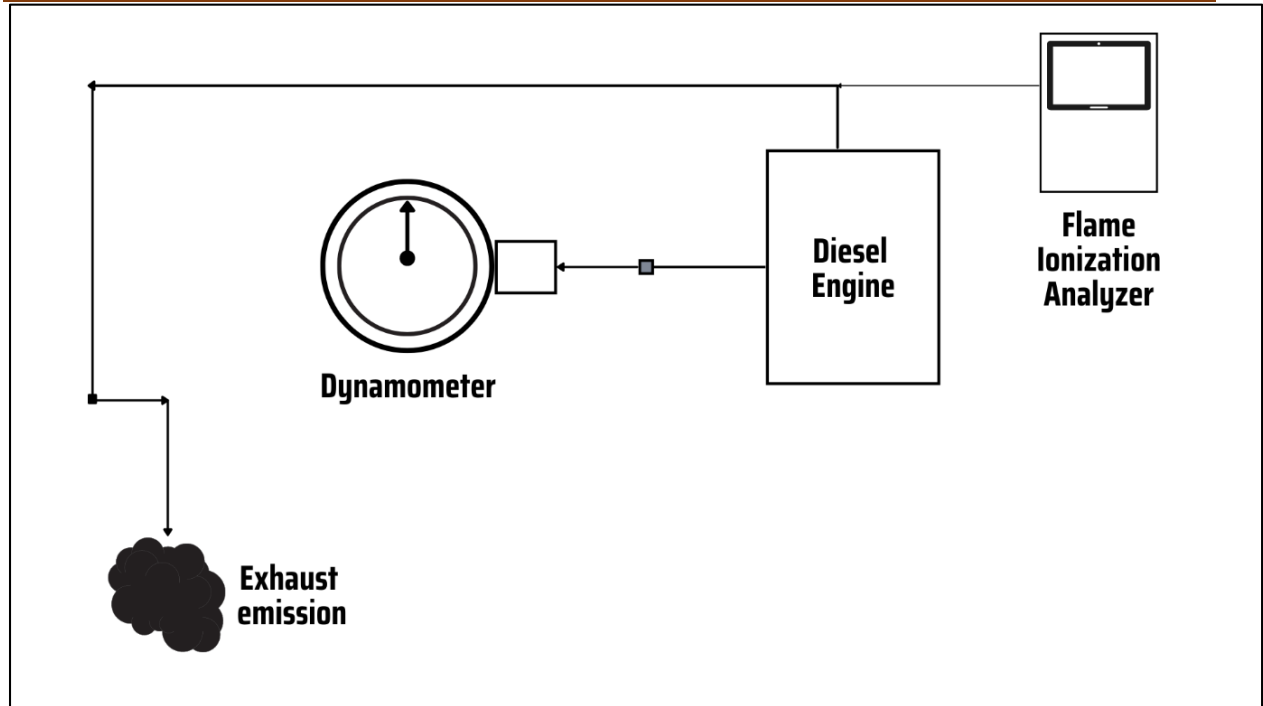


Figure 1. General schematic of diesel engine system

RESULTS

In the current study, the exhaust soot emission concentration values obtained as a result of operating the diesel engine at different engine loads and using different fuel types are obtained in the experimental analysis. The soot emission concentration values of the diesel engine according to fuel type and engine load obtained as a result of the experimental analysis are given in Table 1.

Table 1. Soot emission concentration of the diesel engine according to fuel type and engine load (Yildiz, 2018)

Soot Emission Concentration (mg/m ³)		
Engine load	Diesel fuel	Biodiesel fuel
100 Nm	2.16	0.88
200 Nm	1.53	0.38
Full load	1.23	0.27

When the soot emission concentration results obtained are examined, the soot emission concentration is found as 2.16 mg/m³ for diesel fuel at 100 Nm. However, the soot emission concentration is determined as 0.88 mg/m³ for biodiesel fuel at 100 Nm.

On the other hand, while the soot emission concentration is obtained to be 1.53 mg/m^3 for diesel fuel at 200 Nm, the soot emission concentration is determined as 0.38 mg/m^3 for biodiesel fuel at 200 Nm.

When tested with the diesel engine operating under full load, the soot emission concentration is 1.23 mg/m^3 with using diesel fuel. However, the soot emission concentration is found to be 0.27 mg/m^3 with using biodiesel fuel.

DISCUSSION

The present study analyzes the results of the soot concentration released into the environment from the exhaust emissions of a diesel engine, taking into account the conditions in which the diesel engine is used at different engine loads and different fuel types. When the results obtained are examined in detail, it is determined that the values obtained when using biodiesel fuel are lower than the values obtained when using diesel fuel in terms of soot emission concentration. It is also concluded that operating the diesel engine at high engine load contributes to the reduction of the concentration of soot emissions released to the environment.

CONCLUSION

The following main results are obtained from the study:

- If the diesel engine is operated at 100 Nm, the soot emission concentration for diesel fuel is 2.16 mg/m^3 while the soot emission concentration for biodiesel fuel is 0.88 mg/m^3 .
- The soot emission concentrations are found as 1.53 mg/m^3 and 0.38 mg/m^3 for diesel fuel and biodiesel fuel at 200 Nm, respectively.
- When the engine load is set to full load, the soot emission concentration is 1.23 mg/m^3 for diesel fuel. In addition, the soot emission concentration is 0.27 mg/m^3 for biodiesel fuel.
- It can be said that the engine load values and the values of the soot emission concentration are inversely proportional. As the engine load increases, the soot emission concentration decreases.

In addition to the results mentioned above and obtained from the current study, it is determined that the use of biodiesel fuel contributes to obtaining more environmentally friendly results than the use of diesel fuel.

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**EFFECT ON FLOW AND HEAT TRANSFER OF TURBULATORS IN A TRAPEZOIDAL
CORRUGATED CHANNEL**

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Abstract

In this study, the effects on the flow and heat transfer of turbulators in a trapezoidal corrugated channel are numerically investigated. The numerical study is actualized with the Computational Fluid Dynamics (CFD) based ANSYS-Fluent program and the governing equations are solved using the SIMPLE algorithm. The present study is compared with the literature studies. The working fluid is water, and the channel material is considered aluminum. The fluid is considered incompressible, single-phase, and Newtonian type. The channel flow is two-dimensional and in the steady regime. The grooved surfaces of the channel are trapezoidal and placed in a staggered arrangement. The turbulators are added at a certain angle towards the trapezoidal spaces to the center of the channel. The upper and lower walls of the corrugated channel are kept at a constant temperature of 350 K. Nusselt number (Nu) and friction factor (f) are calculated for different Reynolds numbers ($100 \leq Re \leq 600$). This study is also compared to the channel without turbulators. To observe the flow and heat transfer mechanism in the channel, the velocity and temperature contours are obtained at different parameters in the trapezoidal corrugated channel with/without turbulators. The numerical findings show that the heat transfer and friction factors are significantly affected by the channel geometry and the turbulators. The heat transfer increased due to the turbulators at high Reynolds numbers. Moreover, it is observed that the turbulators considerably are changed the flow structure and thermal fields compared to the channel without turbulators. The highest Nusselt number is obtained at $Re=600$ in the trapezoidal corrugated channel with turbulators. However, a slight increase in the friction factor is also observed

Keywords: Trapezoidal corrugated channel, Turbulator, Heat transfer, Friction factor

INTRODUCTION

Passive heat transfer improvement methods are widely used in heat transfer improvement. One of the passive methods is the use of corrugated surface geometries. Corrugated channels are widely used in several engineering fields such as transportation, cooling/heating systems, heat exchangers, solar air ducts, food, and chemical process. (Alam et al., 2014; Zontul et al., 2021; Akcay, 2021). Corrugated surfaces can also substantially improve thermal performance depending on the geometrical properties of the channels. Heat transfer in corrugated channels has been researched in many numerical and experimental studies, and it has been reported that these surfaces have a considerable effect on thermal enhancement but increase the pressure drop compared to smooth channels (Alam et al., 2014; Davkhar and Deshmukh, 2021; Akcay, 2022). Kurtulmus and Sahin (2019) carried out a review study investigating the flow and heat transfer in the wavy surfaces. In experimental and numerical work, Brodnianská and Kotšmíd (2021) examined the heat transfer in a channel with different waveforms and reported that the Nusselt number increased with increasing Reynolds number and decreasing channel height. Mehta et al. (2022) numerically studied the effects of wall wave amplitude on flow and thermal performance in asymmetrical corrugated channels and noticed that Nusselt number increased with increasing Reynolds number and wall wave amplitude.

Another passive heat transfer improvement method is the use of extended surface modifications such as twist tape, winglet, rib, fin, and baffle within the channel. These modifications, known as turbulators,

are reported to improve the flow mixing and increase the heat transfer rate. Turbulators will expand the contact surface of the fluid, create a swirling flow, and thereby change the flow structure. Flow and thermal characteristics of turbulators with different geometries have been investigated by many researchers. Very high heat transfer improvement has been achieved in studies on this subject. These modifications added into the channel completely disrupt the flow structure, and help flow mix and heat transfer improvement, but a slight pressure drop occurs compared to straight channels (Mokhtari et al., 2017; Li and Gao, 2017; Modi and Rathod, 2019). Lei et al. (2008) examined the effects of the inclination angle of the baffles on thermal performance in a heat exchanger with helical baffles. Promvonge et al. (2015) presented an experimental study investigating thermal behavior in a duct with curved horseshoe-type baffles and declared that the Nusselt number increased by about 208% and the pressure drop rose by 6.37 times, according to smooth channels. Kumar et al. (2016) experimentally studied the hydraulic and thermal performance of the solar duct with multiple V shaped baffles. They found that thermal performance significantly increased with the baffles. In another experimental study conducted by Sahel et al. (2016), it was reported that a rectangular cross-section duct with a different arrangement of the baffles, increased the heat transfer by 65%. Sriromreun (2017) performed a numerical study on thermo-hydraulic behaviors of inclined baffles in a rectangular channel. Li and Gao (2017) numerically investigated thermal performance in a triangular corrugated duct with delta type baffles. Kumar et al. (2018) theoretically examined the heat transfer in a triangular air duct with rectangular ribs. Sripattanapipat and Promvonge (2019) numerically studied heat transfer in a channel with diamond type baffles. Luan and Phu (2020) investigated the thermohydraulic performance of a solar air channel with curved baffles. Bensaci et al. (2020) experimentally and numerically examined the flow and heat transfer of solar air channels with different baffle configurations. These study results showed that corrugated channels and surface modifications significantly enhanced the heat transfer. Promvonge et al. (2020) experimentally and numerically investigated thermal efficiency using a heat exchanger with discrete V-type winglets. The results revealed that at a specific winglet height, the smallest pitch length ensured the highest Nusselt number and pressure drop. The thermal and frictional behaviors of a triangular turbulators in a channel with different cross-sectional areas were analyzed by Tian et al. (2020). They found that the turbulators significantly enhanced heat transfer performance. Bidar et al. (2021) presented a comprehensive review study of the effects of different types of the turbulators in improving thermal performance in heat exchangers.

According to review of the open literature, the effects of corrugated channels in different geometries on flow and heat transfer have been investigated. No study has been found in the open literature investigating the flow and heat transfer in a trapezoidal corrugated channel with turbulators under steady laminar flow conditions. Therefore, in this work, the effect of turbulators on flow and heat transfer in a trapezoidal corrugated channel is numerically investigated.

NUMERICAL STUDY

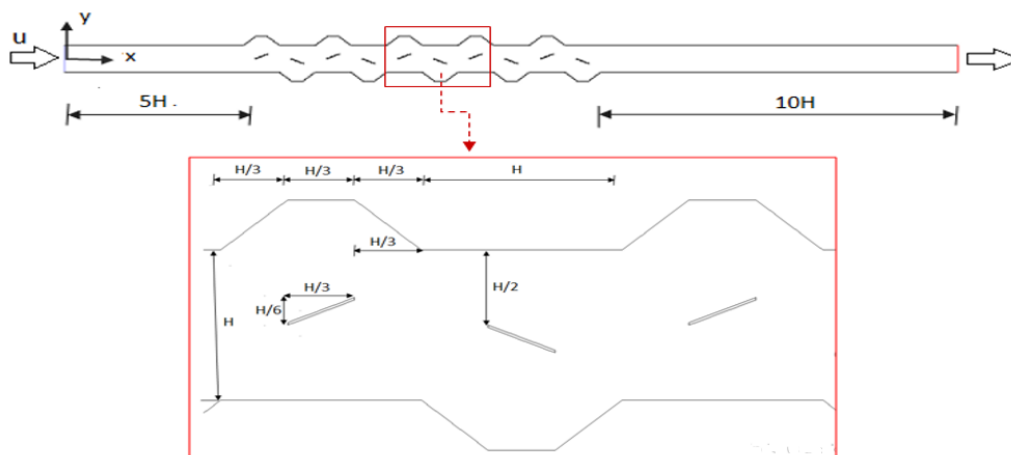


Figure 1. The geometry of the numerical model.

The geometry of the trapezoidal corrugated channel with turbulators is given in Figure 1. The height of the channel is $H = 12$ mm. At the inlet and outlet of the channel, there is an unheated flat section of $L_1 = 5H$ and $L_3 = 10H$, respectively, and the length of the corrugated channel is $L_2 = 14H$. Numerical study is performed for six Reynolds numbers (Re: 100, 200, 300, 400, 500, 600). Water is used as the working fluid and aluminum is considered as the channel material.

The fluid is incompressible, single-phase, and Newtonian type, the flow is steady, two-dimensional, and in a laminar regime. Fluid properties do not change. Gravity and heat transfer with radiation are ignored. According to these assumptions, the following equations are used.

$$\nabla(\rho u) = 0 \quad (1)$$

$$\frac{\partial(u_i u_j)}{\partial x_i} = -\frac{\partial p}{\partial x_i} + \frac{1}{\text{Re}} \nabla^2 u_j \quad (2)$$

$$u_i \frac{\partial T}{\partial x_i} = \frac{1}{\text{Re Pr}} \nabla^2 T \quad (3)$$

The solutions are applied with the FLUENT 15.0 program (2015) and governing equations are solved with the SIMPLE algorithm. The convergence criterion is accepted as 10^{-7} for all equations.

The Reynolds number (Re) is calculated as follows:

$$\text{Re} = \frac{\rho u D_h}{\mu} \quad (4)$$

Here, ρ is the density of fluid, μ is the dynamic viscosity of the fluid, and u is the mean fluid velocity.

The local Nusselt number (Nu_x) is written as follows

$$Nu_x = \frac{h D_h}{k_f} \quad (5)$$

Here, k_f is the thermal conductivity coefficient of the fluid and h is the convective heat transfer coefficient. The average Nusselt number (Nu) can be calculated as follows:

$$Nu = \frac{1}{L} \int_0^L Nu_x dx \quad (6)$$

The friction factor (f) is given by the following equation:

$$f = \frac{2\Delta P D_h}{\rho u^2 L} \quad (7)$$

In this study, the solutions for different grid numbers are compared and a grid-independent solution is obtained. In the channel without turbulators, after 71550 grid numbers, the difference between Nusselt numbers was determined to be less than 1%. Therefore, the grid number of 71550 was adopted for the numerical model.

The inlet temperature of the fluid is $T_0 = 300$ K. At the channel entrance and outlet, the “velocity inlet” and “outflow” boundary conditions are used, respectively. The lower and upper surfaces of the trapezoidal corrugated channel are maintained at a constant temperature of $T_w = 350$ K. Non-slip and adiabatic boundary conditions are defined for the unheated section at the entrance and exit of the channel. Non-slip and adiabatic boundary conditions are defined for the turbulators in the channel.

RESULTS AND DISCUSSION

To confirm the validity of the solutions, the results of the present work were compared with those of the study conducted by Boukhadia et al., (2018). The agreement between the results of literature study and present study is shown in Figure 2.

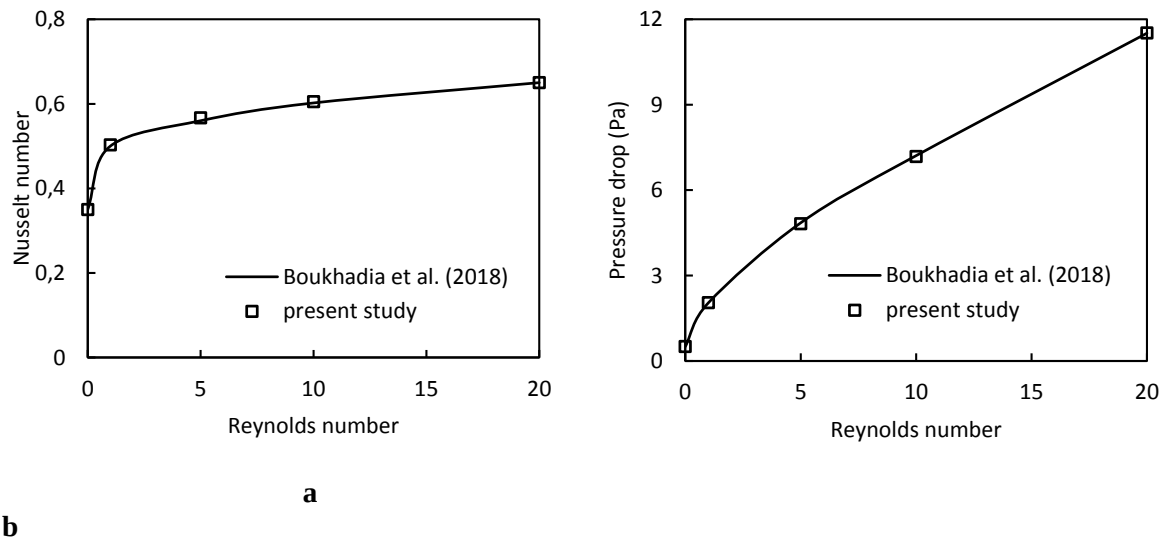


Figure 2. Validation of the numerical study by comparison with literature study.

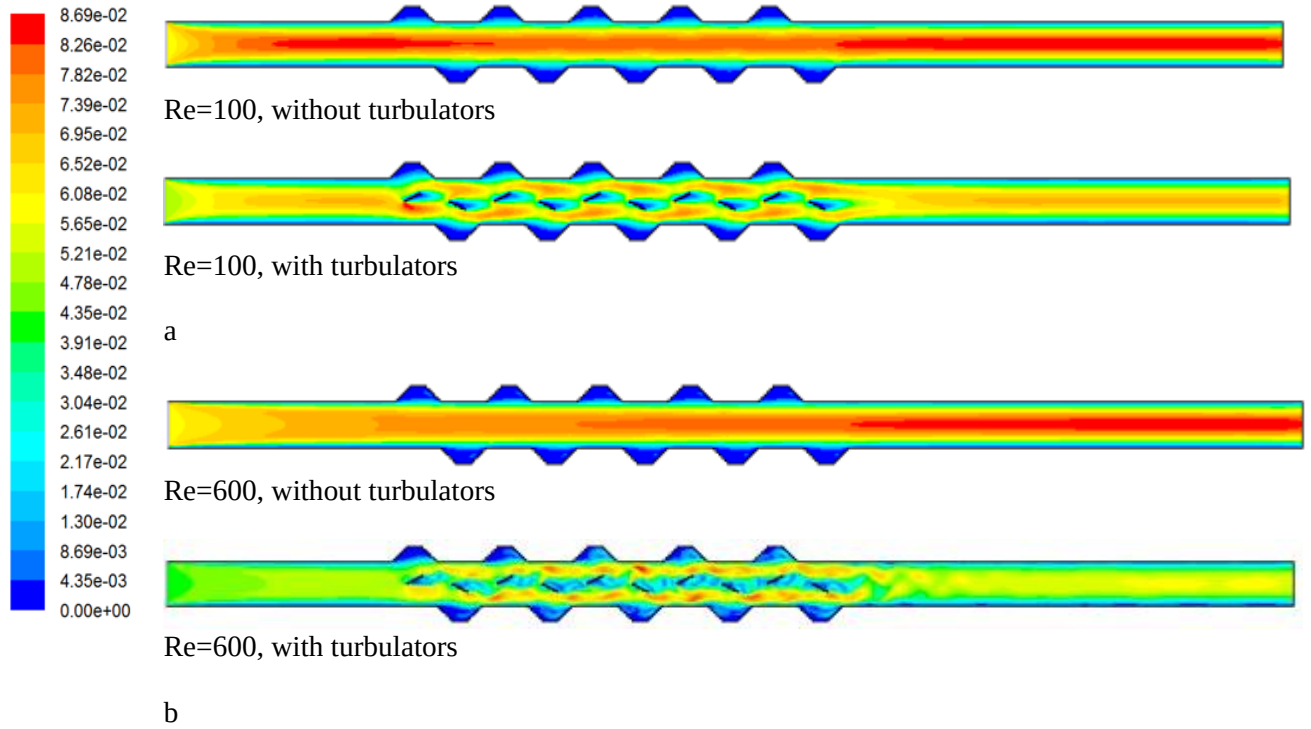


Figure 3. Velocity fields for different Reynolds numbers in the trapezoidal corrugated channel with/without turbulators, (a) Re=100 and (b) Re=600

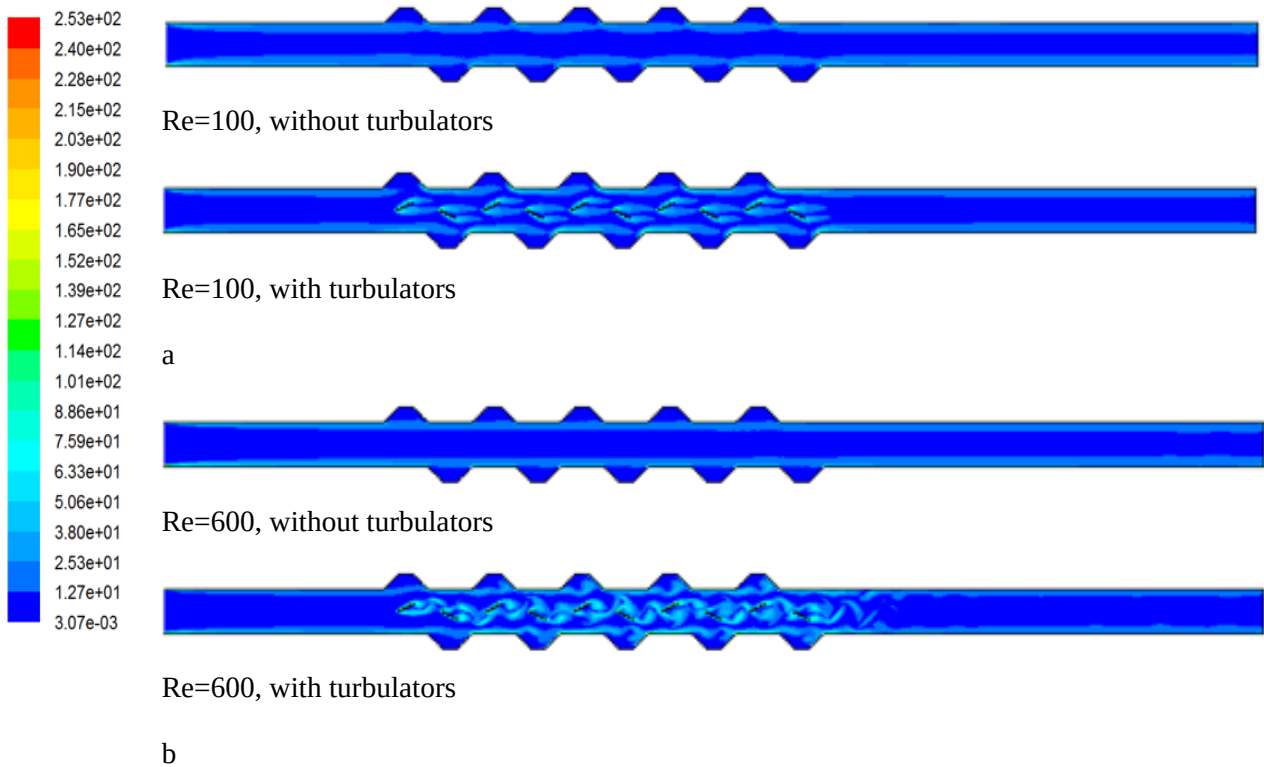


Figure 4. Temperature distributions for different Reynolds numbers in the trapezoidal corrugated channel with/without turbulators, (a) Re=100 and (b) Re=600

Figure 3 shows the velocity fields for $Re = 100$ (a), and $Re = 600$ (b) in the trapezoidal corrugated channel with/without turbulators. It is seen that the fluid layer flowing parallel to the channel surfaces at $Re=100$ and $Re=600$ in the channel without turbulator is slightly directed towards the trapezoidal spaces. The presence of the turbulators significantly changes the velocity fields. The turbulators prevent the formation of velocity boundary layer by disrupting the parallel flow structure. Also, turbulators direct the flow into trapezoidal spaces, causing flow oscillation. In the channel with turbulators, the flow structure is thicker at low Reynolds number. It becomes thinner at high Reynolds number and ruptures in the flow begin.

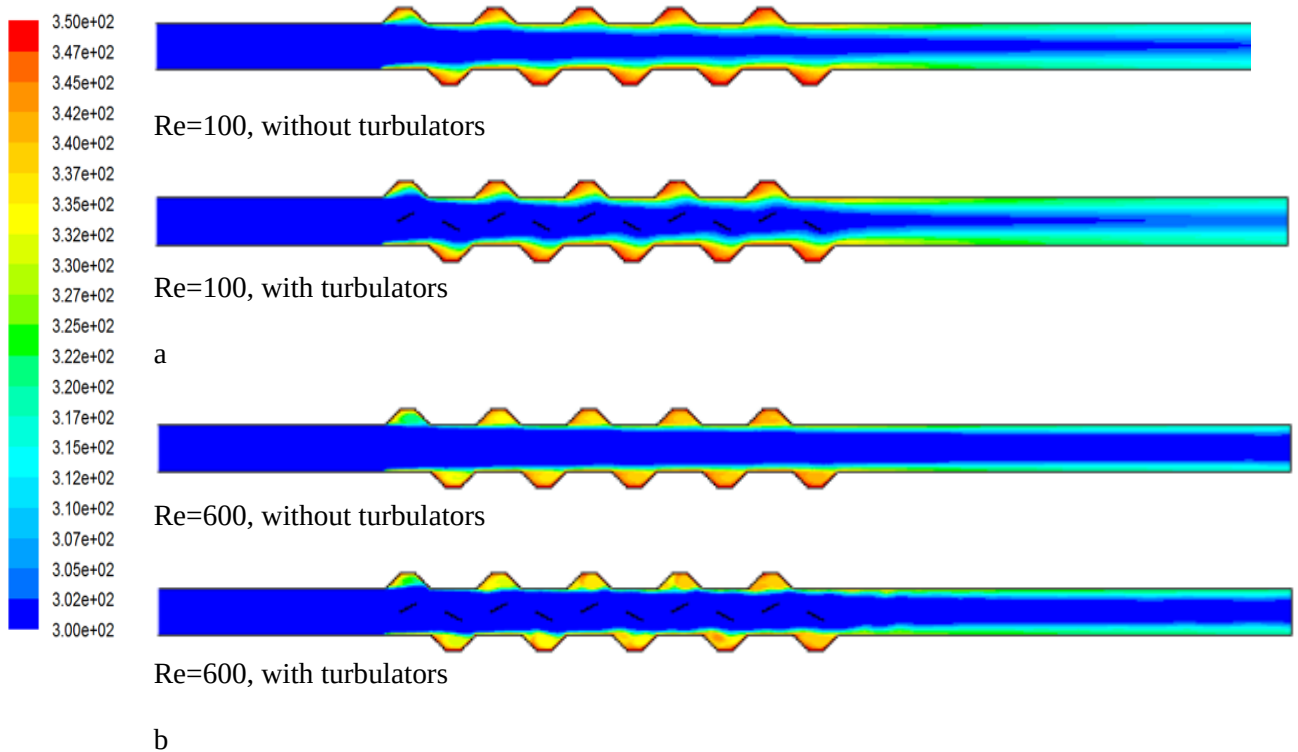


Figure 5. Temperature distributions for different Reynolds numbers in the trapezoidal corrugated channel with/without turbulators, (a) $Re=100$ and (b) $Re=600$.

Figure 4 presents the vorticity magnitudes for $Re = 100$ (a), and $Re = 600$ (b) in the trapezoidal corrugated channel with/without turbulators. It is seen that the vortex magnitudes that continue parallel to the channel surfaces in the channel without turbulators are disrupted in the channel with turbulators. Flow cycles begin to form around the turbulators. The increasing Reynolds number causes these flow cycles to grow. These structures provide better mixing of the fluid at the corrugated surfaces and in the central region, preventing high temperature gradients along the channel surfaces. It is observed that these cycles increase around turbulators and in trapezoidal spaces with increasing Reynolds number.

Figure 5 shows the temperature distributions for $Re = 100$ (a), and $Re = 600$ (b) in the trapezoidal corrugated channel with/without turbulators. The surface temperature decreases with increasing Reynolds number in the channel with/without turbulators. However, it was observed that the surface temperatures in the channel with turbulators were lower than the channel without turbulators. The turbulators activate the stagnant fluid by creating flow loops in trapezoidal spaces. The hot trapezoidal surfaces encounter the colder fluid layer. Thus, the temperature of the channel surfaces decreases, and heat transfer is improved. From the temperature distributions, it is seen that the temperature of the channel surfaces is lower at $Re = 600$ than at $Re = 100$.

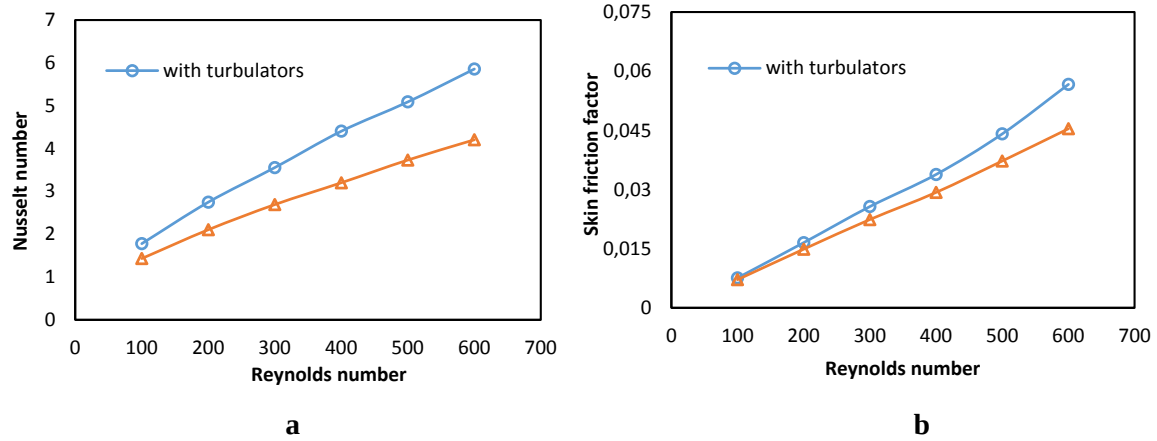


Figure 6. Nusselt number (a), skin friction factor (b) with Re in the channel with/without turbulator.

Figure 6 shows Nusselt number (a), skin friction factor (b) with Reynolds numbers in the channel with/without turbulator. The Nusselt number increases with the Reynolds number in both turbulator and non-turbulator channels. It is seen that the Nusselt number is higher in the channel with turbulators than in the non-turbulator channel. The highest Nusselt number was found to be 4.2 at $Re=600$ in the channel without turbulators, while it was obtained to be 5.86 at $Re=600$ in the channel with turbulators (Fig.6a). The skin friction factor increases with the Reynolds number in both turbulator and non-turbulator channels. It is seen that the skin friction factor is higher in the channel with turbulators than in the non-turbulator channel. The highest skin friction factor was found to be 0.046 at $Re=600$ in the channel without turbulators, while it was obtained to be 0.057 at $Re=600$ in the channel with turbulators (Fig.6b).

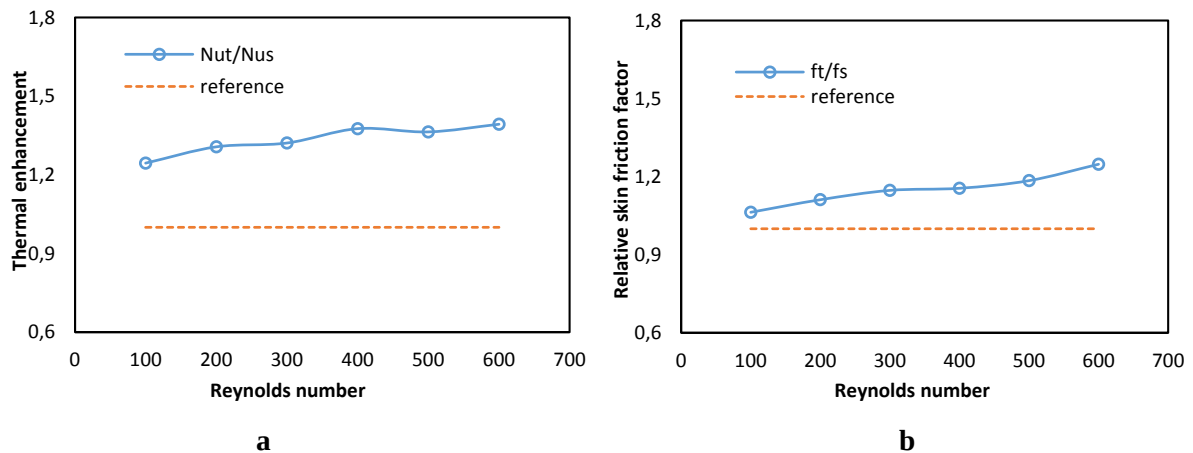


Figure 7. Thermal enhancement (a), relative skin friction factor (b) with Re in the channel with/without turbulator.

Figure 7 shows thermal enhancement (a), relative skin friction factor (b) with Reynolds numbers in the trapezoidal corrugated channel. In Figure 7a, the dashed line represents the Nusselt number obtained in the channel without turbulators and is taken as a reference. The thermal enhancement increases with the Reynolds number. The highest thermal enhancement was found as 1.39 at $Re=600$ (Fig 7a). In Figure 7b, the dashed line shows the skin friction factor obtained in the channel without turbulators and is taken as a reference. The relative friction factor increases with the Reynolds number. The highest relative friction factor was obtained as 1.25 at $Re=600$ (Fig.7b).

CONCLUSION

This study examined numerically the flow and heat transfer of a trapezoidal corrugated channel with/without turbulators under steady laminar conditions. The effects on the thermal enhancement and skin friction factor of Reynolds number were studied. The velocity, temperature, and vorticity contours in the channel with/without turbulators were obtained.

The prominent findings of the study were as follows:

- The flow and temperature contours were highly influenced by channel geometry and turbulators.
- Recirculation zones occurred in the channel due to the turbulators and these structures were repeated periodically in each corrugated part and turbulators.
- The Nusselt number and skin friction factor increased with Reynolds number for all channel cases.
- The highest Nusselt number was found to be 5.86 at $Re=600$ in the channel with turbulators.
- The highest skin friction factor was found to be 0.057 at $Re=600$ in the channel with turbulators.
- The thermal enhancement in the channel with turbulators increased 1.39 times at $Re=600$ compared to the channel without turbulator.
- The relative friction factor in the channel with turbulators increased 1.25 times at $Re=600$ compared to the channel without turbulator.

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**EFFECT OF GRAPHENE ON MICROSTRUCTURE AND HARDNESS PROPERTIES IN
MULTI-COMPONENT ALLOYS**

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Abstract

Multi-component alloys obtained as a result of technological studies have become a new field of study at all stages of the industry. In this study, Cu, Fe, Co, Ni and V elements were used to form the multi-component alloy structure. Elements were added at 40%, 15%, 15%, 15% and 15% by weight, respectively. Also added to the alloy was 1% by weight Graphene nanoplatelets (GNP). Thus, two samples with and without GNP were obtained. Elements used as micron-sized powder raw materials were pressed after a simple hand mixing. Pressing process was done with 20kg/mm² pressure. The compressed powder materials in the form of tablets were melted. Alloys were produced under high temperature in the mini-arc furnace. The production was carried out with the help of an electric arc in a vacuumed environment. The produced alloys were examined in scanning electron microscope (SEM) and hardness (Vickers) test after sample preparation process. The obtained alloys were also subjected to X-ray diffraction (XRD), X-ray fluorescence (XRF) and Energy Dispersive X-Ray (EDX) analyzes. As a result of the examination, different phase regions where different elemental compounds were observed were obtained. The hardness map of the structure was drawn with the hardness test taken on a volumetric and regional basis. In addition, changes due to the effect of GNP have been reported. With the addition of GNP, thinning of the phases occurred and the hardness increased by about 20%. With the analysis studies (XRD, XRF and EDX), the effect of the GNP structure was examined in detail. In this study, both a new multi-component alloy was produced and the effect of GNP structure on the alloy was investigated.

Keywords: Multi-component alloy, Graphene, hardness, manufacturability.

INTRODUCTION

Conventional alloys are formed with a low proportion of elements added to a major element. Many features change with this method. Elements added to the matrix are generally chosen according to their ion equivalence. In addition, productions are made according to Hume-Rothery alloying rules (Wang, Huang, Liu, Li, & Wang, 2019). However, there is no matrix element in the materials produced by deviating from these rules. In this way, structures in which at least 5 multi-component elements are used are called high entropy alloys (HEA) (or multi-component alloy). Elemental ratio should be used between 5% and 35% in HEA structure. These elements, which are under the influence of each other and in ion energy, can reveal different phase states. (Miracle et al., 2014; Yang & Zhang, 2012). Cooling and solidification processes are different from conventional alloys. Therefore, different microstructures are obtained in different regions. Thus, many new properties of different elements emerge. High strength, high hardness, good corrosion resistance and high wear resistance are known properties in HEA structures. In addition to these properties, thermal changes can occur. Thus, the use of alloys in technological applications can be expanded (Gao, Yeh, Liaw, & Zhang, 2016; George, Raabe, & Ritchie, 2019; Tsai & Yeh, 2014).

Graphene (G) structure, which is formed with the 2D form of the carbon element, is a material with high strength. The material, which shows strength at the GPa level, has a high surface area at the nano level. G structure can be produced and used in forms such as plate, nano-tube, spherical, fiber etc. G is a by-product in many alloys. The G structure, which improves many properties in alloys, is often used

in many materials (Ashwini, Kumar, Rekha, Santosh, & Srivastava, 2022; Rekha, Mallik, & Srivastava, 2018).

In this study, 5 different elements, which are planned to reveal different properties, were used. An alloy is formed with Cu, Fe, Co, Ni and V. Other elements were used as 15%, provided that Cu was 40%. Additionally, 1% graphene nano platelet (GNP) was added to the alloy. Thus, the state of the HEA structure and the effect of GNP on the alloy were investigated. SEM, EDX, XRD, XRF and hardness examination were performed on the alloys. When the results were analyzed, it was observed that different phases were formed. In addition, the hardness value increased by approximately 20% with the effect of GNP.

MATERIALS AND METHODS

In this study, the elements were used in powder form. The powders have a size of micron (max. 100 micron) and are 99.9% pure. The powders were prepared by a simple hand mixing process. The mixture was pressed to keep it together. Tablet samples of Ø16 mm, obtained as a result of pressing, were melted. The melting process was carried out in the Buhler MAM-1 mini arc furnace. When complete melting occurred, the structure was left to cool and the melting process was repeated 5 times. Thus, a homogeneous melting process was applied. The melting furnace is shown in Figure 1.



Figure 1. Melting furnace (Supplies, 2022)

Elements were used as powders and added to the alloy in proportions by weight. The elements used in the alloy are given in Table 1.

Table 1. Elements ratio (% wt)

Alloy	Materials % wt					
	Cu	Fe	Co	Ni	V	GNP
HEA1	40	15	15	15	15	0
HEA2	40	15	15	15	15	1

After production, the samples were homogenized annealed for 6h at 900°C for a homogeneous phase distribution. The samples obtained were examined after the necessary metallographic preparation. Zeiss Ultra Plus brand SEM microscope was used for microstructures. SEM-EDX analyzes were made with the detectors on the device. Samples were also subjected to XRD and XRF analyses. In order to follow the GNP structure added to the alloy, XRD was performed with detailed scanning in the appropriate

range. Finally, the samples were taken to the Vickers microhardness test in the Qness Q250M brand device. The hardness test was carried out under 1000gr load for 15 seconds.

RESULTS

The microstructures obtained as a result of SEM examination are given in Figure 2. EDX examination was applied on microstructures. Elemental ratios obtained in regions and phases are shown in Figure 2.

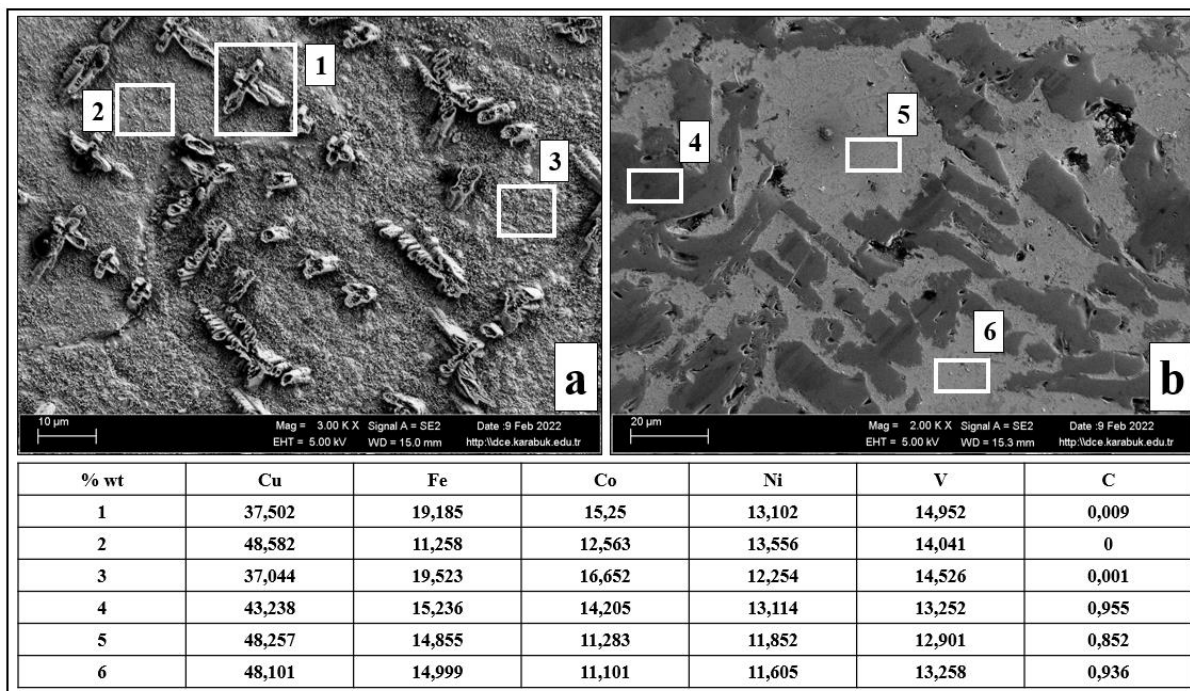


Figure 2. Microstructures for alloy (a) HEA1 and (b) HEA2

The result of the XRF analysis applied to examine the element ratios formed in the alloys is given in Table 2.

Table 2. XRF chemical compositions

% wt	Cu	Fe	Co	Ni	V	C
HEA1	39,0107	16,2999	16,2999	14,5006	14,7671	0,0018
HEA2	38,0464	14,6688	16,4728	14,9867	14,8206	1,0043

The graph obtained as a result of the XRD analysis applied to the samples is given in Figure 3. In addition, the peak obtained as a result of detailed scanning of the GNP structure was added to the image.

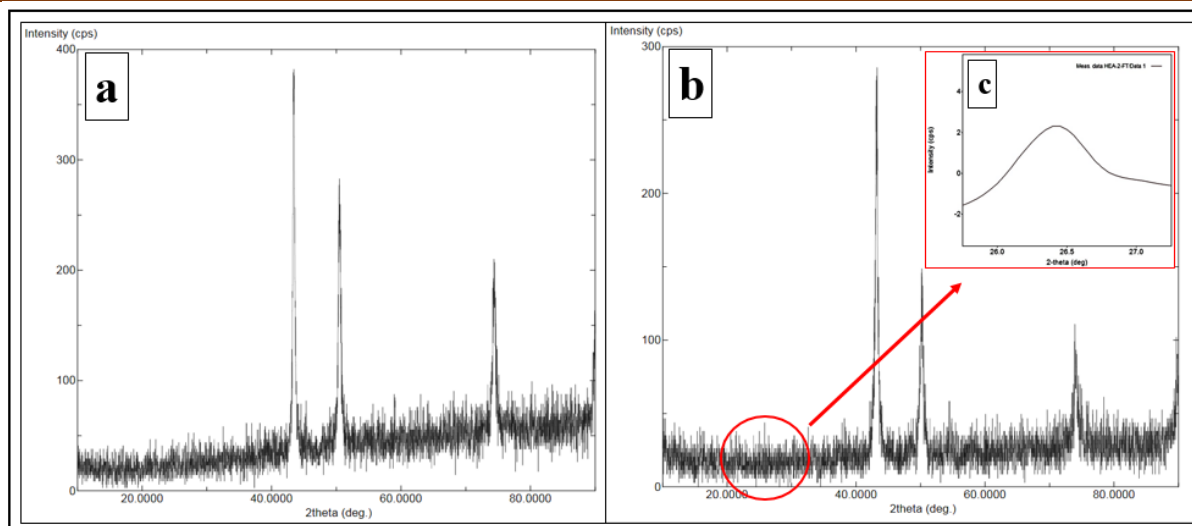


Figure 3. XRD peak for alloys (a)HEA1, (b)HEA2, and (c)GNP Peak

The final hardness test results applied to the alloys are given in Table 3. Hardness results are given as the average of 5 measurements.

Table 3. Hardness results (average)

Hardness	HV1
HEA1	315
HEA2	365

DISCUSSION

In this study, the manufacturability and basic properties of HEA alloys produced by the full melting method were investigated. In addition, the effects of the GNP structure added to the HEA alloy on the alloy were monitored.

When Figure 2 is examined, different phase structures including all the elements in the alloy are seen. According to the HEA production conditions, different chemical compositions were formed in different parts of the alloy by combining 5 elements. The ratios added during alloying gave close results in EDX analyses. Due to the dendritic solidification of Fe, Co and Ni elements in microstructures, sharp angular forms were formed. It can be said that the same phases solidify later with the change of solidification time with GNP added to the alloy. Therefore, dark structures have been changed in Figure 2(b) microstructure. Due to the high heat capacity of the GNP structure, the solidification time has changed. Thus, the phase distribution has also changed in the microstructure (Gao et al., 2016; George et al., 2019; Rekha et al., 2018; Tsai & Yeh, 2014; Yang & Zhang, 2012).

According to the XRF results given in Table 2, the % ratios of the elements added during alloying were formed appropriately. The C element originating from the GNP structure was followed in the HEA2 list. Thus, the % ratios of the alloys were realized as planned.

When XRD peaks were examined, both alloys showed similar peaks. Figure 3(c) shows the 26-27° peak value where the GNP structure is located. The peak at which the GNP structure emerged was consistent with the literature (Ashwini et al., 2022; Lewis, Barani, Magana, Kargar, & Balandin, 2019; Turan, Sun, Akgul, Turen, & Ahlatci, 2017). Thus, both alloys showed similar structure and the GNP structure was determined.

According to the hardness test results, an increase was observed in the values due to the high strength of the GNP structure. The hardness test was repeated 5 times and the average values were taken. The increase in the hardness of the alloys by the GNP structure showed results consistent with the literature (Ashwini et al., 2022; Lewis et al., 2019; Turan et al., 2017).

CONCLUSIONS

The production of HEA structure with Fe, Co, Ni, V, and C reinforcement in a Cu-based system was completed in a mini arc furnace. When the samples obtained in metallic form were examined, a multi-component alloy was produced. The results obtained after the examinations applied to the samples are listed below.

- 1- Homogeneous microstructures were obtained in the SEM images taken from the samples.
- 2- Elemental distributions showed differences according to phase structures in SEM-EDX analysis.
- 3- In the XRD and XRF examinations, the elements in the chemical structure and the added element C were observed.
- 4- In the hardness test, the hardness of the HEA structure increased by 20% with the addition of GNP.

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**THE EFFECTIVENESS OF LAENNEC IN THE PREVENTION
OF ANASTOMOTIC LEAKAGE**

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Abstract

One of the serious complications after intestinal surgery is intestinal anastomotic leakage, which is observed in 5.4-10.5% of cases. We conducted an experimental research study to investigate the effectiveness of human placental hydrolysate – Laennec (Japan) in the prevention of intestinal anastomotic leakage. A total of 60 chinchilla rabbits (weight 3-4 kg) were divided into 2 groups (20 in control and 40 in main). The model of acute intestinal obstruction and primary anastomosis was performed in all groups. Control group animals received standard treatment. Rabbits in the first half of the main group were given intramuscularly - Laennec 0.15ml (8.4mg)/kg once a day along with standard treatment. The second half of the main group was given Laennec 0.15ml (8.4mg/kg) infusion by using catheter placed in the root of the mesentery during the operation along with the standard treatment. The rabbits were operated again on the 3rd, 5th, 7th and 15th days of the operation and the intestinal anastomoses tissues were taken for morphological examination. It was found that the control group results of regeneration indicators, mitotic index, fibrillogenesis, vascularization were at the lower level, compare to the main group results. The morphological examination of tissues taken from the experimental animals it was found that the crypts were thickened and deepened, the mitotic index was high, collagen fibers were denser, and fibrillogenesis and microangiogenesis were more intense, the intramural nerve plexus was very well preserved in the anastomosis wall. The results of the study demonstrate that Laennec has a positive effect on the regeneration of intestinal anastomoses and decreases the frequency of postoperative complications. We recommend the wide application of Laennec for the prevention of intestinal anastomotic leakage.

Key words: intestinal anastomoses, anastomotic leakage, prevention of anastomotic leakage, Laennec, postoperative complications.

INTRODUCTION.

The complications after laparoscopic and open resection of intestines and its prevention are actual problems of abdominal surgery. One of the most serious complications after intestinal surgery is intestinal anastomotic leakage, which is observed in 5.4-10.5% of cases (Kingham and Pachter, 2009, McDermott et al. 2016, Meyer et al. 2019). Recently, many fundamental scientific-research works attention has been paid to the investigation of the application of preparations containing growth factors in pathologies where regeneration processes are important (Kim et al. 2010, Seo et al. 2006, Yamauchi et al. 2017). One of these drugs is human placental hydrolysate – Laennec. We considered to conduct an experimental research study to investigate the effectiveness of Laennec in the prevention of intestinal anastomotic leakage.

The aim of the study is experimental research the effect of human placental hydrolysate LAENNEC on the regeneration of intestinal anastomoses, substantiate and apply in clinical practice.

MATERIAL AND METHODS. A total of 60 chinchilla rabbits (weight 3-4 kg) were divided into 2 groups (control and main). Control group consist of 20 rabbits. The main group equally divided into 2 half groups. In this experiments, short-term daily model of acute intestinal obstruction and primary anastomosis was performed in all groups. Control group animals received standard treatment. Rabbits in the first half of the main group were given intramuscularly human placental hydrolyzate-Laennec 0.15ml (8.4mg)/kg once a day along with standard treatment. The second half of the main group was given Laennec 0.15ml (8.4mg/kg) infusion by using catheter placed in the root of the musculature during the operation along with the standard treatment. The rabbits were operated again on the 3rd, 5th, 7th and 15th days of the operation and the intestinal anastomoses tissues were taken for morphological examination. Morphological studies were performed during experimental studies. In the anastomotic aera by the hematoxillin - eosin, van- Gizon by hematoxylin - picrofuxin, methyl blue - eosin, buffered 0.05% thionine, toluidine, hematoxylin - sodium - fluorescein (uranine), by iron hematoxylin incubation methods mitotic index (ratio of dividing cells to non-dividing cells), fibroblastic activity, denovo formation of fibers (collagen), mucus secretion, muscle-cell response, microvascular density (angiogenesis) were studied. The obtained results are expressed in conventional units.

For the purpose of clinical research, we analyzed the results of surgical treatment and examination of 128 patients who underwent laparoscopic and open intestinal resection and anastomosis of the intestines at the Education Surgical Clinic of the Azerbaijan Medical University in 2014-2019. 68 patients of these formed the main group under our personal observation, and 60 patients formed the comparison group, the results of which were retrospectively examined.

In the comparison group, archival documents of 60 patients who underwent laparoscopic and open bowel resection and anastomosis were extensively examined, technical aspects of anastomoses, methods of prevention of anastomotic leakage and postoperative complications were analyzed. 29 (48.3%) of the patients in this group were women and 31 (51.7%) were men. In the comparison group 9 (15.0%) patient of the 60 patients underwent laparoscopic surgery and 51 (85.0%) patient underwent open surgery. Of the patients undergoing laparoscopic operation in 1 (11.1%) right hemicolectomy, ileotransverso anastomosis, in 6 (66.7%) subtotal colectomy ileosigma anastomosis, and in 2 (22.2%) Sigma resection, descendorecto anastomosis placement operations were performed. Of the patients undergoing open surgical operation in 1 (1.9%) patient resection of the IV segment of the duodenum, duodenoeyeyuno anastomosis, in 5 (9.8%) resection of small bowel, enteroentero anastomosis, in 15 (29.5%) right hemicolectomy, ileotransverso anastomosis, in 9 (17.6%) subtotal colectomy ileosigma anastomosis, in 1 (1.9%) resection of the transverse colon, transversotransverso anastomosis, in 6 (11.8%) left hemicolectomy, transversorecto anastomosis, in 8 (15.7%) Sigma bowel resection, descendorecto anastomosis and in 6 (11.8%) anterior resection of the rectum, sigmarecto anastomosis placement operations were performed. Of the patients in the comparison group 23 (38.3%) had end to end anastomosis and 37 (61.7%) had side by side anastomosis. The patients in the comparison group received standard treatment.

In the main group 10 (14.7%) patient of the 68 patients underwent laparoscopic surgery and 58 (85.3%) patient underwent open surgery. Of the patients who underwent laparoscopic operation in 3 (30.0%) patient right hemicolectomy, ileotransverso anastomosis, in 3 (30.0%) left hemicolectomy, transversorecto anastomosis, in 3 (30.0%) Sigmoid and rectal resection, descendorecto anastomosis, and in 1 (10.0%) total colectomy, ileorecto anastomosis were performed. 62 anastomoses were performed in 58 patients who underwent open surgery (8 anastomoses in 4 patients: in 3 patients in parallel entero-entero and transversorecto, and in 1 patient ileoceco and descendorecto anastomosis). Of these, 1 (1.6%) had a duodenoeyeyuno anastomosis due to arteriomesenteric duodenostasis, 6 (9.7%) had a small bowel resection, enteroentero anastomosis, 1 (1.6%) had a resection of the terminal part of the small intestine, ileoceco anastomosis, 8 (12.9%) had right hemicolectomy, ileotransverso anastomosis, 2 (3.2%) had transverse colon resection, transversotransverso anastomosis, 21 (33.9%) had subtotal colectomy, ileosigma anastomosis, 8 (12.9%) had left hemicolectomy, transversorecto anastomosis, 8 (12.9%) had Sigma bowel resection, descendorecto anastomosis, 5 (8.1%) had anterior

resection of the rectum, sigmoidectomy and anastomosis and 2 (3.2%) had resection of the rectum and sigmoid, colorectal anastomosis. In all patients who underwent laparoscopic operation, the anastomoses were formed end-to-end. 62 anastomoses were performed in 58 patients who underwent open surgery (8 anastomoses in 4 patients). In 24 (38.7%) of these patients' anastomoses were formed end-to-end, and in 38 (61.3%) they were formed side by side.

During clinical trials in patients, general blood analysis, coagulogram, blood albumin, total protein, creatinine levels, CRP, ECG, EXO-cardiography, chest X-ray, colonoscopy, gastroscopy and dual contrast computed tomography of the abdomen, abdomen review X-ray, irrigography, magnetic resonance imaging examinations were performed.

In patients of the main group human placental hydrolysate (LAENNEC) was used as a part of complex treatment measures to prevent intestinal anastomotic leakage. In 65 (95.6%) patients in the main group, human placental hydrolysate was used 1-2 times a day, 2-4 ml intramuscularly for 7-10 days. In 3 (4.4%) patients, who underwent laparoscopic surgery, 8 French microirrigators were placed at the root of the mesenter during the operation and in the postoperative period, 4 - 6 ml of human placental hydrolysate diluted in 0.9% - 50 ml of saline was applied once a day for 5 - 7 days, then it was continued as intramuscular use in a dose of 2 - 4 ml of human placental hydrolysate. In the patients of the main group complex prophylaxis measures for intestinal anastomotic leakage was performed in the postoperative period. In this case, hypoproteinemia was corrected by transfusion of 20% albumin, plasma of the same group, and patients with hypotension were prevented by intravenous infusions. To improve the blood circulation of the segments to be anastomosed, fractionated heparin molecules were used, taking into account the rheological properties of the blood and INR. Efforts have been made to keep the INR as close to maximum as possible. In some group of patients, these measures were started before the operation.

Another important point was the control of the partial pressure of oxygen in the blood. Because in the comparison group, the majority of patients with intestinal anastomotic leakage reported a decrease in partial oxygen pressure in the blood on days 1st – 2nd of operation. Taking this into account, we determined nasal oxygen support in patients in the postoperative period, depending on the degree of saturation. In addition, patients received high doses of vitamin C (500 - 1000 mg / day).

RESULTS. It was found that the control group results of regeneration indicators, mitotic index, fibrillogenesis, vascularization were at the lower level, compare to the main group results. However, the morphological examination of tissues taken from the experimental animals it was found that the crypts were thickened and deepened, the mitotic index was high, collagen fibers were denser, and fibrillogenesis and microangiogenesis were more intense. In the second half of the main group, the intramural vegetative nerve plexus was very well preserved in the anastomosis wall. The fibrillogenesis processes and fibrinolysis were balanced, and the muscle membrane layers were kept. This allows to prevent circular hyperplasia of the anastomotic area and formation of fibrosclerotic signs.

Clinical studies. In the comparison group in 8 (13.3%) patients, was noted intestinal anastomotic leakage. As a result of the use of LAENNEC as part of complex surgical and conservative treatments to prevent intestinal anastomotic leakage, in patients of the main group intestinal anastomotic leakage was observed in only 1 (1.5%) of 68 patients. Accelerated regeneration in placed primary intestinal anastomoses has led to earlier recovery, activation, nutrition, and earlier restoration of defecation in patients in this group. So that, out of 68 patients included in this group, 18 were activated on the 1st day of operation, 34 on the 2nd day of operation, 13 on the 3rd day of operation and 3 on the 4th day of operation. Also, defecation was restored on the 1st day of surgical operation in 16 patients, on the 2nd day of surgical operation in 42 patients, and on the 3rd day of surgical operation in 10 patients, and that's why patients could fed early. In this regard, the initiation of early feeding led to an earlier stop of parenteral nutrition, created conditions for faster recovery of microelement and protein balance in the blood. All this has led to a reduction in medical consumption of patients, shortening the duration of inpatient treatment, earlier recovery of working capacity.

The above processes are observed during the use of LAENNEC both intramuscularly and intramesenterally. But when applied to the root of the mesenter, the effects are express itself relatively

more earlier. This suggests that in more severe cases, it is more appropriate to inject LAENNEC into the root of mesenter. In other cases, intramuscular use of the drug may be sufficient. By the obtained experimental studies, it has been proved that human placental hydrolyzate has a positive effect on the regeneration of intestinal anastomoses.

DISCUSSION. On the 7th day of the experiment, microscopic examination of intestinal anastomoses taken from control animals revealed signs of vacuolar dystrophy in the mucous membrane (Figure 1). Mitosis index is characterized by low values (1.0 - 2.0 c.u.). Although the epithelial layer is composed mainly of brush-edged enterocytes, which is found in a variety of functional conditions. So that, some cells are desquamated, but in the cytoplasm of another cells there are signs of destruction and karyolysis. Although the third part of the enterocytes retains its intact shape and size, it suffers from mucoid dystrophy.

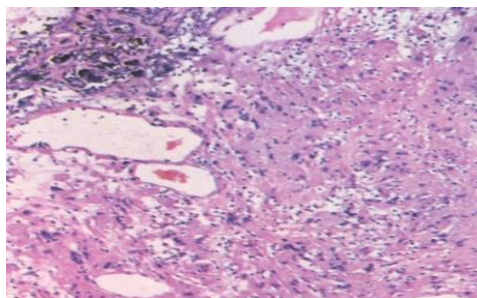


Figure 1. Symptoms of edema and vacuolar dystrophy in the epithelial layer of mucosa are distinguished. Fibroblast-type cells make up only 10-15% of the total cell volume.

Dye: hematoxylin-eosin, thionine. Magnification: ok.12.5, ob.10

The special layer of the mucous membrane is diffuse edematous and partially hyperemic. Specific layer vessels are deformed, partially or completely thrombosed. Only 20% of microcirculatory vessels are free of thrombus masses. It should be noted that very few fibroblast-type cells are found on this layer, which also make up only 10 - 15% of the total cell volume (Figure 1). The fibrous carcass of the submucosal layer is very thin.

In the I subgroup of the main group, on the 7th observation day of the experiment, there was an increase in the density and depth of crypts in the mucous membrane, as well as mitotic activity of cambial elements ($2.0 - 4.0$ c.u., $M = 3.0 \pm 0.12$; $p < 0.001$) noted. The fibrous carcass of the special layer is loop-shaped and intensive fibrillogenesis is noted (Figure 2). Most of the microcirculatory vessels of the submucosal layer are free of thrombus masses and dilated. In contrast to the control group, no signs of possible anastomotic leakage such as unsatisfactory tissue nutrition, bad fibrous carcass formation and deformative-dysfunctional microcirculatory vessel disorders were detected.

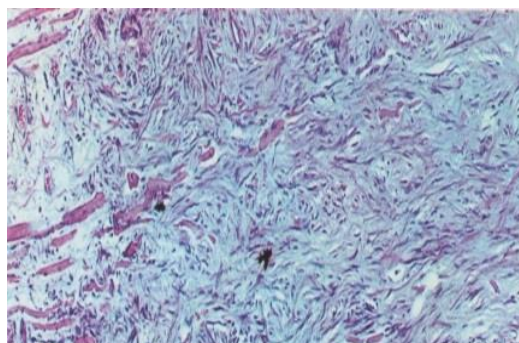


Figure 2. Intensive increase in the number of fibroblasts is observed in a special layer of the mucous membrane. Dye: hematoxylin-eosin. Magnification: ok.12.5, ob.40

Examination of intestinal anastomoses taken 7 days after surgery in the II subgroup of the main group showed that the integrity of the epithelial layer of the intestinal mucosa was not damaged, the relief, folds and color of the mucous membrane of the anastomosis wall on the intestinal side did not differ

significantly from neighboring intact areas. Density and depth measurements of mucous membrane crypts significantly increased, compared even I subgroup of the main group experimental animals. Active regenerative-mitotic processes were observed in crypts (3.0 - 5.0 c.u. $M = 4.0 \pm 0.12$; $p < 0.001$). At this time, a special point caught our attention. So that, compared with the control group, a very high number of fibroblasts was recorded in the studied anastomosis area of the main group of experimental animals. Especially fibroblastic activity was higher in the II subgroup of the main group (Figure 3). This is directly related to the effect of fibroblast growth factor (FGF) included in human placental hydrolyzate. The submucosal layer also retained the overall structural plan in full and was relatively thick. Unlike other observation groups, the formation of the fibrous carcass is more regular.

Activation of angiogenesis mechanisms has accelerated the regeneration process. This indicator shows a direct correlation between vascularization and regeneration. This result indicates a close relationship between angiogenesis and the mitotic index of the epithelium, fibroblastic activity, de-novo formation of fibers, also give evidence of improved supply of oxygen and nutrients to cellular and non-cellular elements. Improved blood supply led to a decrease in the number of apoptotic and necrotic cells compared to the previous study day.

Morphohistochemical examinations in the I subgroup of the main group led to the conclusion that intramuscular administration of human placental hydrolyzate in experimental animals stimulates both the formation of a fibrous carcass, acceleration of collagen synthesis and also angiogenesis which results with higher density of microvessels in the anastomosis area. As a result, morpho-functional and vascular changes in the anastomosis zone of the intestinal wall accelerate the process of adaptation to new anatomical and physiological conditions. Correction of microcirculation improves the near and long-term results of the operation, prevents complications associated with postoperative microcirculatory changes, especially anastomotic leakage (Table 1).

Table 1.

Indications	3 day	5 day	7 day	15 day
Mucus secretion	4,0 (3,5-5,0)	3,5 (3,0-4,0)	2,5 (2,0-3,0)	2,0 (1,0-3,0)
Epithelial mitosis index (regeneration)	1,0 (0,5-1,5)	2,5 (2,0-3,0)	3,0 (2,0-4,0)	4,0 (3,0-5,0)
Fibroblastic activity	1,0 (0,5-1,5)	1,5 (1,0-2,0)	2,0 (1,0-3,0)	2,5 (2,0-3,0)
Muscle-cell response	3,0 (2,0-4,0)	4,0 (3,0-6,0)	2,0 (1,0-3,0)	1,0 (0,5-1,5)
De-novo fibers formation (collagen)	1,0 (0,5-1,5)	1,5 (1,0-2,0)	2,0 (1,0-3,0)	2,0 (1,0-3,0)
Density of microvessels (1mm ²) (angiogenesis)	30,0 (20,0-40,0)	30,0 (20,0-40,0)	35,0 (25,0-45,0)	40,0 (30,0-50,0)

Thus, after an experimental study, it was found that LAENNEC has a positive effect on the regeneration of intestinal anastomoses. So that, LAENNEC in the anastomosis zone increases the mitosis index, the

activity of fibroblasts, collagen regeneration and also multiply the density of microvessels by stimulating angiogenesis. The above processes are observed during the use of human placental hydrolyzate both intramuscularly and intramesenterally. But when applied to the root of the mesenter, the effects are express itself relatively more earlier. This suggests that in more severe cases, it is more appropriate to inject human placental hydrolyzate into the root of mesenter. In other cases, intramuscular use of the drug may be sufficient. By the obtained experimental studies, it has been proved that LAENNEC has a positive effect on the regeneration of intestinal anastomoses.

Clinical studies have shown that intestinal anastomotic leakage in patients in the comparison group is due to late visit to the doctor, inadequate preoperative preparation without taking into account risk factors, tactical and technical mistakes during operation, incorrect assessment of intestinal viability, lack of complex postoperative prophylaxis methods.

CONCLUSION. Thus, as the successful results of the experiment have proven themselves in clinical practice the inclusion of LAENNEC in a complex treatment regimen to prevent intestinal anastomotic leakage has been important in preventing this complication. As a result, we recommend that the drug should be widely used in clinical practice for the prevention of intestinal anastomotic leakage. We consider that the widespread use of the LAENNEC for this purpose will reduce the incidence of appropriate complications.

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**A LIGHT FOR EDUCATION DURING CORONAVIRUS PANDEMIC: FLIPPED
LEARNING MODEL**

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Abstract

The coronavirus pandemic necessitates change in every field of life, especially in education. In order to reduce the spread of the COVID-19 virus, the widespread closure of schools, colleges, universities, and other educational institutions in many countries has become inevitable. Technology plays an important role in the continuation of education during this process. During the epidemic, one of the technology-based models, flipped learning, also known as the 21st century education model, based on teaching at home by using technology and practicing at school in a short time, is thought as a light for the continuation of education. This technology-centered model aims to both provide social isolation to a great extent by spending little time at schools and grow a generation using science and technology skillfully by taking an active part in the process. This research aims to describe ‘flipped learning’, the conceptual framework and its theoretical basis, application, and differences from the traditional model; moreover, to investigate the effect of applying this model during a pandemic on students’ success by reviewing the related literature. The related studies show that applying the flipped learning model during a pandemic affects learners’ success, motivation, and interest positively. It is considered that flipped learning is shining as a diamond for the endurance of education during a pandemic.

Keywords: Flipped learning, pandemic, epidemic, COVID-19, technology

INTRODUCTION

With the notification of the new type of coronavirus infection (COVID-19) to the World Health Organization in Wuhan, China on December 31, 2019, the presence of a virus threatening the whole world was recognized. This infection is a serious epidemic that manifests itself with complaints such as high fever, loss of taste and smell, joint pains, and causes death (Yuan, Li and Lu, 2020). This epidemic, which started in China, turned into a pandemic that affected the whole world after a while. The pandemic has required countries to take steps in many areas, especially in educational institutions, in order to prevent the spread of the epidemic (Agnoletto and Queiroz, 2020). Since COVID-19 is a respiratory epidemic, it has been one of the first issues to be considered whether educational institutions, which are one of the institutions with the highest human contact, can continue their activities. In this context, the authorities emphasized that the health of students, teachers, and parents was at the forefront and announced that the activities of educational institutions were stopped (Sarı and Nayır, 2020). In order to reduce the impact of the epidemic and to slow its spread due to its highly contagious nature, practices such as flexible working, working from home, and alternating working have been implemented. In addition, measures such as partial or full-time curfews, quarantine processes, self-isolation of individuals, and protection of social distance have been taken all over the world. Within the scope of these measures, places where human-human relations can be found were closed, and schools and universities were included in this scope (Doghonadze et al., 2020; Gupta and Goplani, 2020).

Although life has come to a standstill at many points in the world due to COVID-19, there have been rapid developments in the use of different methods and practices to keep up with this new world order. Globally, teachers and students have adapted to this situation by locking themselves in their homes, teaching remotely, and taking advantage of e-learning platforms (Taylor, 2018). Personal information processing and communication devices have become important tools for learning and information

transfer, and it has become inevitable to benefit from information and communication technologies in education. Developments in internet accessibility and speed have enabled education at all levels, from preschool to graduate studies, to be realized independently of time and place. Tablets, phones, and computers have been the apple of the eye of educators as well as all segments of society during the COVID-19 period (Mulenga and Marban, 2020). In this process, distance education (Cansu, 2010), which is independent of time and space and gives the opportunity to reach large masses at the same time, is presented as an alternative to face-to-face education, which is interrupted by developing technology and the changing understanding of education in the world (Özer, 2011). Roy (2020) suggested applications such as Zoom and Skype in order to realize learning from home during the pandemic period and emphasized that teachers can do synchronous lessons using such online applications. In addition, UNESCO (2020) announced that it supports various digital learning environments in order to continue education during the period when schools are closed, and that it is available to the whole world, especially to economically disadvantaged groups.

In line with the decrease in the number of cases in the future, alternative education models have come to the fore in order to reopen schools but to minimize the time spent at school. In this period, the vital importance of staying away from the crowd, paying attention to cleanliness and social distance, and the constant mention of the importance of contacting as few people as possible by experts, on the other hand, brought up the flipped classroom model, which allows students to spend less time in school and to learn lessons with fewer people (Lo, 2022; Divjak et al., 2022). By applying this model, some of the training is planned to be done face-to-face and some is planned to be done remotely. It aims to provide theoretical education for some courses at home and practical education at school. In this context, the students will reinforce the subject at school with the projects and assignments given after listening to their lessons in the home, and the teachers will be in contact with their students at every stage of the process.

The flipped classroom model is a pedagogical model that improves individual learning, provides information outside the school, allows more collaborative studies on the subject in the classroom environment, and enables the use of asynchronous systems (Bishop and Verleger, 2013). In this model, the student reaches the basic level of knowledge outside the classroom. When he/she is in the classroom, he/she carries out activities to use high-level skills such as problem solving and discussion. The lessons are transferred to digital individuals with digital technology. During the pandemic period, which makes it necessary to reduce human contact as much as possible, this method was seen as a light in order to continue education in a healthy way. In this context, all courses are saved in the virtual environment. Students listen to these lessons whenever they want. The library is configured to support this system. Students come to the classrooms to discuss, ask what they have in mind, and reinforce what they listen to and learn. Lessons are limited to 30 minutes. Students who have previously watched the lessons can participate interactively in the educational environment in the classroom (Talbert, 2017). Thus, both the time spent at school is reduced and the students are provided with a more personalized education (Divjak et al., 2022).

METHODOLOGY

The literature review method was used in this study. A literature review is a method for revealing studies, resources, and ideas on a subject, as well as examining the subject from various perspectives, developing a theoretical framework, and structuring the research (Karasar, 2011). To determine the current situation and applications on the subject, the archive scanning method was used in the study; data were obtained from national and international sources; flipped classroom model archive documents; web pages related to the subject; and web pages of various books, magazines, articles, and institutions/organizations.

LITERATURE REVIEW ON FLIPPED LEARNING MODEL

Flipped Learning Model

Flipped learning is a technology-enhanced pedagogy in which students' first contact with new course materials would take place before class through instructional videos and/or text-based resources (Bergmann and Sams, 2012). In this learning model, the learning process consists of two stages. In the

first stage, while the students are working on the content prepared in accordance with individual learning outside the lesson hours, in the second stage, they come to the lesson and conduct the activities given to reinforce the content under the guidance of the teacher in the classroom environment with the individual or group (Çakır and Yaman, 2018). The students who prepare for the lesson and come to the lesson can ask their teachers questions about the lesson. A discussion environment is created about the assignments in the classroom. Furthermore, when there are issues that are not understood, students and teachers can learn the subject in depth by communicating face-to-face (Saunders, 2014). In flipped learning, the student performs learning under his/her own responsibility with flexible working time. They can watch the course contents shared by the instructors as much as they want. The important thing in the flipped learning model is that the student takes an active role in the classroom environment. By working individually or with a group in the classroom environment, they learn more in a wide range of areas and spend more time on the problems they encounter (Ayçiçek and Yanpar Yelken, 2018). Since instructors serve as guides, they can allocate more time to students (Seaman and Gaines, 2013).

The social network "Flipped Learning Network" created about the flipped classroom model explains the characteristics of the model with four basic principles by taking into account the initials of the word "flip" (Sams et al., 2014).

- **Flexible Environment:** The flipped classroom model provides some flexibility for students and teachers compared to the traditional method. In this model, students can progress at their own learning speed without time and space limitations by watching the course contents repeatedly. Teachers, on the other hand, can be more flexible about classroom activities and evaluations than in the traditional method because they can devote more time to classroom practices in this model.
- **Learning Culture:** Since the flipped classroom model is a student-centered model, it creates an unusual learning culture.
- **Intentional Content:** In the flipped classroom model, the content should be prepared in such a way that students can actively participate in the process. Teachers should determine the topics that are important for students in this model and plan the content and practices that are suitable for the determined topics and accessible to all students.
- **Professional Educators:** In the flipped classroom model, teachers should guide students in the learning process as well as prepare content. They should observe students, support them when they need it, and give feedback. In this learning model, which involves more work for educators, it is thought that experienced educators can manage the process correctly.

Traditional Classroom vs. Flipped Classroom

The flipped learning model includes different processes than the traditional classroom model.

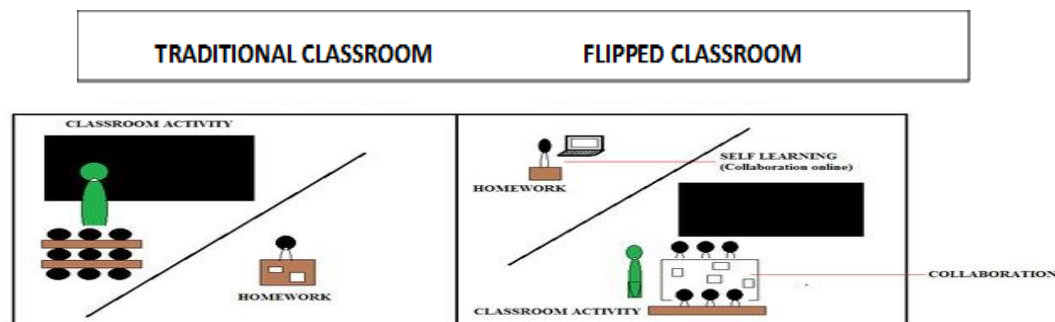


Figure 1. Traditional Classroom vs. Flipped Classroom (Sam, 2016).

Unlike in the traditional classroom, in flipped learning, the student acquires the theoretical knowledge of the course from materials prepared in online environments such as presentations and videos before coming to the class (Kurtoğlu Yalçın and Kazu, 2020). In addition, he has the responsibility to conduct individual research on the subject. In the classroom, activities are carried out using methods and techniques that provide metacognitive skills that support the subject under the guidance of the teacher (Figure 1). In addition, the teacher has the responsibility to correct the incomprehensible or

incompletely learned parts of the subject. In the traditional education model, students have to do assignments that are difficult for them and that they cannot cope with when their teachers are not around (Talbert, 2012). In the traditional classroom, the center is on the teacher in classroom applications. The teacher presents the theoretical knowledge of the course to the student, makes the student understand the subject, and performs supportive activities. In order to reinforce the subject, the student is given homework to do at home. Basically, it is possible to say that the flipped classroom model is the flipped form of the traditional education model.

THE EFFECTIVENESS OF FLIPPED LEARNING DURING THE PANDEMIC

In 2020, both teachers and pupils experienced something unexpected. The COVID-19 pandemic caused the usual teaching and learning in schools to be interrupted in numerous nations. Due to the requirement that all teaching and learning activities be transferred to a totally online format, the protracted school closure has brought previously unrecognized difficulties. Faced with these difficulties, the flipped learning strategy was chosen in the hopes that it would encourage students to participate in online learning. Research suggests that flipped learning has been used more frequently during the pandemic because it can keep engagement high (Collado-Valero et al., 2021; Martinelli et al., 2021; Portela, 2020). In this context, there are several studies that were carried out to investigate the effectiveness of this learning approach on students' motivation, interest, and success.

Mursyidah, Hermoyo, and Suwaibah (2021) aim to examine and determine whether the flipped learning method via MOODLE can improve learning outcomes and motivation to learn discrete mathematics during the COVID-19 pandemic. This study concludes that utilizing MOODLE during the learning process with the flipped learning approach is an alternative option during the pandemic of COVID-19. According to research findings, the strategy can enhance students' learning outcomes and motivation for learning discrete mathematics. The stages of learning using the flipped learning method through MOODLE are as follows: (1) lecturers stimulate students to find references independently of a question by asking questions; (2) students learn the material independently and ask questions about the material which they have not yet understood; (3) students and lecturers conduct discussions to clear up misconceptions; and (4) students work on questions from lecturers as evaluations. Two meetings are required for one material, with the first meeting containing steps (1) and (2) and the second meeting containing stages (3) and (4). According to the study's findings, using this strategy can boost student learning outcomes by 70% while also increasing learning motivation by 34%.

The community of inquiry conceptual framework was used in the research conducted by Jia et al. (2021) to describe how the situation can be handled by converting a traditional flipped course into a fully online flipped course. The quantitative results show that students in the online flipped courses did equally well as their contemporaries in the traditional flipped learning style, and that interest levels among the students were consistently high. In addition, Umar and Ko (2022) aimed to investigate how project-based learning, team cohesion, and flipped learning interact with one another by studying their direct effects on student learning effectiveness, engagement, and engagement impacts on learner performance. They conclude that flipped learning showed increased positive direct effects on student learning effectiveness. On the other hand, the research of Susana and Brahma (2021) aimed to determine the effectiveness and impact of flipped learning on developing the writing competence of students during the COVID-19 pandemic. The study carried out with 32 engineering students implied that there is a huge impact on the use of flipped learning in improving students' writing ability. Likewise, Reflianto et al. (2021) aimed to examine the effects of online flipped classroom learning and student engagement during the COVID-19 pandemic on students' reading comprehension skills. The study concluded that online applications established interactions among the flipped classroom method using different online media with high, medium, and low engagement in reading comprehension skills. Similarly, the study that aims to examine the effectiveness of integrating GeoGebra into the Flipped Learning approach to improve students' self-regulated learning ability in learning mathematics online during the COVID-19 pandemic was carried out by Ishartono et al. (2022). 60 university students were selected as participants randomly. The analysis's findings showed that Flipped Learning using GeoGebra is more effective at raising students' levels of self-regulated learning in online mathematics instruction.

Kim et al. (2021) aimed to study with medical students by applying flipped learning during the pandemic. 110 fourth-year medical students participated in a clinical module of our 1-week health sciences program course from March to June 2020. Students completed the flipped learning before meeting with the teacher each day. They then took part in the online discussion and conference. All tasks were successfully completed on time. Both the students' motivation and their level of satisfaction with the course were excellent. The online materials, the flipped learning approach, and the teachers all received positive feedback from the students. Similarly, Martinelli et al. (2021) studied with medical students and used flipped learning in medical education during the pandemic. The researchers found that learners like flipped learning and that this may improve learning. Learning management systems and flipped learning function well together to distribute targeted pre-class assignments.

Latorre-Coscolluela et al. (2021) found evidence that the advantages and effectiveness of learning with flipped learning in helping students acquire abilities for the twenty-first century for both their personal and professional lives were acknowledged by the students. The effects of flipped learning on the development of skills related to "fun and learning," "collaboration with the classmates," and "learning from/with the classmates" were viewed as less significant by students who participated in flipped classes during the epidemic. Furthermore, Lee (2020) revealed that Korean students prefer online flipped classes to face-to-face education. During the pandemic, flipped learning was used to increase the involvement of the pupils. It was concluded that Korean students asked more questions in online lessons of flipped learning than in face-to-face education.

Campillo-Ferrer and Miralles-Martínez (2021) aimed to investigate the effects of the flipped classroom on students' perceptions of their learning and motivation during the COVID-19 pandemic. The sample included 179 student instructors who were enrolled in the flipped classroom model during the academic year 2020–2021 at the University of Murcia's Faculty of Education. The study showed that the majority of students had favorable opinions of the flipped classroom, citing the benefits of practical in-class activities and more learning autonomy. Aiming to compare a proposed online and flipped learning model to existing online and traditional models, Tang et al. (2020) set out to evaluate the effectiveness of various online teaching formats. It was discovered that the flipped learning and online teaching models together improved student learning, focus, and course evaluation.

With the interruption of face-to-face education, online education has come to the fore. The studies show that flipped learning has been used to support online education and to minimize human contact. Furthermore, the literature review proves that flipped learning applications increase students' success, motivation, and interest during the pandemic period.

DISCUSSION AND CONCLUSION

The COVID-19 pandemic period has been a period that has affected the whole world. Until there is a vaccine or medicine, the only thing that can be done is for people to stay at home and stay away from each other. This situation affects every aspect of life and has forced states, institutions, people, and ways of doing business to change (Serçemeli and Kurnaz, 2020; Kazu and Kurtoğlu Yalçın, 2022). Education is one of the most important elements of life that has undergone change. Studies have been carried out to turn face to face education completely into distance education opportunities. This decision has left students facing new systems and practices that they have never seen before. Flipped learning has been thought as a way to ensure continuity of education during a pandemic, to minimize human contact, and to provide flexible timing for students' learning. Many studies show that some drawbacks of the switch to remote instruction were mitigated by the adoption of flipped learning techniques (Divjak et al., 2022). The studies revealed that implementing flipped learning online has many benefits. The ability to integrate asynchronous and synchronous teaching and learning, the development of twenty-first century skills, and improving the quality of student-teacher interactions were some of the benefits mentioned.

The flipped learning approach, which is called the education model of the future in order to ensure the continuity of education during the pandemic period, has advantages for increasing students' learning performance, interest, and motivation (Tang et al., 2020). On the other hand, many studies found that the application of flipped learning strategies addressed a few drawbacks of the switch to online lecturing. Nerantzi (2020) states that flipped learning approach provides students with the opportunity

to watch lesson videos at any time and place, as much as they want. Moreover, they find chance to learn and follow the lessons at their individual pace. Therefore, he offers flipped learning for educators and pupils in order to support flexible blended learning during the pandemic. Moreover, flipped learning approaches have active learning techniques such as discussion in the classroom, think-match-share and jigsaw to improve students' cooperative learning skills (Ugwuanyi, Nduji, Elejere and Omeke, 2020). Since students are made to perform metacognitive activities, they can gain the ability to comment (Webb and Doman, 2016). Similarly, Liu et al. (2020) reported that in consequence of applying flipped learning during the pandemic, pupils' autonomous learning and problem-solving abilities have improved. Furthermore, a study carried out by Lee (2020) confirmed that the flipped learning application increased the engagement of students. In addition, Jia et al. (2021) indicated that because flipped learning gives the opportunity for student-controlled learning, the usage of this approach gets accomplishment during the pandemic.

A brief literature analysis indicates that the flipped learning model is an effective way of actively and profoundly involving students in the learning process at all stages during the pandemic. The application of this technology-based approach has been perceived as a light to ensure the continuity of education following the urgent move to remote education following the interruption of in-person lectures brought on by the COVID-19 outbreak. Recently, when the literature is reviewed, it has been observed that a lot of studies have been carried out to investigate the effect of the flipped learning model during the pandemic on students' success, motivation, and interest. Accordingly, it is considered that gathering the results of these studies has vital importance in order to provide information for instructors to design online flipped classes in case of future urgent school closures. In light of the findings above, converting traditional classrooms to flipped classrooms can highly be recommended for engaging students in online learning and promoting student learning, motivation, and interest, especially during a pandemic that necessitates social distance and minimal human contact.

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Abstract

All of the world's biggest and most popular companies rely on customer satisfaction. Most of branded companies earned the trust and respect of their consumers, that in turn helped them gain popularity and longevity. As we look at today's biggest brands like Apple, Amazon, Nike they have a lot of fans worldwide, because of their great production work, as well as their support to the customers. Most of "top of the food chain" companies like to bring innovation into their work. As such first means of feedback and customer satisfaction come from the biggest companies that were mentioned earlier. Satisfying customer needs leads to companies being able to predict customer wants in the future. If the customer needs, wants are fully satisfied and he/she is fully comfortable with the product, which creates customer loyalty. In current day and age of countless companies creating similar means of service and production, customer loyalty is utmost important. Feedback and different means of surveys help companies learn the needs, identify the strong/weak sides and to some extent predict the needs of the market. Because of this a lot of companies start either building or outsourcing different feedback systems. Bigger companies like Amazon and Apple like to have their own systems, but some consider outsourcing the system for better quality. Feedback doesn't have to be just a system, most companies use different means to collect it, for example survey monkey is used by most companies, as it is partly free, easy to use and wide spread system.

Keywords: Customer satisfaction, Feedback, Service level, Customer support.

In recent years, a lot of companies delve and allocate resources into customer satisfaction studies. There are two types of wide spread research models: documentary and model based.

Documentary research are mostly descriptive in nature, as they only provide a snapshot of customer needs. If this model is researched on a group of consumers periodically, then a certain descriptive picture of customer satisfaction can be developed.

Model-based research on the other hand, attempt to provide a clear picture on why customers have different perceptions and how to change them. While this model also provides a snapshot of customer needs, the results are usually more powerful as they present the company ways and recommendations on how to improve customer satisfaction. Frequently said studies, also provide companies with recommendations for future planning.

Apart from this, there are also two methods to understand customer satisfaction, which are: quantitative and qualitative research study methods.

Quantitative helps companies form a bigger understanding of their customer experience based on relatively smaller number of interviews. Interviewees must be carefully selected if this is the only method used. The results however are based as the name suggests, on the large pool of interviews. Depending on size of the research responses can vary anywhere from fifty to thousands. Telephone based, internet based and mail based surveys are mostly used to collect data for such method.

Qualitative studies usually help provide company with the more detailed understanding of customer experience. Mostly the results of this methods are only based on dozens of interviews. These studies help understand customer more and bring light to customer perception. Focus group and one on one interviews are common example of such method.

As a conclusion, it would be wise to mention that gathering Feedback is one of the most important objectives of companies. It shows the customer satisfaction, customer needs and improvement paths for any given enterprise. Developing and using the feedback system is not a tough task and can even be outsourced. Various IT companies either create or even fully outsource Feedback as a service. Specialists to find the most useful information should do interpreting the data gathered from Feedback. As a means of encouragement, customers can also be offered various point programs or discounts.

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**INVESTIGATION OF THE EFFECT OF GLASS AND HEMP FIBER- REINFORCED
ALUMINUM COMPOSITE SANDWICHES ON EDGEWISE COMPRESSIVE STRENGTH**

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Abstract

Composite sandwiches are widely used in aviation, defense, marine, and land transportation vehicles, owing to their many advantages. The development of composite technologies has led to many problems such as increased costs and recyclability. The usability of natural fibers in composites is an important topic that needs to be investigated. The top and bottom faces of the composite sandwich are the most important factors providing rigidity and strength to the core structure. Face/core interface strength is another important factor. Additionally, the ultra-lightness of the sandwich composite should also be ensured at an optimum level. In this study, E-Glass fiber and Hemp fiber-reinforced aluminum composite sandwiches were produced. DGEBA epoxy was preferred as a matrix material for E-Glass and Hemp fabrics. DGEBA, which was used as a matrix material, was used between the aluminum honeycomb core structure and the composite faces. Fabrics soaked with epoxy were put on the upper and lower faces of the aluminum core, and composite sandwiches were produced using the hot-press method. The produced E-Glass and Hemp-reinforced aluminum composite sandwiches were cut according to ASTM standards and subjected to edgewise compressive tests. Both different composite sandwiches were compared with each other according to the results of the edgewise compressive tests. At the same time, the types of damage resulting from compression tests were examined by microscope analysis. And the dominant damage types in the fiber-reinforced composite faces and composite sandwiches were determined.

Keywords: Composite Sandwich, Hemp Fiber-Reinforcement, Edgewise Compressive Test.

1. INTRODUCTION

Sandwich composites are preferred in the fields of aviation, space, building construction, automotive defense technologies, as well as in marine transportation technologies and vehicles because of their properties such as ultra-lightness, high impact, rigidity and strength(Fan, Yang, Sun, & Fang, 2013; Gupta, Woldeesenbet, & Mensah, 2004; Mouritz & Gardiner, 2002; Tay, Lee, Kueh, & Lee, 2021). Reinforcement materials such as glass and carbon fiber are generally used on the face-sheets of composite sandwiches(Farooq et al., 2017; Jebadurai, Rose, & Aatthisugan, 2020). Fan et al. (2013) applied three-point bending and edgewise compression tests of carbon lattice core sandwiches of different thicknesses. They have identified dominant damage modes (Fan et al., 2013). Mamalis et al. (2005) applied the edgewise compression tests on two different glass faces and four different polymer core sandwich samples and interpreted their effects on impact strength. At the end of compression experiments, three different collapse damage modes were determined in sandwich samples. They determined that these modes were buckling with core and surface, face/core delamination with buckling and crushing damages(Mamalis, Manolakos, Ioannidis, & Papapostolou, 2005). Toubia et al. (2021) researched the edgewise compression behavior of different PVC foam core composite sandwiches with E-Glass/Vinyl Ester faces under thermal conditions. They investigated the damage behavior of the surface and core thicknesses under thermal effects(Toubia et al., 2021). Lei et al.(2016) determined that I and II buckling damage modes are important factors in the edgewise compression behavior of E-Glass/PVC foam sandwiches(Lei, Yao, Wen, Zhou, & Fang, 2016). Eyvazian et al. (2021) investigated

the effects of face hybridization and thickness, compression boundary conditions and resin pinning on the crush and buckling characteristics of PVC sandwiches with Glass, Dyneema and Aluminum faces under edgewise compression conditions (Eyvazian et al., 2021).

In recent years, factors such as global warming and environmental problems caused by synthetic wastes have brought to the fore the use of materials that can be dissolved in nature and recycled. This situation makes it important to prefer and research natural fibers as reinforcement material in composites. In general, the use of natural fiber types such as hemp, flax, kenaf and sisal in composites is preferred as reinforcement material (Bhoopathi, Ramesh, Kumar, Balaji, & Sasikala, 2018). Natural fibers have advantages such as good mechanical performance/weight, thermal and acoustic insulation, recyclable, low cost, easy availability, biodegradability and environmental friendliness (Bhoopathi et al., 2018; De Fazio et al., 2021; Malinowski et al., 2021; Ramesh, Palanikumar, & Hemachandra Reddy, 2016; Shahzad, 2012).

In this study, it was aimed to investigate the usability of Hemp fiber fabrics as surface reinforcement material in aluminum honeycomb core composite sandwiches due to the specified properties of natural fibers. Edgewise compression tests of synthetic fiber E-glass faces and Hemp faces were performed on aluminum composite sandwiches, and the edgewise compression and damage characteristics were examined and compared with each other.

2. MATERIALS AND METHOD

In this study, 3005/H19 series aluminum with 50 μ m foil thickness was used as the core material of the composite sandwiches. The aluminum honeycomb is a hexagonal geometry. The cell size of the honeycomb is about 5.2 mm and its height is about 8.3 mm. Its nominal density is 72.9 kg/m³. E-glass and Hemp natural fiber fabrics were used as reinforcement material in the upper and lower layered face-sheet composites of the sandwiches. DGEBA epoxy (Hexion LR 160) was preferred as the matrix material and surface/core interface adhesive of E-glass and Hemp composite faces. 25% by weight hardener was used to harden the matrix material. In the first stage of the production processes of the composites, E-glass fabrics (twill woven) and Hemp fabrics (plain woven) were wetted with epoxy by hand lay-up method in three layers for the upper and lower composite face-sheets. Three layers of wetted E-glass and Hemp fabrics were put on the upper and lower faces of the aluminum honeycomb. In the second stage of the production process, it was cured under hot press for 1 hour and 2 hours at 90°C and 120°C, respectively. The thicknesses of the E-Glass and Hemp composite faces were measured with a precision digital caliper as an average of 0.79 mm and 0.86 mm, respectively. E-glass and hemp composite sandwiches produced were cut in 50x50 mm dimensions in accordance with ASTM C 364 standards and made ready for edgewise compressive tests. The hot press method applied to E-glass and hemp aluminum composite sandwiches and the images of specimens are presented in Figure 1 and Figure 2.



Figure 1. Hot press composite sandwich production

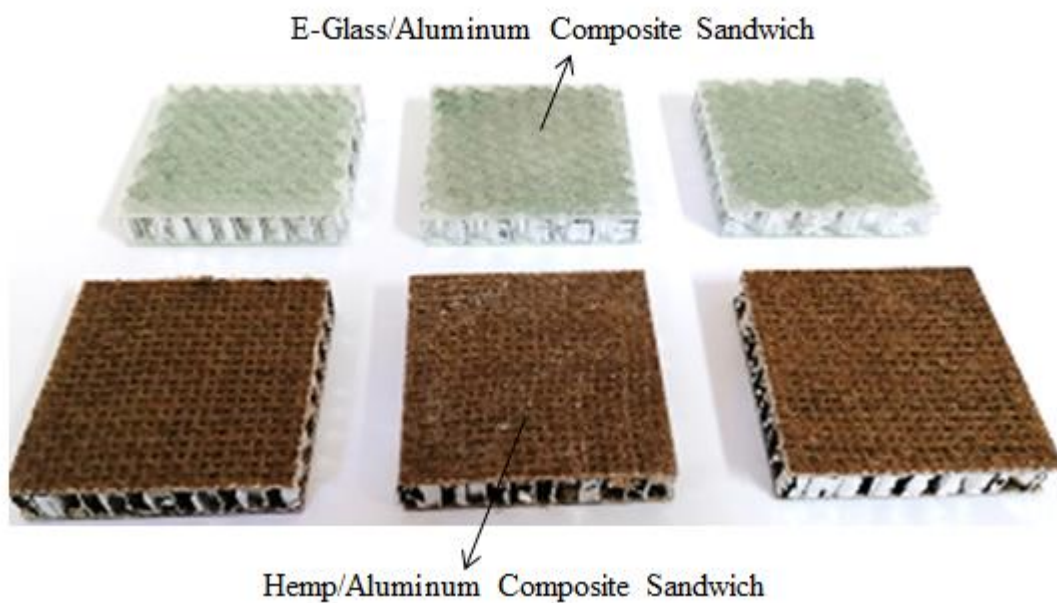


Figure 2. E-Glass and Hemp/Aluminum composite sandwich specimens.



Figure 3. Edgewise compressive tests of test device (a), E-Glass (b) and Hemp (c) sandwich specimens

3. Experimental Results

Edgewise compression tests were performed on E-Glass and Hemp sandwich samples according to ASTM C 364 standards and the obtained compression forces, strengths and compression damage behaviors were compared with each other. Compression load-displacement graph of E-Glass and Hemp sandwich samples is given in Figure 4. In Figure 5, the graph of the average compressive strength of the samples is presented. When the compression force-displacement graph presented in Figure 4 is examined, it is seen that the E-Glass sandwich samples show a higher maximum compression load than the Hemp samples. E-Glass and Hemp Sandwich samples showed average load values of 9828.7 N and 7591.6 N, respectively. The average compressive strengths of E-glass and Hemp composite sandwiches were obtained as 123.8 MPa and 87.9 MPa respectively according to ASTM standard. It can be observed that there are sudden losses in the load value after the maximum compression load. It is interpreted that sudden losses under compression load occur due to face/core delamination damages by forcing E-Glass composite faces to buckling from the aluminum core structure. In the hemp composite samples, after the compression load reached the maximum value, the sudden decrease in the compression loads was detected as in the E-Glass samples. It is observed in E-Glass and Hemp sandwich specimens that surface/core delamination damage occurs by forcing the surface layers to buckling under edgewise compression load. It is interpreted that the small fluctuating decreases in the force values after the sudden force decrease in the load-displacement curve of the E-Glass sample are the delamination and fiber breakage damages that occur with the bending caused by the buckling of the composite face layers. Macro images of composite sandwiches that have suffered buckling damage are given in Figure 6.

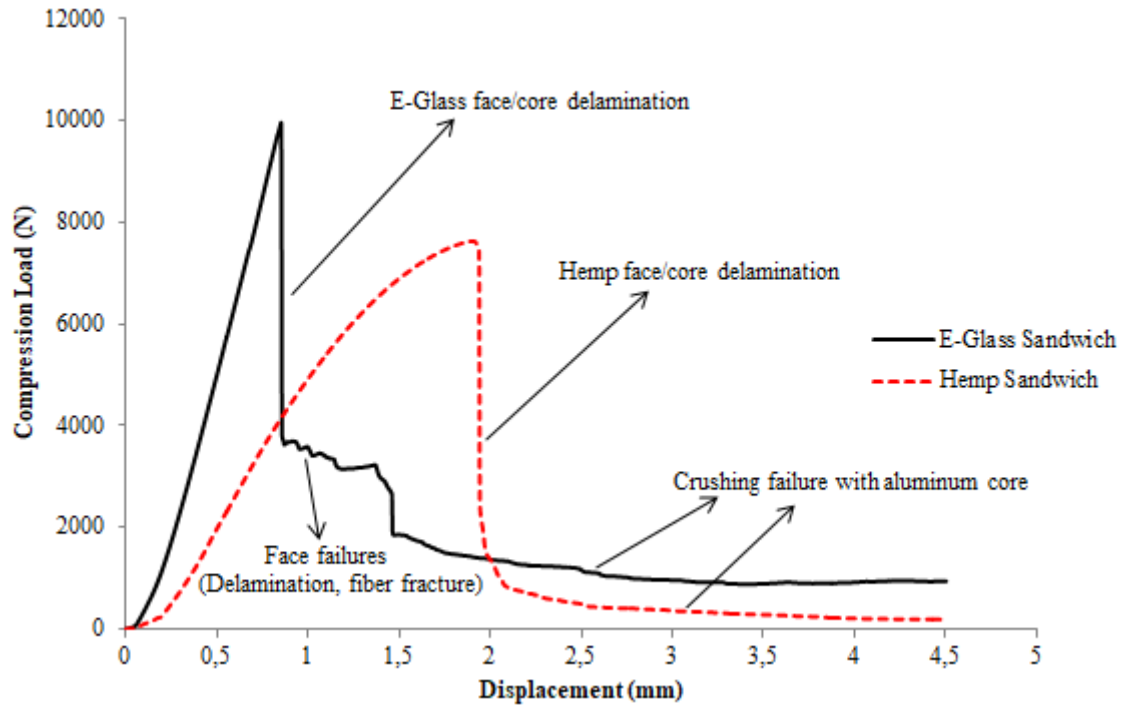


Figure 4. Compression Load & Displacement

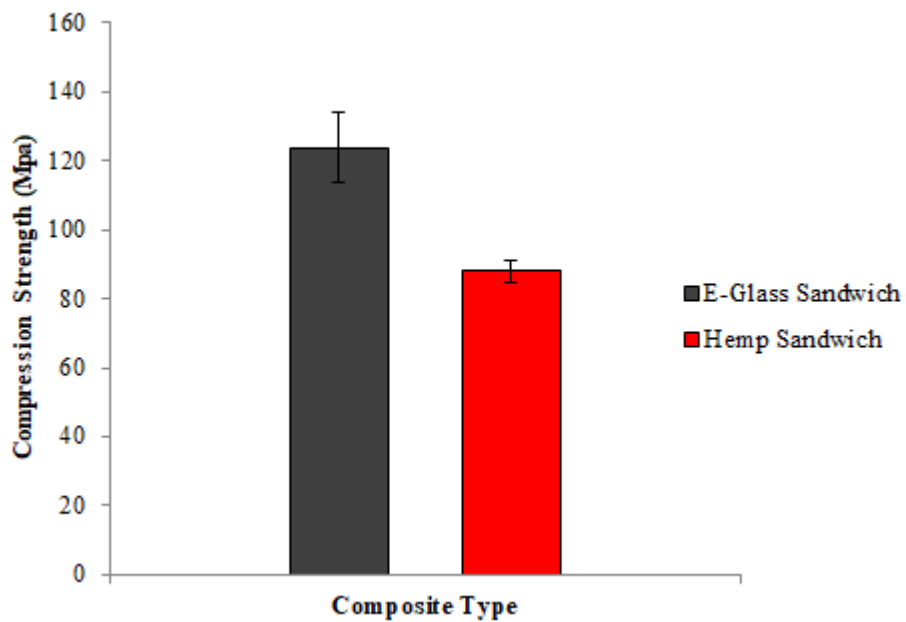


Figure 5. Average compression strength of composites

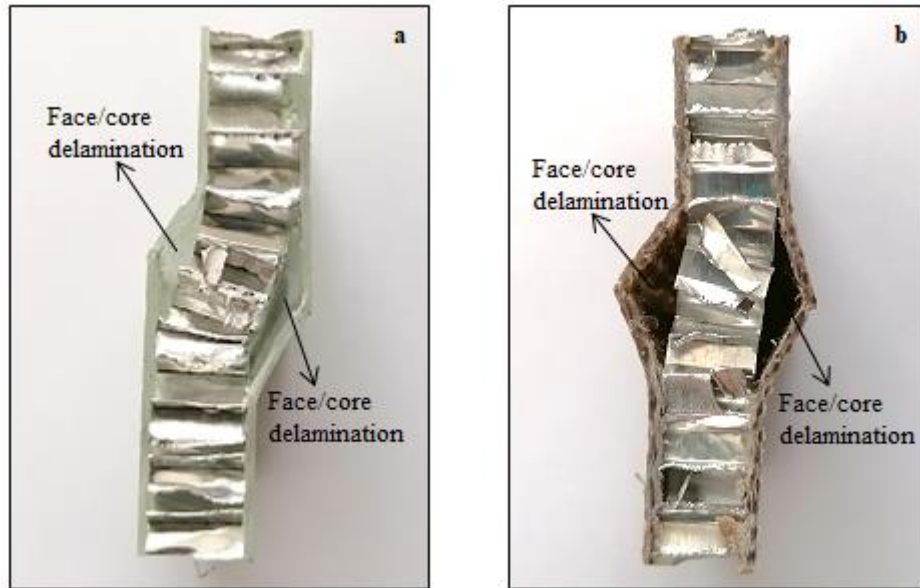


Figure 6. Macro failure images of E-Glass (a) and Hemp (b) sandwich specimens in the compression direction

When the damages occurred in the cross-sections in the side pressing direction given in Figure 6 (a) and (b) are examined, it can be seen that face/core delamination occur together with buckling. Face/core delamination damages can give us an idea about the face and core interface strength.

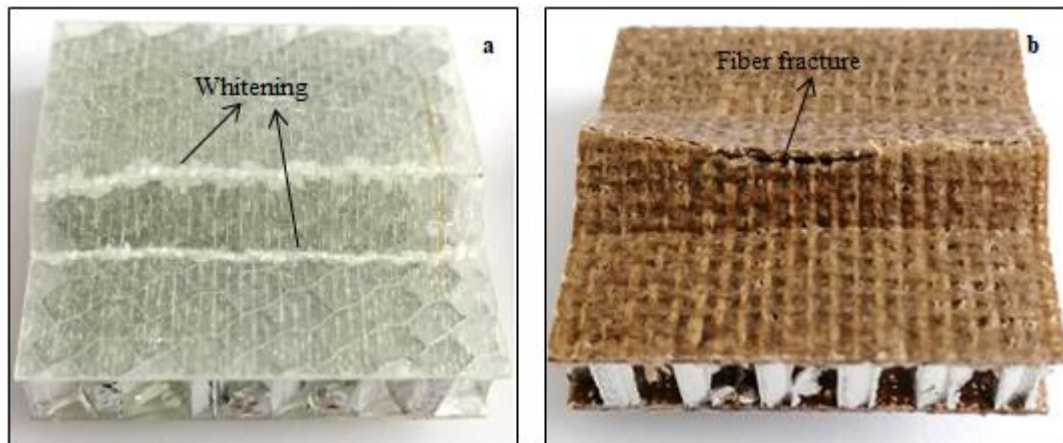


Figure 7. Surface failures of E-Glass (a) and Hemp (b) sandwich specimens

As a result of the edgewise compression force of the E-Glass and Hemp sandwich specimen observed in Figure 7, the damage to the surfaces can be seen. It can be interpreted that local debonding, delamination and fiber breakage failures occur with whitening in E-glass samples (Figure 7(a)). However, it can be clearly detected that buckling and fractures occur in the layers of hemp specimen due to the properties of natural fibers, as can be seen in Figure 7 (b). It is significant to examine the micro images of the failure areas to make better interpretations of damage. Micro images of E-glass and hemp samples are given in Figure 8 and Figure 9.

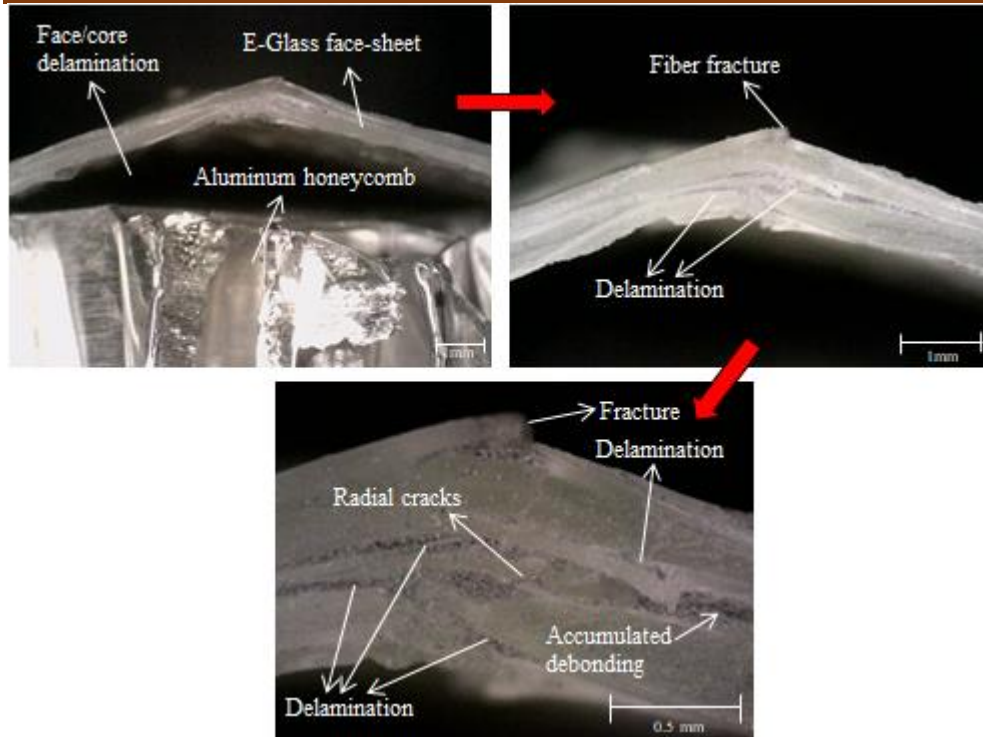


Figure 8. Failures of micro images of E-Glass sandwich specimen

In the microstructure images given in Figure 8, more delamination damages are observed on the E-Glass surfaces besides fiber breakage. Radial cracks are thought to be effective in directing delamination damages. At the same time, the accumulated debonding damages given in Figure 8 are thought to be an important factor in the formation and progression of delamination damages.

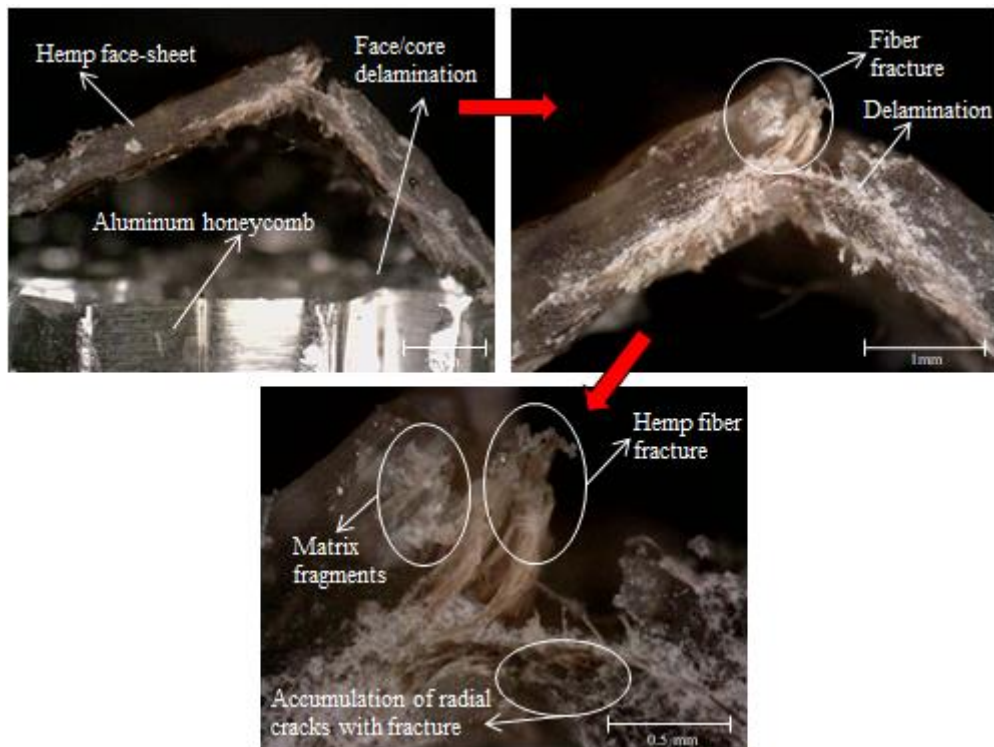


Figure 9. Failures of micro images of Hemp sandwich specimen

It can be clearly seen that there are fractures in the intense Hemp fibers in Figure 9. At the same time, fragments of the matrix can be seen in Figure 9, with intense fractures of Hemp fibers. It was detected

in the micro image that it formed in clustered radial cracks together with fracture damages. When micro damage images are evaluated together with macro damage images, it can be stated that the dominant damage caused by buckling on the faces of E-Glass samples is delamination damage and the faces of Hemp samples is fiber breakage damage.

4. Conclusion

The study aims to reveal the usability of natural fibers in the aerospace, aviation and automotive industries. Edgewise compressive strength tests were applied to E-Glass/aluminum composite sandwiches and hemp/aluminum composite sandwiches according to ASTM C 364 standards.

- In the compression tests, the mean edgewise compression load of the E-Glass samples was found to be approximately 9828.7 N. The mean edgewise compression load of hemp sandwich samples was determined as 7591.6 N.
- The mean compressive strengths of E-Glass and Hemp composite sandwiches were determined as 123.8 MPa and 87.9 MPa, respectively.
- When the micro images of the composite sandwiches were examined, it was commented that the dominant damage on the layered faces of the E-Glass composite sandwich was delamination damage.
- It was considered that the dominant damage on the layered hemp faces of the hemp composite sandwich was fiber breakage damage.
- When evaluated in general in the study, it can be interpreted that although the strength of hemp fibers is lower than E-Glass fibers, it can be an alternative to E-Glass composites according to their usage areas because of advantages.

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**GO-SU NANOAKIŞKANININ ÇALIŞMA ŞARTLARINA BAĞLI OLARAK ENTROPİ
ÜRETİMİ VE EKSERJİ KAZANIMININ ARAŞTIRILMASI**

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ÖZET

Bir ısıl sistemin entropi ve ekserji analizi, sistemin en uygun çalışma şartlarını belirlemek için kullanılabilecek en güçlü araçlardan biridir. Ekserji, kullanılabilirliğin bir ölçüsü iken; sistemdeki entropi üretiminin artışı kullanılabilirliği yani ekserjiyi azaltmaktadır. Bu nedenle, entropi ve ekserji birbirine zıt iki olgudur ve sistemin yüksek verimli olarak çalışabilmesi için kontrol altında tutulmaları gerekmektedir. Bu çalışmada, GO (Grafen Oksit)-Su nanoakışkanı kullanılan sabit ısı yüklü, 12 mm iç çaplı ve 1830 mm uzunluklu bakır düz bir borudan oluşan deneysel bir ısıl sisteminin entropi üretimi ve ekserji kazanımı analizi gerçekleştirilmiştir. Bakır boruya uygulanan ısı yükleri 250 W ve 350 W iken, borularda akan akışkanların debi değerleri 0,9 l/dak., 1,2 l/dak., 1,5 l/dak. ve 1,8 l/dak.' dır. Sistemde çalışma akışkanları olarak %0,01 ve %0,02 hacimsel konsantrasyona sahip GO-Su nanoakışkanı ve saf su kullanılmıştır. Bu çalışmadan elde edilen sonuçlar, literatürde bulunan farklı nanoakışkanlarla yapılan çalışmalarla kıyaslanmış ve sonuçların mantıklı ve tutarlı oldukları belirlenmiştir. Çalışmada değişken parametreler olarak; nanoakışkan konsantrasyonu, akışkan debisi ve boruya uygulanan ısı yükü kullanılmıştır. Çalışmanın sonuçları, 12 mm iç çaplı bakır boru uzunluğu boyunca ısı ve sürtünme entropi üretimi, çıkış ekserjisi ve 2. yasa veriminin değişimleri olarak ayrıntılı bir şekilde değerlendirilmiş ve en uygun çalışma şartları belirlenmiştir. Sonuçlar, 250 W ısı yükünde ve 0,9 l/dak.' lık debide boru boyunca ortalama olarak %0,02 GO-Su nanoakışkan konsantrasyonunda %0,01 GO-Su nanoakışkan konsantrasyonuna göre entropi üretiminde %93,43' lük azalma olduğunu göstermiştir. Ayrıca, 1,8 l/dak.' lık debide 0,9 l/dak.' lık debi değerine göre %0,01 GO-Su nanoakışkanının ekserjisi %58 daha fazla olup; 1,8 l/dak.' lık debide nanoakışkanın ikinci yasa veriminin 0,9 l/dak. debi değerinden %7,15 daha fazla olduğu belirlenmiştir.

Anahtar Kelimeler: Entropi üretimi, Ekserji kazanımı, GO-Su nanoakışkanı, 2. yasa verimi.

**INVESTIGATION OF ENTROPY GENERATION AND EXERGY GAIN OF
GO-WATER NANOFLUID DEPENDING ON WORKING CONDITIONS**

ABSTRACT

Entropy and exergy analysis of a thermal system is one of the most powerful tools that can be used to determine the optimum operating conditions of the system. While exergy is a measure of usability; The increase in entropy production in the system reduces the usability, that is, the exergy. Therefore, entropy and exergy are two opposite phenomena and they must be kept under control in order for the system to operate with high efficiency. In this study, entropy generation and exergy gain analysis of an experimental thermal system consisting of a copper straight pipe with a constant heat load, 12 mm inner diameter and 1830 mm length using GO (Graphene Oxide)-Water nanofluid was performed. While the heat loads applied to the copper pipe are 250 W and 350 W, the flow rates of the fluids flowing in the pipes are 0.9 l/min., 1.2 l/min., 1.5 l/min. and 1.8 l/min. GO-Water nanofluid with 0.01% and 0.02%

volumetric concentrations and distilled water were used as working fluids in the system. The results obtained from this study were compared with the studies conducted with different nanofluids in the literature and it was determined that the results were reasonable and consistent. As variable parameters in the study; nanofluid concentration, fluid flow rate and thermal load applied to the pipe were used. The results of the study were evaluated in detail as the variations of thermal and friction entropy generation, output exergy and the 2nd law efficiency along the length of the 12 mm inner diameter copper pipe, and the most suitable working conditions were determined. The results showed a 93.43% reduction in entropy production at an average of 0.02% GO-Water nanofluid concentration along the pipe at 250 W heat load and 0.9 l/min flow rate compared to 0.01% GO-Water nanofluid concentration. In addition, the exergy of 0.01% GO-Water nanofluid is 58% higher at a flow rate of 1.8 l/min compared to a flow rate of 0.9 l/min; it has determined that 2nd law efficiency of the nanofluid is 7.15% higher than the flow rate value of 0.9 l/min at a flow rate of 1.8 l/min.

Keywords: Entropy generation, Exergy gain, GO-Water nanofluid, 2nd law efficiency

1. GİRİŞ

Artan enerji kullanımı ve enerji kaynaklarının verimsiz değerlendirilmesi araştırmacıları ısı transferi üzerinde çalışmaya zorlamıştır. Bununla birlikte, araştırmacılar ayrıca ısı performansını iyileştirilmesi ve sistemin basınç kayıplarının azaltılmasına yönelik çalışmalara da yönelmişlerdir. Isı transfer oranları ile ilgili özellikler araştırılmış ve ısı sistemlerinin verimliliğini arttırmanın daha iyi bir yolunu bulmak için hala çalışılmaktadır.

Son zamanlarda, araştırmacılar su, etilen glikol, yağlar vb. gibi geleneksel akışkanların termofiziksel özelliklerini iyileştirmeye çalışmaktadırlar. Geleneksel çalışma akışkanlarının ısı iletkenliği, bu akışkanlara ısı iletkenliği yüksek nanometre boyutundaki katı parçacıkların eklenmesiyle artırılmaktadır. Birçok araştırmacı, boyutları 1 nm ile 100 nm arasında değişen, metaller (Cu, Al, Ag, Au vb.), metal oksitler (CuO, Al₂O₃, ZnO, TiO₂ vb.), karbon bazlı malzemeleri (grafit, grafen, karbon nanotüp) kullanmaktadırlar (Wen ve ark., 2009; Saidur ve ark., 2011; Godson ve ark., 2010).

Grafen, olağanüstü mekanik, termal ve elektriksel özellikler sergilemekte ve bu nedenle birçok araştırmacının dikkatini çekmiştir (Novoselov ve ark., 2005). Grafen suyu sevmez. Grafit, grafen okside (GO) oksitlendiğinde, termal iletkenliği grafitten daha düşüktür. Ancak GO su benzeri bir özelliğe sahiptir, kullanılan nanoakışkanın kararlılığı yükselir ve çökelme olmaz (Yu ve ark., 2010).

Termodinamiğin ikinci yasası, işin dönüşümü sırasında kaybedilen enerjinin dönüşüm miktarı olan entropi ile ifade edilir. Hem fiziksel hem de kimyasal tüm süreçler, sistemin entropisini en üst düzeye çıkarmaya çalışır, yani kullanılabilir enerjiyi azaltma eğilimindedir. Termodinamiğin ikinci yasasına göre, bir süreçte meydana gelen entropi üretimi, kaybolan iş ve kullanılmayan enerji ile ilişkilidir (Bejan, 1996). Bu nedenle sistemler için entropi üretiminin minimum seviyede tutulması esastır. Entropi, diğer bir deyişle, tersinmezlik, ısı transferi ve viskoz sürtünme tarafından üretilen ısıya neden olduğu etkilerdir (Singh ve ark., 2010).

Bejan (1979) tarafından tanıtılan entropi üretimi minimizasyon yöntemi, akışkanlar mekaniği, ısı transferi ve termodinamiğin bir kombinasyonudur. Günümüzde akışkan akışı ve ısı transferinin sürtünme ve ısı transferi değerlendirmesi (Ji ve ark., 2016; Herwig ve Wenterodt, 2011; Schmandt ve Herwig, 2011), ısı borusu ve soğutma sistemlerinin optimizasyonu (Khalkhali ve ark., 1999; Myat ve ark., 2011), iki fazlı doğal dönüşüm çevrimlerinin performans iyileştirmesi gibi birçok uygulamada yaygın olarak kullanılmaktadır (Goudarzi ve Talebi, 2015). Ayrıca birçok araştırmacı, termal sistemin optimum tasarım durumunu keşfetmek için entropi üretimini araştırmıştır. Mahmud ve Fraser (2002) kanaldaki akışkandaki entropi üretimini araştırmış ve enerji denkleminde viskoz ısıtma faktörünü ihmal etmiş ancak entropi denkleminde dikkate almıştır. Mahmud ve Fraser (2003), başka bir çalışmada, gözenekli ortamlarda akışın tersinmezliğini analitik olarak ifade etmişlerdir. Leong ve ark., (2012) analitik çalışmada sırasıyla 2-10 m uzunluk ve 0,01-0,03 m çapında dairesel bir boruda laminar koşullarda hacimce %0-7 Al₂O₃-su nanoakışkanı ve türbülanslı ve hacimce % 0-4 TiO₂-su nanoakışkanı

için entropi üretiminin %6,4 azaldığını belirlemiştir. Moghaddami ve ark., (2012) 1 m uzunluğunda ve 6 mm çapında radyal bir boruda hacimce %1-4 Al_2O_3 -su nanoakışkanı için yaptıkları sayısal çalışmalarında toplam entropi üretiminde %15'lik bir azalma elde ederken, termal entropi üretiminde bu azalma oranı %25 olmuştur. Al_2O_3 -su nanoakışkanının kullanıldığı başka bir çalışmada, Karami ve ark., (2012), 45,7 cm uzunluğunda ve 0,457 cm iç çapı olan dairesel bir boruda %0,6 hacimsel nanoakışkan konsantrasyonu için entropi üretiminde %6'lık bir azalma belirlemişlerdir. Hussien ve ark., (2019), 300 μm iç çaplı ve 0.27 m uzunluğunda pirinçten yapılmış bir boruda, MWCNT/GNP-DW hibrit nanoakışkan için $Re=200$ 'de termal entropi üretimi için maksimum %37.5'lik bir azalma bulmuşlardır. Mehrali ve ark., (2015), çalışmalarında GNP (Grafen nano plaka) - su nanoakışkanını kullanarak laminar akış koşulları altında dairesel bir borudaki entropi üretimini analiz etmişlerdir. Çalışmada, ağırlıkça %0.025-%0.1 aralığında nanoparçacık konsantrasyonu kullanılmış ve konsantrasyon artışı ile toplam entropi üretiminin azaldığını saptamışlardır. Ji ve ark., (2017) dairesel bir boruda tam gelişmiş türbülanslı akış için RANS türbülans modelini kullanarak Al_2O_3 -su nanoakışkanının entropi üretim analizini sayısal olarak gerçekleştirmişlerdir. Korei ve Benissaad (2021) üç boyutlu 90° dirsek yoluyla Al_2O_3 -su nanoakışkanının entropi üretimini analiz etmişlerdir. Hacimce %2 nanoparçacık konsantrasyonu için $Re=10000$ 'de minimum toplam entropi üretimini elde etmişlerdir. Taşkesen ve ark., (2021) laminar akış koşullarında 16 mm hidrolik çapa ve 1,5 m uzunluğa sahip çeşitli kanal geometrilerinde Fe_3O_4 -su nanoakışkanlarının entropi üretimini araştırmışlardır. Hacimce %5'lik nanoakışkanın suya göre %12,1 daha düşük entropi üretim oranı sunduğunu, hacimce %2'nin ise %5,5 daha düşük, hacimce %1'in suya göre %2,9 daha düşük entropi üretimi olduğunu belirlemişlerdir. Keklikcioğlu (2021) türbülanslı akış koşullarında bir ısı eşanjör borusunda %0,5 - 1 aralığında altı farklı hacimsel fraksiyona sahip grafen-demir oksit-su hibrit nanoakışkanın entropi üretim analizini sayısal olarak araştırmıştır. Sonuçlar, entropi üretiminin hibrit nanoakışkan hacim konsantrasyonunun artmasıyla azalan bir eğilim sergilediğini göstermiştir.

Belirli bir durumda ve miktarda enerjinin pratik çalışma potansiyeli gibi bir özelliği tanımlamak çok yardımcı olacaktır. Bu özellik, kullanılabilirlik veya kullanılabilir enerji olarak da bilinen ekserjidir. Kütle ve enerji korunan özellikler iken ve ekserji enerji ile aynı birimde olmasına rağmen korunmayan bir özelliktir. Madde veya enerjinin tüm dönüşümlerinde her zaman ekserji kaybı vardır. Ekserji kaybı, toplam entropi üretimi ile doğrudan ilişkilidir (Szargut ve ark., 1988).

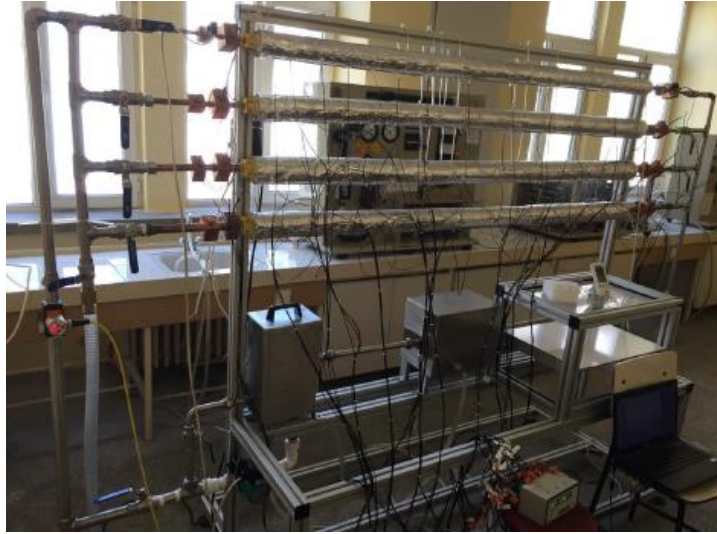
Ekserji analizi, enerji kayıplarının boyutunu, şeklini ve yerini doğru bir şekilde belirlediği için enerjiyi ve kaynakları verimli kullanmak için faydalı bir analiz yöntemidir. Ekserji analizi, ekserji yıkımının ve ekserji kayıplarının meydana geldiği süreçleri ve bölgeleri belirler. Bir ekserji analizi yapmanın amacı, doğanın sınırları içinde termodinamik mükemmellik derecesini ölçmektir. Bu bağlamda literatürde şimdiye kadar farklı alanlarda ekserji analizleri üzerine çok sayıda araştırma yapılmıştır. Ekserji analizi daha çok kimyasal işlemlere ve ısı eşanjörlerine uygulanmıştır. Ancak ısı değiştiricili sistemlerde nanoakışkanların kullanıldığı ekserji analizleri oldukça sınırlıdır. Khaleduzzaman ve ark., (2016) deneysel çalışmalarında, 94mmx94mmx20mm boyutlarındaki bir kanalda 1.0-1.5 l/dak. arasında bir akış hızında %0,1 TiO_2 -su nanoakışkanı için çıkış ekserjisinde %87'lik bir artış elde etmişlerdir. Başka bir çalışmada, Khaleduzzaman ve ark., (2014) deneysel olarak hacimce %0,1-0,25 konsantrasyon aralığında Al_2O_3 -su nanoakışkanı için 50 mm uzunluğunda ve 0,8 mm yüksekliğinde ve 0,5 mm genişliğinde mini kanal soğutucusunda çıkış ekserjisinde %60,86 artışa ulaşmışlardır. Pandey ve Nema (2012) 2-5 l/dak. akış hızı aralığında bir plakalı ısı eşanjöründe hacimce %2-4 Al_2O_3 -su nanoakışkanı ile %8,6 boyutsuz ekserji kaybı elde etmişlerdir. Ahammed ve ark., (2016) çok portlu mini kanallı ısı eşanjöründe hacimce % 0,1'lik Al_2O_3 -su, Grafen-su ve Grafen- Al_2O_3 -su hibrit nanoakışkanın ısı transferi ve ekserji analizini gerçekleştirmiştir. Çalışılan nanoakışkanlar arasında, Grafen-su nanoakışkanının, ısı transferi ve ekserjik analiz açısından daha iyi üretkenlik gösterdiği sonucuna ulaşmışlardır.

Bir termal sistemin optimum tasarımına yönelik modern yaklaşım, termodinamiğin ikinci yasasına dayanmaktadır. Özellikle entropi üretimi, bir sistemin üretkenliğini yorumlamak için bir değişken olarak kullanılmaktadır. Optimum tasarım, en düşük entropi üretimine sahip sistem olarak kabul edilmektedir. Entropi üretiminin minimum olduğu koşulları belirlemenin en doğru yolu, entropi üretimi analizi yapmaktan geçmektedir. Ancak, literatüre ve edindiğimiz bilgilere göre, farklı çalışma koşullarına ve sabit ısı yüküne sahip borularda GO-Su nanoakışkanının kapsamlı bir entropi ve ekserji

incelemesi bulunmamaktadır. Bu nedenle, bu çalışmadaki deneysel ısı sistemde GO-Su nanoakışkanının entropi üretimi ve ekserji analizleri, sabit ısı akıllı 12 mm iç çapa sahip düz bakır boruda gerçekleştirilmiştir. Boruya uygulanan ısı yükleri 250 W ve 350 W iken, borulardaki akışkan debi değerleri aralığı 0,9 l/dak.-1,8 l/dak.'dır. Borularda çalışma akışkanları olarak %0,01 ve %0,02 konsantrasyonlu GO-Su nanoakışkanı ve saf su kullanılmıştır. Bu çalışmadan elde edilen entropi ve ekserji analiz sonuçları, literatürde farklı nanoakışkanların kullanıldığı çalışmalarla karşılaştırılmış ve sonuçların mantıklı ve tutarlı olduğu görülmüştür. Bu çalışmanın temel amacı, uygulanan deneysel koşullar altında termodinamiğin ikinci yasa analizi ile entropi üretimini en aza indirecek en uygun koşulları belirlemek ve buna göre ikinci yasa verimlerini karşılaştırmaktır. Çalışmanın sonuçları, 12 mm iç çapa sahip boruda farklı GO-Su nanoakışkanı konsantrasyonlarında ısı ve sürtünme entropi üretimi, çıkış ekserji oranı ve 2. Yasa verimi olarak sunulmuştur.

2. DENEYSEL SİSTEM

Bu çalışmada, Şekil 1'de verilen deney sisteminde kullanılan 12 mm iç çapa ve sabit ısı yüküne sahip bakır borudaki GO - su nanoakışkanının entropi ve ekserji analizleri yapılmıştır. Deney tesisatı temel olarak test bölümü (12 mm iç çaplı boru), veri kayıt bölümü, toplama tankı, pompa ve soğutma bölümünden oluşmaktadır. Toplama tankından alınan test sıvısı bir pompa ile ana hatta pompalandıktan sonra debimetreden geçerek 12 mm çaplı borulardan oluşan test bölümüne ulaşır. Akış hızı bir vana ile kontrol edilebilen ve istenilen sıcaklığa ulaştıktan sonra bu borudan geçen belirli bir sıcaklıktaki akışkan, sabit bir giriş sıcaklığı elde etmek için şehir suyu ile soğutulan spiral şekilli bakır borudan oluşan soğutucudan geçerek toplama tankına geri döner. Ayrıca, 12 mm çaplı boru deney sisteminde üstten 2. Sırada bulunan borudur.



Şekil 1. Entropi ve ekserji analizi yapılan borunun deneysel sistemi

2.1 Nanoakışkanın Hazırlanması

Bu çalışmanın deneysel kısmında grafitten sentezlenen GO nanoparçacığı kullanılmıştır. GO nanoparçacığı sentezlenirken grafit bazı kimyasallarla işleme alınmıştır. Bu işlemde sonra grafit, asitlerden ve kimyasallardan ayrılması için damıtılmış sudan geçirildi ve daha sonra GO nanoparçacıkları elde etmek için bir fırında kurutuldu (Hajjar ve ark. 2014; Hummers ve Offeman, 1958). GO-Su nanoakışkanı, sentezlenen GO nanoparçacığı kullanılarak iki aşamalı bir nanoakışkan hazırlama yöntemi ile elde edilmiştir. Deneylerde kütleleri 0,4 g ve 0,8 g olan GO nanoparçacıkları kullanılarak sırasıyla %0,01 ve %0,02 hacimsel konsantrasyonlarda GO-Su nanoakışkanları elde edilmiştir.

Nanoakışkandaki hacimsel nanoparçacık konsantrasyonu Denklem (1) ile hesaplanmaktadır.

$$\frac{v_p}{v_{nf}} = \frac{v_p}{v_{bf} + v_p} = \frac{\frac{m_p}{\rho_p}}{\frac{m_p}{\rho_p} + \frac{m_{bf}}{\rho_{bf}}} = \frac{m_p \rho_{bf}}{m_p \rho_{bf} + m_{bf} \rho_p} \quad (1)$$

Denk. (1)' de m_p nanoparçacık kütlesi, m_{bf} su kütlesi ve ρ_{bf} ve ρ_p sırasıyla su ve nanoparçacığın yoğunluklarıdır.

2.2 GO-Su Nanoakışkanının Termofiziksel Özellikleri

Hazırlanan nanoakışkanın viskozite ölçümleri Malvern Kinexsus Pro koni ve plaka gerilim kontrollü reometre ile yapılmıştır. Isıl iletkenlik katsayısının ölçümü, literatürde sıkça kullanılan sıcak tel yöntemi ile KD2 Pro ısı iletkenlik ölçer kullanılarak yapılmıştır. Nanoakışkanın yoğunluk ölçümleri Anton-Paar DMA 4200 Yoğunluk Ölçer ile deneysel olarak yapılmıştır. Bununla birlikte, nanoakışkanın özgül ısı değeri, Pak ve Cho (1998) tarafından önerilen analitik model sonucunda Denklem (2) ile elde edilmiştir.

$$c_{pnf} = (1 - \phi)c_{pbf} + \phi c_{pp} \quad (2)$$

Denk. (2)' deki p, nf ve bf sırasıyla partikül, nanoakışkan ve baz akışkanı ifade etmektedir. Ayrıca konsantrasyonun düşük olması nedeniyle nanoakışkanın hesaplanması sonucunda elde edilen özgül ısı değeri, suya yakın olduğu için birbirine eşit alınmıştır.

Nanoakışkanın ve saf suyun özgül ısı dışında diğer termofiziksel özellikleri deneysel olarak elde edilmiş ve Tablo 1'de gösterilmiştir.

Tablo 1.

Akışkan	k (W/mK)	ρ (kg/m ³)	c_p (J/kgK)	μ (Ns/m ²)
Saf su	0,6172	995,8	4178,4	803,4x10 ⁻⁶
GO-Su (0.01%)	0,6696	996,1	4178,4	1000x10 ⁻⁶
GO-Su (0.02%)	0,678	996,1	4178,4	1060x10 ⁻⁶

Akışkanların termofiziksel özellikleri

2.3 Isı Transferi Hesabı

Test bölümüne sağlanan ısı yükü Denk. (3) ile hesaplanmaktadır.

$$Q = VI \quad (3)$$

Denklem (3)' deki V ve I voltaj ve akım değerini ifade etmektedir.

Test borusuna sağlanan ısı akısı Denk. (4) ile bulunmaktadır.

$$q'' = \frac{Q}{A_s} = \frac{Q}{\pi D_e L} \quad (4)$$

Bu denklemdeki, A_s ısı transferi yüzey alanını, L ve D_e ise borunun uzunluğu ve dış çapıdır.

Akışkana olan ısı transferi Denk. (5) ile gösterilmektedir.

$$Q_f = \dot{m} c_p (T_o - T_i) \quad (5)$$

Denk. (6)' da akışkanın kütleli debisi belirtilmektedir.

$$\dot{m} = \rho u_m A_c \quad (6)$$

Bu denklemlerdeki, ρ , u_m , c_p ve A_c sırasıyla akışkanın yoğunluğunu, ortalama hızını, özgül ısısını ve test borusunun kesit alanını ifade ederken; T_o ve T_i ise akışkanın borudan çıkış sıcaklığını ve boruya giriş sıcaklığını göstermektedir.

Taşıyım ısı transfer katsayısı, aşağıdaki Denk. (7) ile ifade edilmektedir.

$$h_{(x)} = \frac{q''}{T_{s(x)} - T_{m(x)}} \quad (7)$$

Bu denklemdeki, x borunun girişinden olan mesafeyi belirtirken; $T_{s(x)}$ ve $T_{m(x)}$ ise sırasıyla ölçüm yapılan noktadaki boru yüzey sıcaklığını ve kesit alanı boyunca ortalama kütleli akış ortalama sıcaklığını ifade etmektedir. Bununla birlikte, $T_{m(x)}$ aşağıdaki Denk. (8) ile hesaplanmaktadır.

$$T_{m(x)} = T_{m,i} + \frac{q'' P}{\dot{m} c_p} x \quad (8)$$

Bu denklemdeki, $T_{m,i}$ ve P sırasıyla ortalama akış giriş sıcaklığını (30 °C) ve borunun çevresini vermektedir.

Denk. (7) ile elde edilen taşıyım ısı transfer katsayısı Denk. (9)' daki boru uzunluğu boyunca Nu sayısına ulaşmak için kullanılmaktadır.

$$Nu_{(x)} = \frac{h_{(x)} D_i}{k} \quad (9)$$

Burada, D_i borunun iç çapı, k akışkanın ısıl iletkenliğidir.

Reynolds sayısı (Re), Denk. (10) ile gösterilmektedir.

Re sayısı

$$Re = \frac{\rho u_m D_i}{\mu} \quad (10)$$

Deneyler sırasında, basınç ölçümleri ile ulaşılan değerler, sürtünme faktörü (f)' i elde etmek için kullanılır. Deneysel f Denk. (11) ile aşağıdaki gibi hesaplanmaktadır.

Deneysel sürtünme faktörü

$$f = \frac{\Delta P}{\left(\frac{L}{D_i}\right) \left(\frac{\rho u_m^2}{2}\right)} \quad (11)$$

2.4 Entropi hesabı

Sabit ısı akısına sahip düz bir boruda akışkan akışı sırasında ısı transferi ve akışkan sürtünmesinden kaynaklanan entropi üretim hızı aşağıdaki gibi hesaplanmaktadır (Singh ve ark., 2010).

Isıl entropi

$$S_{T_{\text{üretim}(x)}} = \frac{q''^2 \pi D_i x}{Nu_{(x)} k T_{\text{ort}(x)}} \quad (12)$$

Sürtünme entropisi

$$S_{Füretim(x)} = \frac{32m^3 f x}{\rho^2 T_{ort(x)} \pi^2 D_i^5}$$

(13)

Denk. (12) ve (13)' de D_i borunun giriş çapı iken, x yüzey termokupllarının boru girişinden olan mesafesidir. ρ ise akışkan yoğunluğudur.

Denklem (13)' deki $T_{ort(x)}$ aşağıdaki gibi hesaplanmaktadır.

$$T_{ort(x)} = \frac{T_i - T_{m(x)}}{\ln\left(\frac{T_i}{T_{m(x)}}\right)} \quad (14)$$

2.5 Ekserji Hesabı

Çıkış ekserjisi, Denk. (15) ile hesaplanmaktadır (Narendran ve ark., 2018).

$$E_{çıkış} = m \dot{c}_p \left[(T_o - T_{ort}) - T_{ortam} \ln\left(\frac{T_o}{T_{ortam}}\right) \right] \quad (15)$$

Burada, $E_{çıkış}$ çıkıştaki ekserji, T_o çıkıştaki akışkan sıcaklığı, T_{ortam} deneyin yapıldığı laboratuvar şartlarındaki ortam sıcaklığı olup; ekserji hesaplamalarında 22 °C olarak alınmıştır.

Giriş ekserjisini hesaplamak için aşağıda verilen Denk. (16) kullanılmıştır.

$$E_{giriş} = m \dot{c}_p \left[(T_i - T_{ortam}) - T_{ortam} \ln\left(\frac{T_i}{T_{ortam}}\right) \right] \quad (16)$$

Sistemin 2. yasa verimi Denk. (17)' den aşağıdaki gibi elde edilebilmektedir.

$$\eta = \frac{E_{çıkış}}{E_{giriş} + E_e} \quad (17)$$

Burada, η verimi, E_e ise sisteme sağlanan elektrik ekserjisini belirtmektedir.

Akışkanın sabit bir ısı yükü ile ısıtılması için borunun etrafına sarılan nikel krom tel ısıtıcı sayesinde sisteme sağlanan elektrik ekserjisi Denk. (18) ile hesaplanmaktadır.

$$E_e = \left[1 - \left(\frac{T_{ortam}}{T_{ort}} \right) \right] Q_f \quad (18)$$

3. DENEYSEL SİSTEMİN ENTROPİ, EKSERJİ VE 2. YASA VERİMİ ANALİZİ

Bu çalışmadaki çıkış ekserjisi sonuçlarının doğru ve kabul edilebilir olduğunu kanıtlamak için bu çalışmanın sonuçları (Tablo 2); Ahammed ve ark., (2016)' nın (Tablo 3) sonuçlarıyla kıyaslanmıştır. Ahammed ve ark., (2016) çalışmalarında su ve %0,1 hacimsel konsantrasyonda Grafen-su ve Al_2O_3 -su nanoakışkanlarını kullanmışlardır. Çalışmalarında Re sayısı aralığı 200-1000 iken sistemdeki hidrolik çap 1,184 mm'dir. Elde edilen maksimum çıkış ekserjisi, 200 Re sayısında grafen, alüminyum oksit-su (Al_2O_3 -su) nanoakışkanı ve su için sırasıyla 26,06 W, 22,33 W ve 20,57 W' dir. Bu sonuçların, daha düşük GO-Su nanoakışkan (%0,01) konsantrasyonunda ve daha yüksek Re sayılarında ($Re=1580-3171$) çalışılan sunulan çalışmadaki ekserji değerleri ile uyumlu olduğu görülmektedir. Bu uyumlu sonuçlara

literatürde incelenen çalışmalarda entropi değerleri için de ulaşılmış ve entropi grafiklerinin yorumlanmasında tartışılmış ve incelenmiştir.

Tablo 2. Farklı Re sayılarında akışkanların çıkış ekserji değerleri

Re	Saf su	Re	%0,01 GO-Su
2043	16,39	1580	17,35
2692	19	2111	20,26
3352	22,86	2641	23,92
3945	26,39	3171	27,48

Şekil 2’ de 250 W ısı yüküne sahip 12 mm iç çaplı ve 1,83 m boyundaki bakır düz boru boyunca ısı entropi üretiminin ($S_{T_{\text{üretim}}}$) değişimi debi değişimine (Re sayısına) bağlı olarak gösterilmektedir. Entropinin azalması, ısı geçişinin artışıyla sonuçlanmaktadır. Bu bağlamda, debinin artışı, nanoakışkana olan ısı transferini artırarak; ısı entropi üretiminin azalmasını sağlamaktadır. Şekil 1’ de görüldüğü gibi en düşük entropi üretimi 1,5 l/dak debiye sahip olan nanoakışkan için elde edilirken; en yüksek ısı entropi üretimi ise 0,9 l/dak’ lık debi değerinde görülmektedir. 0,9 l/dak ve 1,2 l/dak’ lık debilerde boru boyunca ortalama olarak 1,5 l/dak’ lık debi değerine göre ısı entropi üretiminde sırasıyla %170 ve %147’ lik artışlar bulunmaktadır. Artan akışkan hareketliliği nanoakışkanın boru cidarıyla olan etkileşimini artırarak ısı geçişini iyileştirmektedir.

Tablo 3. Farklı Re sayılarında Ahammed ve ark., (2016)’nın çıkış ekserjisi değerleri

Re	Saf su	%0,1 Grafen-Su	%0,1 Al ₂ O ₃ -Su
200	20,57	26,06	22,33
400	20	24,39	21,37
600	19	23,74	20,57
800	18,48	23,45	19,86
1000	18,13	22,81	19,57

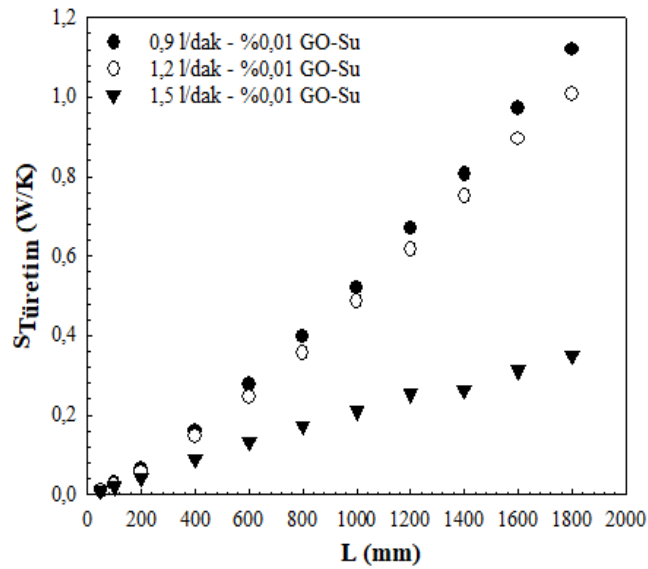
Boru boyunca farklı debilerde ve 250 W ısı yükünde %0,01 ve %0,02 hacimsel konsantrasyonlarda GO-Su nanoakışkanının ısı entropi üretimi ($S_{T_{\text{üretim}}}$) değişimleri Şekil 3’ de verilmektedir. Nanoakışkanın konsantrasyon değerinin artması, ısı geçişine katılan nanoparçacık sayısının artmasını sağlamaktadır. Bu da, sabit ısı yüküne sahip (250 W) bakır boru yüzeyinden nanoakışkana olan ısı transferini artırmaktadır. Bu nedenle, %0,02 GO-Su nanoakışkanın boru boyunca $S_{T_{\text{üretim}}}$ değeri, %0,01 konsantrasyonlu olan GO-Su nanoakışkanından daha düşüktür. 0,9 l/dak’ lık debide boru boyunca ortalama olarak %0,02’ lik nanoakışkan konsantrasyonunda %0,01’ lik nanoakışkan konsantrasyonuna göre entropi üretiminde %93,43’ lük azalma sağlanmaktadır. Bununla birlikte, nanoparçacık konsantrasyonu yanında debi değerinin artışı da entropi üretimi azalışını daha da azaltmaktadır.

Şekil 4’ de %0,02 konsantrasyona sahip GO-Su nanoakışkanı için boru boyunca farklı debilerde (0,9 l/dak ve 1,2 l/dak) ve farklı ısı yüklerinde (250 W ve 350 W) $S_{T_{\text{üretim}}}$ ’ in değişimi sunulmaktadır. Entropi üretimi artışının temel nedenlerinden biri, ısı geçişidir. Bir sisteme olan ısı geçişi, sistemin entropisini

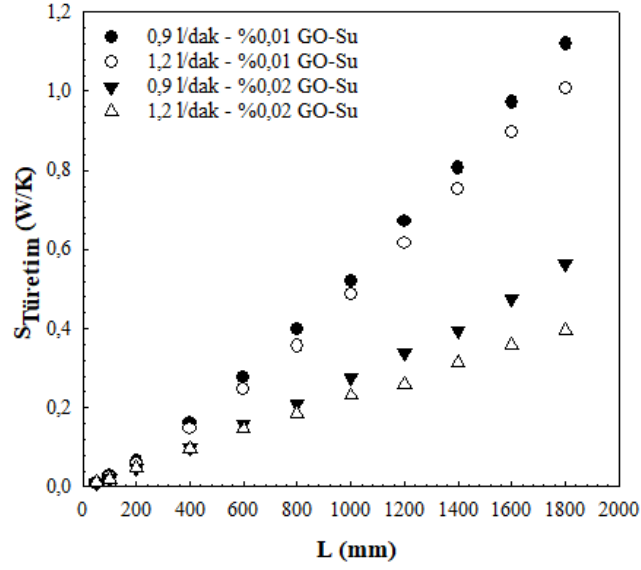
artırmaktadır. Bu nedenle, Şekil 4’ de de görülebildiği gibi her iki debi değerinde de 350 W’ lık ısı yükünde 250 W’ lık ısı yüküne göre elde edilen ısı entropi üretim miktarı daha fazladır. Boru boyunca 1,2 l/dak debi değerinde ve 350 W ısı yükünde 250 W ısı yüküne göre ısı entropi üretiminde %47’ lik artış bulunmaktadır. Ayrıca, entropi üretimi miktarı her iki ısı yükü için de debi değerinin artışına bağlı olarak azalış sergilemektedir.

Boru boyunca farklı debilerde ve 250 W ısı yükünde %0,01 GO-Su nanoakışkanı için sürtünme entropisinin değişimi Şekil 5’ de gösterilmektedir. Hem boru cidarı hem de nanoparçacıklar arası etkileşime bağlı olarak gelişen sürtünme entropisi debinin artışıyla yükselmektedir. Buna bağlı olarak 1,5 l/dak’ lık debide en yüksek sürtünme entropisi elde edilirken; en düşük entropi değerleri ise boru boyunca 0,9 l/dak’ lık debide görülmektedir. Boru boyunca ortalama olarak 0,9 l/dak ve 1,2 l/dak’ lık debilerde 1,5 l/dak’ lık debiye göre $S_{Füretim}$ değerlerinde sırasıyla %77 ve %49’ luk azalışlar elde edilmektedir.

Şekil 6’ da borudaki debi değerine bağlı olarak saf su ve %0,01 GO-Su nanoakışkanının çıkış ($E_{çıkış}$) ekserjisinin değişimi görülmektedir. Ekserji kullanılabilirliğin bir ölçüsüdür. Entropinin artışı, kullanılabilirliği yani ekserjiyi azaltmaktadır. Bu nedenle, entropi ve ekserji birbirine zıt iki olgudur. Debinin artışı, ısı transferini artırıcı etki yaparak akışkanın kullanılabilirliğini artırmaktadır. Bunun yanında sürtünme entropi üretimini ise artırmaktadır (Şekil 5). Bunun yanı sıra, Şekil 6’ da da görüldüğü gibi nanoakışkandaki nanoparçacıkların ısı transferini artırıcı etkisiyle, saf suya göre nanoakışkanın kullanılabilirliği artmaktadır. 1,8 l/dak’ lık debide 0,9 l/dak’ lık debi değerine göre %0,01 GO-Su nanoakışkanının kullanılabilirliği %58 daha fazladır.

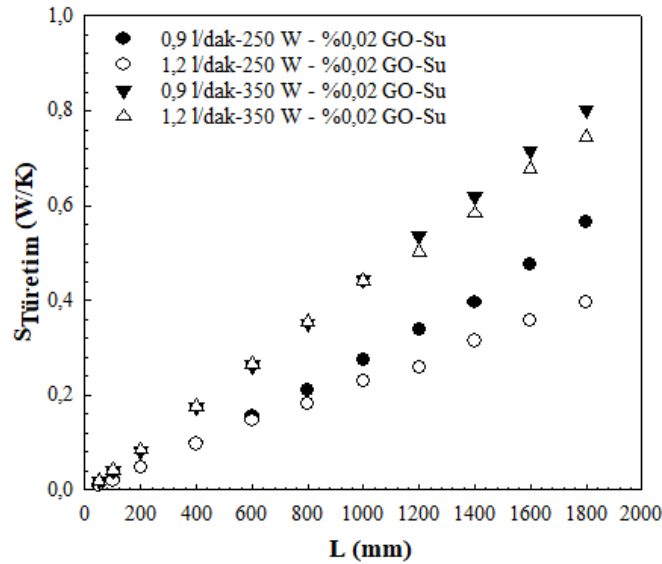


Şekil 2. 250 W ısı yükünde boru boyunca farklı debilerde %0,01 GO-Su nanoakışkanının ısı entropi üretiminin değişimi

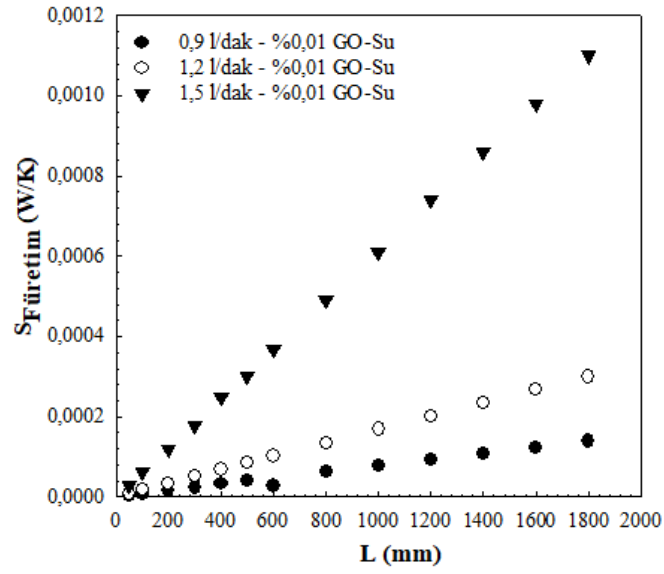


Şekil 3. 250 W ısı yükünde boru boyunca farklı debilerde %0,01 ve %0,02 hacimsel konsantrasyonlu GO-Su nanoakışkanının ısı entropi üretiminin değişimi

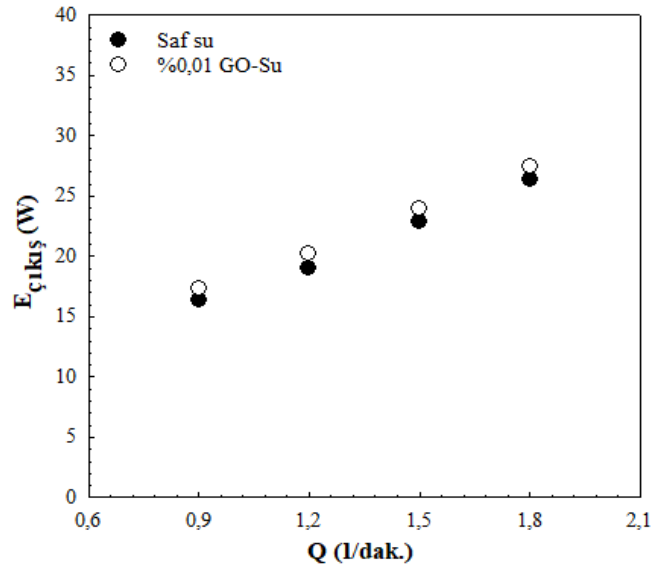
Şekil 7' de boru boyunca farklı debilerde akışkanların 250 W ısı yükünde ikinci yasa verimlerinin (η) değişimleri sergilenmektedir. İkinci yasa verimi, akışkanın çıkış ekserjinin; giriş ekserjisi ve elektrik ekserjisi nedeniyle sisteme sağlanan ekserjinin toplamının oranıdır. İkinci yasa verimi (η), debinin artışıyla ve akışkana eklenen nanoparçacıklar nedeniyle artan ısı geçişine bağlı olarak elde edilen çıkış ekserjisinin artışıyla artmaktadır. Bu nedenle, saf suya göre nanoakışkanın ikinci yasa verimi daha fazla iken; 1,8 l/dak'lık debide nanoakışkanın ikinci yasa verimi %97,15 iken 0,9 l/dak'lık debide %90 olmaktadır.



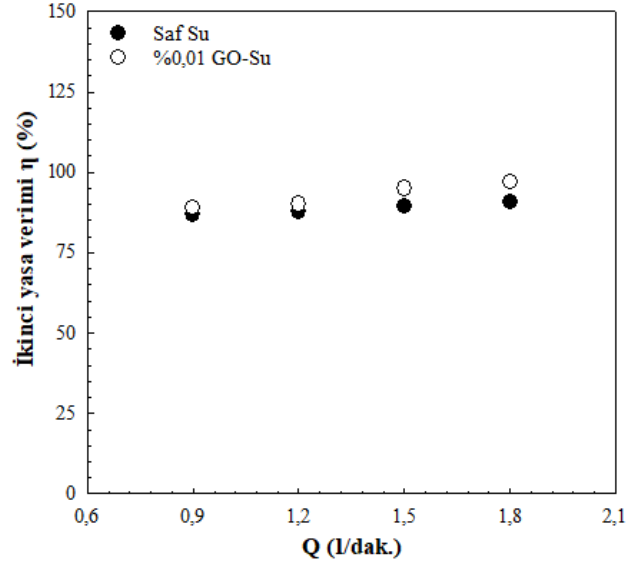
Şekil 4. %0,02 GO-Su nanoakışkanı için farklı debilerde ve ısı yüklerinde



Şekil 5. 250 W ısı yükünde %0,01 GO-Su nanoakışkanı için farklı debilerde



Şekil 6. 250 W ısı yükünde debi değerine göre akışkanların



Şekil 7. 250 W ısı yükünde debi değerine göre akışkanların

4. GENEL SONUÇLAR VE TARTIŞMA

Gerçek bir süreç sırasında, enerji miktarı her zaman korunur, ancak kalitesinin düşmesi gerekir. Kalitedeki bu düşüşe entropideki artış eşlik eder. Bununla birlikte, ısı enerjisi düzensiz bir enerji şeklidir ve ısı enerjisi ile birlikte bazı düzensizlikler de taşınır.

Isıl sistemlerde ısı transferi sırasında oluşacak bu düzensizliklerin azaltılması, ısı sistemin ekserjisinde bir artışa yol açacaktır. Ekserjideki artış, entropi üretimini azaltarak mümkün olacaktır. Buna göre, bir ısı sistemin verimini yükseltmek için entropi oluşumunu en aza indiren, esasen düşük entropili bir sistem tasarlanmalıdır. Bu nedenle, nanoakışkanlarda ısı transferini artırmak için entropi ve ekserji analizi hayati önem taşımaktadır.

Bu çalışmada, iç çapı 12 mm olan ve sabit ısı yüküne sahip yatay bakır bir boruda hacimsel konsantrasyonları %0,01 ve %0,02 olan Su (saf) ve GO-Su nanoakışkanının entropi ve ekserji analizleri gerçekleştirilmiştir. Böylece, kullanılan bakır boruda çalışılan nanoakışkan konsantrasyonlarında en düşük entropi ve dolayısıyla en yüksek ekserjili kullanım koşulları belirlenmeye çalışılmıştır. Çalışmadan elde edilen sonuçlar şu şekilde özetlenebilir:

- Debinin artışı, nanoakışkana olan ısı transferini artırarak; ısı entropi üretiminin azalmasını sağlamaktadır.

- En düşük entropi üretimi 1,5 l/dak debiye sahip olan nanoakışkan için elde edilirken; en yüksek entropi üretimi ise 0,9 l/dak'lık debi değerinde görülmektedir.

- 0,9 l/dak ve 1,2 l/dak'lık debilerde boru boyunca ortalama olarak 1,5 l/dak'lık debi değerine göre ısı entropi üretiminde sırasıyla %170 ve %147'lik artışlar bulunmaktadır.

- %0,02 GO-Su nanoakışkanın boru boyunca $S_{T_{\text{üretim}}}$ değeri, %0,01 konsantrasyonlu olan GO-Su nanoakışkanından daha düşüktür.

- 0,9 l/dak'lık debide boru boyunca ortalama olarak %0,02'lik nanoakışkan konsantrasyonunda %0,01'lik nanoakışkan konsantrasyonuna göre entropi üretiminde %93,43'lük azalma sağlanmaktadır. Bununla birlikte, nanoparçacık konsantrasyonu yanında debi değerinin artışı da entropi üretimi azalışını daha da azaltmaktadır.

-350 W'lık ısı yükünde 250 W'lık ısı yüküne göre elde edilen ısı entropi üretim miktarı daha fazladır. Boru boyunca 1,2 l/dak debi değerinde ve 350 W ısı yükünde 250 W ısı yüküne göre ısı entropi üretiminde %47'lik artış bulunmaktadır.

- Boru boyunca ortalama olarak 0,9 l/dak ve 1,2 l/dak'lık debilerde 1,5 l/dak'lık debiye göre $S_{F_{\text{üretim}}}$ değerlerinde %77 ve %49'luk azalışlar elde edilmektedir.

- Nanoakışkandaki nanoparçacıkların ısı transferini artırıcı etkisiyle, saf suya göre nanoakışkanın kullanılabilirliği artmaktadır. 1,8 l/dak'lık debide 0,9 l/dak'lık debi değerine göre %0,01 GO-Su nanoakışkanının kullanılabilirliği %58 daha fazladır.

- Saf suya göre nanoakışkanın ikinci yasa verimi daha fazla iken; 1,8 l/dak'lık debide nanoakışkanın ikinci yasa verimi %97,15 iken 0,9 l/dak'lık debide %90 olmaktadır.

Sonuç olarak, hacimsel debideki artış ısı entropi üretim miktarını azaltırken, sürtünme entropi üretim miktarını artırmaktadır. Ayrıca boruya uygulanan ısı yükünün artması da entropi üretimini artırmaktadır. Dolayısıyla bu çalışmada da görüldüğü gibi düşük konsantrasyonlarda GO-Su nanoakışkanının kullanılması bile saf suya kıyasla entropi üretimini azaltarak; ısı sistemin ekserjisini artıracak ve böylece enerjinin verimli kullanımını sağlayarak küresel ısınmaya olumlu katkı sağlayacaktır.

SEMBOLLER

A	Alan, m^2
c_p	Özgül ısı, $J\ kg^{-1}\ K^{-1}$
D	Boru çapı, m
E	Ekserji, W
f	Sürtünme faktörü, boyutsuz
h	Isı taşınım katsayısı, $W\ m^{-2}K^{-1}$
I	Akım, Amper
k	Isı iletim katsayısı, $W\ m^{-1}K^{-1}$
L	Boru boyu, m
$\dot{m}$	Kütleli debi, $kg\ s^{-1}$
Nu	Nusselt sayısı, boyutsuz
P	Borunun çevre uzunluğu, m

S	Entropi, W K ⁻¹
q"	Isı akısı, W m ⁻²
Q	Isı yükü, W
Re	Reynolds sayısı, boyutsuz
T	Sıcaklık, °C
V	Voltaj, Volt
u	Hız, m s ⁻¹
x	Test bölümünün girişinden olan uzaklık, m
ΔP	Basınç düşüşü, Pa
μ	Viskozite, kg m ⁻² s ⁻¹
φ	Konsantrasyon, %
ρ	Yoğunluk, kg m ⁻³
η	2. Yasa verimi, %

Alt İndisler

bf	Temel akışkan
c	Kesit
e	Dış
f	Akışkan
nf	Nanoakışkan
p	Parçacık
m	Ortalama
m,i	Ortalama giriş
s	Yüzey

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**A NEW DEEP LEARNING-BASED APPROACH FOR AUTOMATED KIDNEY STONE
DETECTION FROM CT SCANS**

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Abstract

Kidney stone disease has been increasing worldwide in recent years. Various medical imaging methods such as (Computed Tomography) CT, ultrasonography and MRI (Magnetic Resonance Imaging) are utilized to detect and locate kidney stone. Among them, CT is the most widely utilized imaging modality. However, in the diagnosis of kidney stones, interpretation of CT scans is a time-consuming, laborious and experience-requiring process. In this study, a new deep learning-based model is proposed for automatic kidney stone detection from CT scans. In the proposed model, transfer learning strategy is employed and model achieved 94.1% classification accuracy for 10-fold cross validation. The high classification accuracy achieved shows that the proposed model can be used as a tool to assist the specialist for kidney stone detection. It also automates the interpretation process, thus minimizing specialist errors.

Keywords: Machine learning, Deep learning, Kidney stone detection, Transfer learning

INTRODUCTION

Kidney stones, also known as renal calculi, are mineral concretions in the calyces and pelvis found free or attached to the renal papilla. In addition, stones known as nephrolithiasis or urolithiasis may form in the urinary tract as a result of excessively supersaturated urine to a mineral (Khan et al., 2016). The prevalence of kidney stones has been increasing in recent years due to changing lifestyle, dietary habits global warming, and developments in medical imaging (Coe et al., 2005; Khan et al., 2016; Romero et al., 2010; Siener, 2021; Thongprayoon et al., 2020). Patients with kidney stones usually apply to the hospital with the complaint of severe back or flank pain (Thongprayoon et al., 2020). Kidney stones can be treated with shockwave lithotripsy method or surgically (Coe et al., 2005; Khan et al., 2016). In addition, stones can lead to kidney failure and obstruction of the urinary tract, reducing the quality of life (Yildirim et al., 2021). However, these complaints may be caused by kidney cancer, pyelonephritis, and musculoskeletal strain (Thongprayoon et al., 2020). Therefore, the diagnosis of kidney stone is inevitable for a correct and complete treatment. Various medical imaging modalities such as computed tomography (CT), ultrasonography and magnetic resonance imaging (MRI) are utilized to detect and locate kidney stone (Brisbane et al., 2016; Ziemba & Matlaga, 2015). Among them, non-contrast CT is the most widely used and most accurate imaging modality for kidney stone examination due to its high sensitivity, specificity, ability to accurately size the stone and evaluate non-stone-related pathologies. In addition, non-contrast CT has ionizing radiation. Therefore, ultrasonography is the first preferred method for imaging kidney stones in pregnant women and children. Ultrasonography is less expensive than CT and does not have ionizing radiation. However, it has lower sensitivity and specificity than CT (Brisbane et al., 2016; Thongprayoon et al., 2020).

Early and accurate diagnosis of kidney stones is important for the success of therapeutic practice and the prevention of severe kidney stone diseases (Elton et al., 2022). In addition, the interpretation of non-contrast CT scans, which is the most commonly used imaging method, is time consuming and laborious. Moreover, if there are insufficient experts or the experts have a heavy workload, the decision-making process may be delayed and misinterpretations may be encountered in this process (Baygin et al., 2022). Recently, rapid developments in artificial intelligence and especially deep learning have shown that these techniques can be used successfully in classification and segmentation of medical images (Yanase

& Triantaphyllou, 2019). For this purpose, various artificial intelligence-based computer-aided diagnosis systems have been developed for high accuracy detection of diseases such as brain tumor (Aurna et al., 2022), skin cancer (Jain et al., 2021), Covid-19 (Ismael & Şengür, 2021), multiple sclerosis (Narayana et al., 2020), Alzheimer's (Loddo et al., 2022), lung cancer (Ardila et al., 2019), and breast cancer (Jabeen et al., 2022). These intelligent systems reduce the workload of the expert, assist the expert in the decision-making process and eliminate the manual interpretation process. Thus, expert errors are prevented during the interpretation of medical images and the effectiveness of the treatment is increased. Several methods have been proposed in the literature for the detection of kidney stones. Artificial intelligence techniques were utilized in most of the proposed methods (Baygin et al., 2022; Caglayan et al., 2022; Cui et al., 2021; De Perrot et al., 2019; Parakh et al., 2019; Yildirim et al., 2021). Also, mostly CT images were used for kidney stone detection. In addition, several traditional image processing-based methods have been proposed for kidney stone detection (Borges et al., 2022; Caycho Valencia et al., 2022; Nithya et al., 2020). These methods rely on the hand-crafted feature extraction process. Current studies reveal the need for an efficient, powerful and automated model that can detect kidney stones with high accuracy. Therefore, in this study, a high-accuracy, automated, deep learning-based approach for kidney stone detection using non-contrast CT images, which is the standard imaging method, is presented. In the presented approach, the transfer learning technique was utilized. For this purpose, the pre-trained DenseNet201 network is employed as feature extractor and the extracted features are classified by fine kNN. The proposed final model achieved 94.1% accuracy for 10-fold cross validation on the large dataset containing 1799 non-contrast CT images.

MATERIALS AND METHODS

Proposed Approach

In this study, a new transfer learning-based approach for kidney stone detection using non-contrast CT images is presented. The presented approach is depicted in Figure 1. Accordingly, non-contrast CT images are fed into the pre-trained DenseNet201 network and 1000 dimension deep features are extracted from the fc1000 layer of the network. Then the extracted deep features are classified by fine kNN.

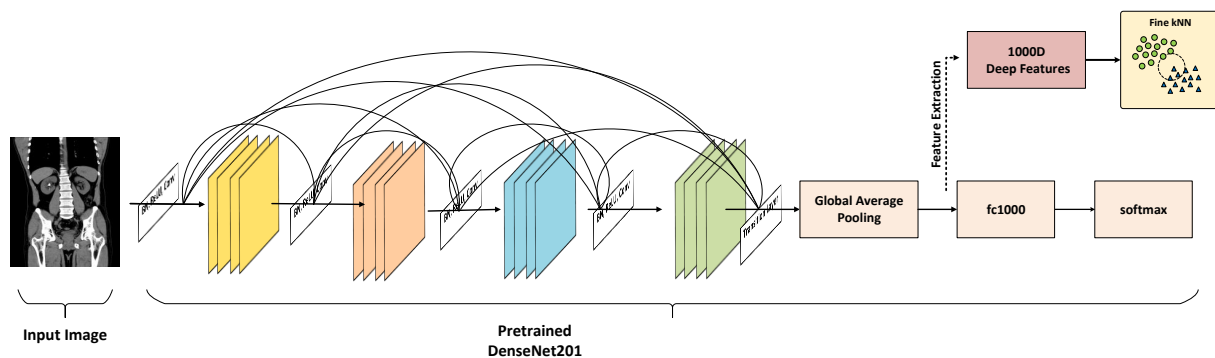


Figure 1. The proposed approach

Dataset

In this study, a publicly available two-class (kidney stone, normal) data set collected by Yildirim et al. (Yildirim et al., 2021) was used. The dataset consists of 1799 non-contrast CT images, 790 of which belong to the kidney stone class and 1009 to the normal class. The CT images in the dataset were obtained from a total of 433 subjects, 278 of whom were kidney stones and 165 were normal. The images were stored in PNG format. The original dataset published by the authors is divided into two folders, test and training. The training and test datasets included 1453 and 346 non-contrast CT images, respectively. In this study, test and training datasets were merged before using the dataset. Randomly selected examples of CT images from the kidney stone and normal classes in the dataset are shown in Figure 2.



Figure 2. Randomly selected non-contrast CT images from kidney stone and normal classes in dataset.

Transfer Learning

Today, deep learning methods and its flagship CNNs produce smart solutions to many problems, especially medical image classification. In fact, the history of CNNs dates back to 1980. However, the unexpected success of the AlexNet CNN model, developed by (Krizhevsky et al., 2012) in 2012, in the ImageNet competition showed the potential of CNNs in image classification task. After this success of AlexNet in image classification, many CNN architectures such as VGGNet (Simonyan & Zisserman, 2014), GoogleNet (Szegedy et al., 2014), ResNet (He et al., 2015), MobileNet(Howard et al., 2017; Sandler et al., 2018), DenseNet (Huang et al., 2016) and ShuffleNet (Zhang et al., 2018) have been developed since 2012.

Training CNN models from scratch requires a large amount of labeled datasets and powerful hardware that can perform intensive computational operations (Kang et al., 2021; Narayana et al., 2020). In addition, training the models from scratch is quite laborious and time consuming (Morid et al., 2021). Moreover, the large labeled dataset currently available is limited, especially in the medical field. If the model is trained from scratch using a dataset with a small number of samples, it is possible to encounter an overfitting problem (Kaur & Gandhi, 2020). A transfer learning strategy has been proposed to overcome these problems. Transfer learning is defined as the process of transferring a model previously trained on a similar problem, for example ImageNet, with its weights to solve a similar problem (Deepak & Ameer, 2019). This technique eliminates the laborious and time-consuming scratch training process, the need for powerful hardware and large labeled datasets, and minimizes the risk of overfitting. The pre-trained model transferred in the transfer learning strategy is mainly used for two purposes: feature extractor or classifier (Öksüz et al., 2022; Shoeibi et al., 2021). If the transferred model is used as a feature extractor, the feature is extracted from a certain layer of the pre-trained model, usually the last connected layer, and the extracted features are classified by traditional machine learning classifiers. If it is used as a classifier, the output layer of the pre-trained model is customized for the new problem. Then, the customized model is fine-tuned for several epochs using the new dataset.

In this study, a transfer learning strategy is used to classify non-contrast CT images as kidney stone or normal. For this purpose, firstly, the pre-trained DenseNet201 model is employed as a feature extractor, and then the extracted features are classified by fine kNN.

DenseNet Architecture

CNNs are an algorithm of deep learning, a sub-branch of machine learning. Basically, the CNN architecture consists of three core blocks, the convolution layer, the pooling layer, and the fully

connected layer, as shown in Figure 3 (Alzubaidi et al., 2021; Sarvamangala & Kulkarni, 2022). In the convolution layer, features are extracted using learnable filters. In the pooling layer, the size of the extracted feature maps is reduced. In the fully connected layer, the features are classified by the forward neural network.

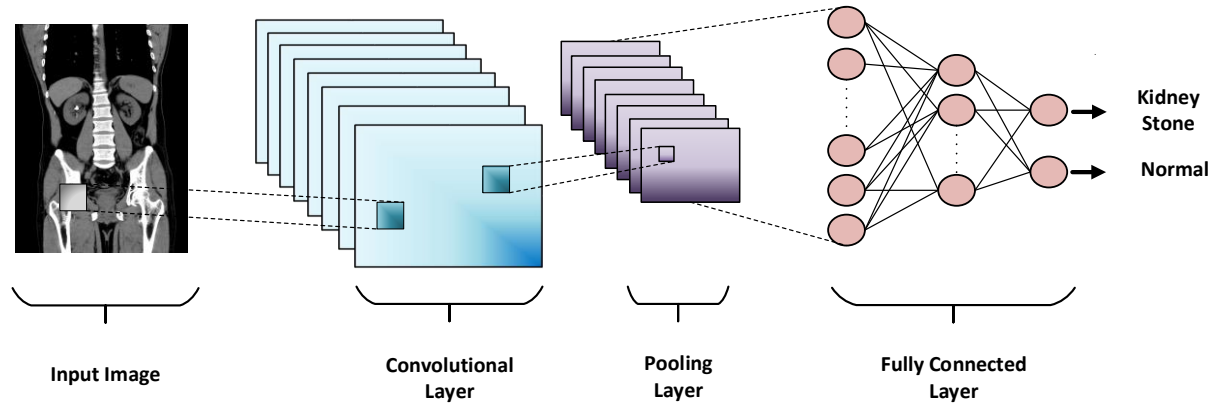


Figure 3. The core blocks of CNN.

Dense Convolutional Network (DenseNet) is a CNN model developed by (Huang et al., 2016). In this model, the output of each layer is connected to every other layers through the dense blocks. In other words, each layer uses the feature maps of the previous layers as input. Thus, the information flow between layers is at the maximum level. Moreover, this architecture alleviates the problem of vanishing gradient, which is an important problem as the network gets deeper, allows features to be reused, strengthens feature propagation, and greatly reduces the number of parameters. However, it has the problem of large memory usage. There are various DenseNet architectures, consisting of 121, 169, 201 and 264 layers, respectively. All DenseNet architectures basically consist of 10 parts: convolution, pooling, 4 dense blocks, 3 transition layers and a classification layer. The difference between the architectures is due to the number of convolutional layers in the dense block.

RESULTS

In this study, a new transfer learning-based approach for kidney stone classification is introduced. All coding was done in MATLAB R2022a software on a laptop with 16 GB RAM, Intel(R) Core i7-11800H @ 2.30GHz CPU and NVIDIA GeForce RTX 3050 GPU. Since the data set we used was not large enough, the transfer learning strategy was utilized. Therefore, popular pre-trained CNN networks trained on ImageNet dataset are used as feature extractors. The extracted features were classified by traditional machine learning classifiers using 10-fold cross validation. Classification accuracies obtained from traditional machine learning classifiers for 10-fold cross validation are presented in the Table 1.

Table 1. Evaluation results of features extracted from pre-trained CNN models by traditional machine learning classifiers using 10-fold cross validation.

CNN Modeli	Kübik SVM	Quadratik SVM	Fine KNN	Weighted KNN	Bagged Trees	Subspace KNN	Neural Network (Wide)
AlexNet	84.8	81.4	90.1	79.5	74.4	89	80.3
DarkNet19	85.2	82.6	91.3	81.1	75.9	90.9	81.5
Densenet201	87	84.4	94.1	80.5	75	93.4	82.3

GoogleNet	81	79	85.7	75.8	71.4	84.3	77.5
VGG16	84.1	80.7	90.8	80.3	75.1	90	79.5
MobileNetV2	80.4	83.5	91.6	80.8	70.8	91.6	78.4
Resnet50	88.5	84.5	91.7	79.3	74.7	90.7	82.5
InceptionV3	81.8	79.4	83.9	76.4	70	83.7	76.5
SqueezeNet	81.8	84.9	89.4	80.1	72.9	89.4	80.3

Classification accuracies were calculated over the confusion matrix using Eq.1.

$$\frac{TP + FP}{TP + TN + FP + FN} \quad (1)$$

Where, true positive (TP) and false positive (FP) refer how many of the positive and negative predictions are correctly classified by the classifier, respectively. Similarly, true negative (TN) and false negative (FP) refer how many of the positive and negative predictions are incorrectly classified, respectively.

According to the evaluation results in the Table 1 obtained from the traditional classifiers, the best performance was obtained from the KNN classifier by using the features extracted from DenseNet201. Therefore, DenseNet201 was used as feature extractor and fine KNN was used as classifier for kidney stone classification. The confusion matrix of the proposed DenseNet201-fine KNN-based model is shown in the Figure 4.

		PREDICTED CLASS	
		Kidney Stone	Normal
TRUE CLASS	Kidney Stone	702	88
	Normal	17	992

Figure 4. Confusion matrix of the proposed approach.

According to Figure 4, the proposed approach incorrectly classifies only 88 of the kidney stone CT images. It incorrectly classifies only 17 of the normal images.

DISCUSSION

Recently, deep learning methods have shown tremendous success in the task of classifying medical images (Alzubaidi et al., 2021). In this study, a deep learning-based model was developed for kidney stone classification. The comparison of the developed model with the existing studies, its limitations and strengths are given in the Table 2.

Table 2. Comparison of the proposed model and existing studies.

Authors Year	and Method	Accuracy (%)	Limitations and Strengths
Proposed model	DenseNet201-kNN	94.1	Lightweight, low complex and low intensive load.
(Yildirim et al., 2021)	XResNet-50	96.82	Time consuming and complex. High accuracy.
(Baygin et al., 2022)	ExDark19, INCA, kNN	99.22	Intensive computational load and high complex. High accuracy.
(Nithya et al., 2020)	GLCM, ANN	93.45	Small dataset and low accuracy.
(Cui et al., 2021)	3D U-Nets	98.7	Small data set and complex.
(Borges et al., 2022)	CLAHE, Watershed	-	Small dataset.
(Caglayan et al., 2022)	xResnet50	93	Low accuracy.
(De Perrot et al., 2019)	AdaBoost	85.1	Low accuracy.

CONCLUSION

In this study, a new transfer learning-based lightweight model is proposed for kidney stone detection from non-contrast CT images. The proposed model achieved 94.1% classification accuracy. In future studies, it is aimed to develop a model with higher accuracy for kidney stone detection.

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**NIGERIA DEVELOPMENT PLANS AND ITS IMPLICATION FOR NATIONAL
DEVELOPMENT IN NIGERIA**

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Abstract

Every society has a set of resources, natural and man-made, which are normally harnessed to produce the goods and services consumed by members of the society and for export. It is in pursuance of economic growth and development that developing countries have always engaged in economic growth and development planning. Nigeria as a country has always engaged in one form of national planning or the other. This paper review various development plans of Nigeria, and its implication for national development from 1946-2020. This study employed a theoretical review approach. The study identified some achievements of national development plans such as the establishment of the oil refinery in Port Harcourt, the Niger Bridge at Asaba, the Niger Dam at new Bussa, rehabilitation of farms and plantations, abandoned during the civil war, the establishment of twenty new Federal Government Secondary Schools, establishment of the Nigerian National Oil Corporation (NNOC), now Nigerian National Petroleum Corporation (NNPC). reconstruction of 2,200 miles of roads and establishment of food production companies. The challenges of national development plans identified are deficiencies in the plan and implementations, financial constraints, political instability, and upheavals, plan Indiscipline, inadequate well-trained planners and executors, poor information and data, lack of national interest, and political will, corruption, and Institutional weaknesses. The study recommended that there is a serious need to eradicate corruption in all its ramifications. There is a need for national awareness to sensitize, and conscientize Nigerians to be patriotic to the country among other recommendations were made

Keywords: Development Plans, National Development, Nigeria, Plan Implementation

Introduction

Every society has a set of resources, natural and man-made, which are normally harnessed to produce the goods and services consumed by members of the society and for export. It is the total values of these goods and services that provide an estimate of the economic worth (income) of the society as a country. One measure of this income is the Gross

Domestic Product (GDP). The resources used to produce the goods and services come in different forms, namely, vegetation, waters in rivers, lakes, and shores, domesticated, wild animals, and aquatic animals; all man-made physical assets, human resources that provide the workforce, and management as a stock of human capital that combines all other resources optimally to produce the goods and services. For any quantum of resources, there is potential GDP that can be produced and it is expected that as more resources are employed every year, the potential GDP should follow a steady growth pattern. However, in real life the actual GDP deviates from the potential GDP because of some inherent bottlenecks or usual externalities in the economy. The goal of the managers of any economy is always to close the gap between the potential and actual GDP, that is, remove the bottlenecks and create a situation of full employment and economic stability.

It is a fact that backward societies have not succeeded in making full use of their potentials for development not only because of the underdevelopment of their natural resources, including human resources and production technologies, but also due to the underdevelopment of the existing socio-economic organisations and institutions, including the network of markets and administrative machinery of government in such societies. The general presumption, therefore, is that the elimination of these structural deficiencies in the economy of a backward society would enable such a society, be it a nation, state, or local government area, to make better use not only of its domestic resources but also its external economic opportunities in the form of international trade, and technological organisational innovations.

It is in pursuance of the foregoing that developing countries have always engaged in economic growth and development planning. The conventional plan attempts to promote economic growth and development in three main ways, namely by:

- i. Increasing the overall rate of investment in the economy
- ii. Engaging in some special types of investment designated to ease bottlenecks of production in important sectors of the economy
- iii. Trying to improve the coordination between the different sectors and subsectors of the economy.

Of these three, the third is perhaps the most important but the least understood function of economic planning amongst technocrats and policymakers in developing countries. The other two functions cannot be efficiently carried out without effective coordination between different government departments and agencies within the public sector, and the private sector. To improve coordination, it is necessary to spread reliable economic information to indicate the future course of government intentions and activities. This way, people concerned both in the public and private sectors can make appropriate plans on their own to bring them in line with government plans. This issue has always been a source of concern to people in and out of government in Nigeria.

Nigeria as a country has always engaged in one form of national planning or the other. The earliest national plan was the 1946-1955 Ten-year plan of Development and welfare (with plan revisions, 1951-55). This was followed by the plan of 1955-1960 which was later extended to 1962. These first two

plans were initiated by the colonial administrators. They were, however, not development plans in the true meaning of the term, but only a list of projects, which were not put together in a coordinated way or related to any overall national economic target (Gwaison, 2022). However, some growth was witnessed in the economy in these periods of national plans. After independence, several development plans were embarked upon in Nigeria as reviewed below.

As earlier noted the colonial government undertook no serious plan, however, after independence in 1960, development planning had a broad scope; encompassing government policies to achieve national economic objectives, such as accelerated growth and a higher level of average welfare. The plans affected the policies of Government agencies such as the Central Bank of Nigeria (CBN), Government-owned parastatals, Marketing Boards, and Extension services. Post-independence plans were more comprehensive and integrated than Pre-Independence plans formulated by the British-led Government. The plans included details about our resources potential and their mobilisation in the different sectors of the economy. All the plans were influenced by the theories and approaches most widely accepted at the time. The National Development Plans spanned 23years (1962-1985).

In all, the country has since initiated four medium-term development plans, a stop-gap Structural Adjustment Programme (SAP), and a long-term perspective plan termed vision 2010 which was later extended to vision 2020. The First National Development plan 1962-1968, was intended to put the economy on a fast growth path, by giving priority to agriculture and industrial development as well as the training of high and intermediate manpower to fill the gap in human resource requirements given the exit of expatriate workers after independence. The second National Development Plan, 1970-1974, was launched after the civil war to reconstruct and rehabilitate the economic and social infrastructure damaged during the war. The next two plans were more serious and more elaborate. The third national development plan, 1975-1980, was designed in the oil-boom years of the mid-1970s and, therefore very ambitious. Its principal aims were to diversify the economy, promote balanced regional developments and domesticate the economy through the deliberate encouragement of local private investment. The lack of appropriate executive capacity and unanticipated shortfalls in revenue, however, limited the achievement of the plan as several of the projects were rolled over to the fourth National Development Plan, 1980-1985. This fourth plan suffered mostly from the wasteful and relaxed spending of the post-military civilian administration of 1979-1983 and the collapse of international prices of crude oil. The period between the Second and Fourth National Development Plans (1970-1985), signaled both a period of unparalleled foreign exchange earnings totaling N152.5 billion and the beginning of an unequaled importation of food into the country, which was a manifestation of the failure of the development plans to achieve the often proclaimed national objective of food self sufficiency. As indicated in what follows, all the four post-independence plans have similar overall goals of economic development and improved well-being of Nigerians, but they all failed to meet the expectations of the people. Let us now go into the details of the development plans.

Overview of the Nigeria Development Plan 1946-2021

Pre-National Development Era

Before 1945, the colonial government undertook no serious comprehensive planning. Nigeria's earliest national plans, the 1946 – 1955 Ten-year Plan of Development and Welfare (with plan revisions, 1951-1955 and the 1955-1960 plan (later extended to 1962), were framed by colonial administrators. These development plans of the Pre-National Development Era were regarded by scholars of the first plan after independence as "were no plans" in the truest sense of the word ... "but a series of projects which had not been coordinated or related to any overall economic target." After 1960, the development planning was enlarged and comprised government policies to achieve national economic objectives, such as accelerated growth and higher levels of average material welfare. This planning affected the policies of such agencies as the Central Bank, State-owned enterprises, the Ministry of Education, Marketing Boards, State-level Departments, and Extension Services (Coutsoukis, 2005).

The First National Development Plan (1962-1968)

The First National Development Plan was essentially similar in focus to the ones designed for the country by the pre-independence colonial administrators. It included economic targets to be met, policies friendly to the private sector, and a list of projects to be undertaken by the government. Though political leadership made decisions about the general objectives and priorities for the First Plan, foreign economists were the main author of the plan. They favoured decentralized decision-making by private units, disregard for major discrepancies between financial and social profitability, and high economic payoffs from directly productive investments (as opposed to indirect return from social overheads). The plan discouraged increased taxes on the wealthy (out of fear of dampening private initiative), and advocated a conservative monetary and fiscal policy emphasizing a relatively small plan, openness to foreign trade and assistance, and reliance on overseas assistance. It was an export-oriented, urban-biased plan which focused mainly on the promotion of agricultural export to the neglect of food crop production and urban-based import-substitution manufacturing establishments without any consideration for rural-based industries (Olatunbosun, 1975).

The objectives of the First National Development Plan are summarised thus:

- i. To raise the growth rate of GDP to 4% per annum
- ii. To achieve an investment rate of 15% of the GDP
- iii. To raise the saving ratio from 9.5% to 15% of the GDP
- iv. To lay the enduring foundation for national development in infrastructural and social Facilities
- v. Attainment of self-reliant nation

Against these planned objectives, the First National Development Plan suffered from poor feasibility studies, inadequate evaluation of projects, the minimal contribution of ideas from the local academic environment, and excessive political interference in the implementation of decisions (Lewis, 1966). The political crisis in the nation during the period further stalled project implementation and weakened the effectiveness of the plan.

The Second National Development Plan (1970-1974)

As earlier stated, this plan was principally aimed at restoring and rehabilitation economic activities adversely affected by the 1967-1970 civil war. To achieve this, the bulk of available resources were allocated to reconstruction and rehabilitation projects. Primary production, which is agricultural production, was allocated only 12.9 percent in the plan as against 28 percent for transportation and communication. Agricultural programmes during this plan period were designed without regard to the complementary relationship between production, marketing, and storage on one hand and between agriculture and rural development on the other hand. This explains why GDP grew at an impressive rate during the second plan period while the agricultural sector remained relatively neglected, signaling the beginning of a decline in the sector. The objectives of the Second National Development Plan are:

- i. To build a just and egalitarian society
- ii. Attainment of a united and strong nation
- iii. To make Nigerian a dynamic and democratic society
- iv. To reconstruct and rehabilitate existing socio-economic infrastructure
- v. To enhance the participation of the Government in agricultural production

- vi. To promote domestic industries through the policy of import substitution

The Third National Development Plan (1975-1980)

The general objectives of the Third National Development Plan are stated below:

- i. To boost the standards of living of the populace
- ii. To expand facilities in the areas of social services
- iii. To employ all citizens
- iv. To achieve a 9% GDP growth rate

The most elaborate plans for agricultural development were designed under the Third plan which was extended to the Fourth plan. This issue is aptly demonstrated by the long list of agricultural programmes during the plan period. Agricultural Programmes during the Third National Development Plan were estimated to gulp a capital expenditure of N2, 201 billion broke down as 74.5% for the crops subsector; 15.6% for the Livestock subsector; 5% for the forestry subsector, and 4.6% for the fisheries subsector. Some of the agricultural programmes under this plan are National Accelerated Food Production Programme (NAFPP), Tree Crop Production Programme, Farm Input Supply Programme, and Infrastructural Development Programme. Others include Beef Production Programme, Dairy Production Programme, Livestock Marketing Programme, Forestry Development Programme, Forest Protection Programme, Artisanal Fisheries Programme, Aquaculture Development Programme, and Fisheries Research Programme among others.

The Fourth National Development Plan (1981-1985)

The Fourth National development plan has the following objectives:

- i. To increase the real income of the average citizen
- ii. To create room for more even distribution of income among individuals and socioeconomic groups
- iii. To reduce the level of unemployment and underemployment
- iv. To achieve a balance in the developments of different sectors of the economy and the various geographical areas of the country
- v. To increase dependence on nations' resources in seeking to achieve the various objectives of the society
- vi. To achieve a 7.2% GDP growth rate

Similar to what was obtained under the Third National Development Plan, the Federal Government, given its high liquidity position, embarked on several ambitious agricultural development programmes with or without the collaboration of State Governments during the Fourth Plan period. An increase of 47% over the third plan period was allocated to the agricultural sector. Over fifty different agricultural programmes were implemented in different subsectors of agriculture. However, no other sector or region was neglected under the Fourth Plan as the objective of balanced development was the overriding force behind the design of the plan. The Fourth National Development Plan was the last because Structural Adjustment Programme (SAP) was introduced to substitute the fifth National Development Plan in 1986. SAP was used by the World Bank (IMF) to overthrow the need for planning and

government intervention in Nigeria.

Post-Fourth Development Plan (1985 – 1987) Following the report of Olayiwola and Adeleye (2005), this plan period witnessed the establishment of the Directorate for Foods, Roads, and Rural Infrastructure (DFRRI) in 1985 to provide rural infrastructure in the countryside. The establishment of this Directorate (DFRRI) was backed up by Decree No. 4 of 1987. The core of the Directorate's programme is the promotion of productive activities. Besides, the directorate recognized the provision of rural infrastructure such as feeder roads, water, electricity, and housing as essential for the enhancement of the quality of life in rural areas. The programme of the directorate includes the organization and mobilization of the local people to enhance or facilitate closer interaction between the government and the people. In addition, the local communities were asked to form unions or associations to provide common facilities for themselves; the provision of rural infrastructures such as rural feeder roads, rural water and sanitation, rural housing, and electrification; the promotion of productive activities such as food and agriculture, rural industrialization and technology; the promotion of other extracurricular activities such as socio-cultural and recreational programmes, intra and inter-community cohesion activities. The plan for the implementation of DFRRI programmes was organised into two phases. In phase one, the target was to provide water for 250 communities in each of the states of the federation, construct 90,000km of feeder roads, and promote rural housing, health, and agriculture. To facilitate industrial growth, and improve the attractiveness of the rural environment, the Directorate planned to commence its rural electrification programme in the second phase starting in June 1987. In pursuit of its objectives, DFRRI also planned to co-operate with organizations like Nigerian Building and Road Research Institute (NBRRI) as well as the rural water supply and sanitation programme (RWATSAN). The Directorate for Foods, Roads and Rural Infrastructures (DFRRI) does not get involved in the direct implementation of the programmes. Rather, for the programme implementation, the directorate uses as its main agents, the states and the local governments, to execute its programme. The funds for the programme of the Directorate are made available directly to each state government then sees the disbursement of such funds to the local governments. The local governments in the federation are constituted into rural development committees. These committees embrace the local government officials and the rural communities. Overall, about N433 million was allocated to the Directorate in 1986 to implement its programme. But only N300 million was disbursed. In 1987 and 1988, N500 million and N1 billion respectively were allocated to the Directorate.

The Fifth National Development Plan (1988 – 1992) This development plan emphasized Structural Adjustment Programme (SAP). Its targets were to devalue the naira, remove import licenses, reduce tariffs, open the economy to foreign trade, promote non-oil exports through incentives, and achieve national self-sufficiency in food production. The development plan had the vision of improving labour productivity through incentives, privatization of many public enterprises, and different government measures to create employment opportunities. General Ibrahim Babangida Administration abandoned this fixed-five-year plan in late 1989 for a 3-year rolling plan.

The Three-Year Rolling Plan (1990-1992) The objectives of this plan were to reduce inflation, and exchange rate instability, maintain infrastructure, achieve agricultural self-sufficiency, and reduce the burden of structural adjustment on the most vulnerable social groups. The rolling plan was for the period between 1990 and 1992 with the vision of revising and renewing plans at the end of each year (and inculcating a more comprehensive fifteen-to-twenty-year plan) but the number of years remains the same as the plan rolls forward.

Era Of Visions, National Planning Commission Of Nigeria And Their Programmes (1992/93 – Date) This is an era of formulation of medium-term and long-term economic and development plans for the nation advising the federal government on matters relating to National Development and overall management of the national economy. So many other development plans, programmes, or even visions such as vision 2010, vision 2015, and even vision 2020, etc in different areas of life are being made such as are discussed below:

The Vision 2010 This is a vision dreamt of or initiated by Sani Abacha in Nigeria. The vision 2010 Council, a mosaic of 248 sages headed by Ernest Shonekan, was inaugurated on November 27, 1996. The committee's mandate set out in a 14- item Terms of Reference required it to develop a blueprint

that will transform the country and place it firmly on the route to becoming a developed nation by the year 2010 (Egbunike, 2010). On a review of the vision, it was explained that the committee worked for 10 months using the following methodology: plenary sessions, held in the form of 12 workshops, spread over the period; subcommittees on particular problem areas; 57 external workshops; specifically commissioned studies; consideration of 750 memoranda from the general public; presentations by guest speakers, and intensive brainstorming among committee members.

Vision 2015 - Millennium Development Goals (In Nigeria) This is a vision created by the United Nations. The United Nations Foundation is committed to helping the UN achieve the eight Millennium Development Goals by 2015. The MDGs are a commitment by the UN to establish peace and a healthy global economy by focusing on major issues like poverty, children's health, empowerment of women and girls, sustainable environment, disease, and development. Nigeria entirely embraced this vision and is working towards all its objectives. The eight MDGs call for a Global Partnership for Development. It reflects the fact that the fates of all people and nations are linked. These eight MDGs and their targets i.e. the Millennium Development Goals are:

Goals 1: Eradicate extreme poverty and hunger: Reduce by half the proportion of people living on less than a dollar a day. Reduce by half the proportion of people who suffer from hunger.

Goals 2: Achieve Universal Primary Education - Ensuring that all boys and girls complete a full course of primary schooling.

Goals 3: Promote Gender Equality and Empower Women - Eliminate gender disparity in primary and secondary education preferably by 2005, and at all levels by 2015.

Goals 4: Reduce Child Mortality - Reduce by two-thirds the mortality rate among children under five.

Goals 5: Improve Maternal Health - Reduce by three quarters the maternal mortality ratio.

Goals 6: Compact HIV/AIDS, Malaria, and other diseases - Halt and begin to reverse the spread of HIV/AIDS. Halt and begin to reverse the incidence of malaria and other major diseases.

Goal 7: Ensure environmental sustainability.

Goals 8: Develop a global partnership for development.

VISION 20:2020 The Nigerian vision 2020 is a perspective plan - an economic business plan intended to make Nigeria a fully developed economy by the year 2020; that is, the intent of Nigeria in vision 2020 programme is to position Nigeria to become one of the top 20 economies in the world by the year 2020. To ensure the achievement of this objective, an institutional framework responsible for the development and implementation of vision 2020 was created – a framework consisting of the National Council on Vision 2020 (NCV 2020), and the National Steering Committee (NSC); and Stakeholder Development Committee (SDCs). National Planning Commission and the vision 2020 secretariat were then mandated by the Federal Executive Council (FEC) to produce the vision 2020 plan for launching by the president on October 1st, 2009. The vision commenced in January 2010 (Ahmed, 2009) and the Chairman of the Business Support Group of the Vision is by name - Alhaji Umaru Mutallab, CON. The constitution and inauguration of the Business Support Group (BSG) intended to engender private sector support for the vision 2020 process by the National Steering. The vision 20:2020 sought to accelerate the pace of the country's growth and development and make it among the world's twentieth economies by the year 2020. Muttalib believed that for the vision to succeed, the civil service must be carried along. Thus, the government and the institutional organs took steps toward the development of vision 2020 by making such plans as: -

- ❖ Provision for the development efforts in the 2009 budget;
- ❖ - Development of sectoral strategies for the vision by some Ministries, Departments, and Agencies (MDAs);
- ❖ - CBN financial sector strategy 2020;
- ❖ - FIRS 2020 strategy; - Medium Term Sector Strategy (MTSS).

The objectives of the vision 2020 programme are to:

- ❖ Stimulate Nigeria's economic growth and launch the country onto a path of sustained and rapid socioeconomic development.
- ❖ • Place Nigeria in the bracket of the top 20 largest economies of the world by the year 2020, with a growth target of not less than \$900 billion in GDP and a per capita of not less than \$4,000 per annum.

PROGRAMMES

In addition to the visions, the National Planning Commission also has what they called programme. Under the programme, there is what is called the Transformation Agenda which is a medium-term development strategy to speed up the actualization of the vision 20:2020, and as such for the actualization of the federal government's economic growth agenda during 2011 – 2015. The Agenda is anchored on the pillars and targets of the NV 20:2020 and aims at:

- ❖ Creating decent jobs in sufficient quantity to resolve the protracted problem of unemployment and reduce poverty;
- ❖ - Laying the foundation for robust and inclusive growth within the Nigerian economy.
- ❖ - Improving on a sustainable basis, the well-being of all classes of Nigerians regardless of their circumstances and location.

The four areas of focus of the Transformation Agenda are governance, human capital development, infrastructure, and real sector (Wikipedia, 2013). Some of the programs of this National Planning Commission include:

- ❖ The National Economic Empowerment and Development Strategy (NEEDS);
- ❖ The State Economic Empowerment and Development Strategies (SEEDS); and so on.

The Seven Point Agenda (2007-2011)

The administration of President Yar'adua presented a seven-point agenda for development in Nigeria and it is aimed at tackling the numerous problems of power and energy; food security and agriculture; wealth creation and empowerment; transport sector; land reforms; security; education. Ibieta and Ekhoesuehi (2013) recorded that the seven-point agenda was an off-shoot of the United Nations Millennium Development Goals (MDGs) and it was expected to run concurrently with its agendas of eradicating extreme poverty and hunger by 2015; achieving universal primary education by 2015; reducing child mortality by two-third; improving maternal health by 2015; combating HIV/AIDS, malaria and other preventable diseases by 2015; ensuring environmental sustainability between 2015 and 2020 and developing a global partnership for development by 2015. The seven-point agenda of the Yar'adua administration was somewhat an uncoordinated plan and looked more like an administration's mantra with much talk than actions. It rather aligned itself with the MDGs which were much of "goals from outside." Though some of the objectives were achievable, the programme did not go beyond the usual policy formulations that lacked the necessary implementation mechanism which had been the major challenge of other plans in Nigeria. The seven-point agenda died immediately with the sudden demise of President Yar'adua.

The Transformation Agenda (2011 – 2015)

In May 2011, another government took over the helms of affair and was headed by the person of President Goodluck Jonathan. Suffice it to say that President Jonathan did not continue with the "seven-point agenda" of his former boss – President Yar'adua, he rather came up with the new idea tagged "Transformation Agenda." Awojobi (2017) noted that the transformation agenda was meant to run from 2011 – 2015 and it promised to be a policy and programme that will transform Nigeria into an economic powerhouse in the world. Itah (2012) believes that the transformation agenda of President Jonathan aimed to address the surge in poverty and insecurity. The then Minister of Trade and Investment Olusegun Aganga describes the agenda as a development policy that is embedded with good governance, security, energy, and human development (Awojobi, 2017). In the words of Gyong (2012),

the transformation Agenda seeks to catapult Nigeria into economic growth and national development. He elaborates that the agenda had its focus on three core areas: revamping all ailing industries, encouraging agriculture and agro-related businesses to promote small and medium enterprises (SMEs); secondly, reducing poverty and creating massive employment; and thirdly, fighting corruption at all levels of governance. As Awojabi (2017) noted, the realization of the objectives of the transformation agenda remains a mirage. Nigeria witnessed a high level of corruption, insecurity, high cost of governance, an upsurge in the rate of unemployment, etc. On the second anniversary of the Jonathan administration on May 29, 2013, the president asked Nigerians to evaluate his government transformation agenda. In a quick reaction, erudite constitutional lawyer, Prof. Ben Nwabueze after a careful assessment of the agenda, said that it has absolutely nothing to do with, not a word to say about, the transformation of our society from rural decadence into which it has sunk. As he noted, no agenda in the context of Nigeria is worth being called a transformation agenda that does not aim at the moral and ethical transformation of the society Nwabueze (2013) as cited by Aloa and Alao, (2013) and quoted by Awojabi, (2017). In a similar view, Afolayam (2011), Gyang (2012) and Aloa and Aloa (2013) stressed that high-level corruption was the biggest obstacle to the realization of the transformation agenda which invariably brought stagnation of economic growth and development. El Rufai (2014) notes that corruption brings no good to any society, funds that are meant for developmental purposes were carried away by public office holders and this led to the increasing rate of poverty, unemployment, diseases, inequality, and insecurity in the life of the country. The Jonathan Transformation Agenda connotes a clear-cut agenda for development purposes, but it equally tailored the path of other development plans of Nigeria as it was marred with a lack of implementation and inconsistencies.

The Economic Recovery and Growth Plan (ERGP) 2017

The continuous search for the optimal development strategy in Nigeria led to the introduction of ERGP by the present administration of President Mohammed Buhari (PMB). The government launched the ERGP in 2016 as a medium-term economic framework meant to stimulate the recessive economy back to sustainability, accelerate development and restore the economy in the medium term (Kyaram and Ogwuche, 2017). The ERGP was launched soon after Nigeria slumped into economic recession in the second half of 2016 (PWC, 2017) as cited by Kyaram and Ogwuche (2017). The ERGP has so many lofty objectives, it aims to restore growth, and engender macroeconomic stability and diversification. It equally aims at investing in the Nigerian people by continuing to provide support for the economically disadvantaged individuals, creating jobs, and improve accessibility and affordability to quality healthcare across the country, and improved human capital in the areas of improved education for all. Finally, the ERGP aims to significantly increase investment in infrastructure through a robust Public Private partnership arrangement, it equally aims to simplify and improve the legal and regulatory framework for doing business in Nigeria and promote digital-led growth through the expansion of broadband coverage (Kyarem and Ogwuche, 2017). It is expected that the cumulative effect of the ERGP's targets will translate to expansion and growth in GDP by 2.19% in 2017, averaging 4.62% between 2018 and 2019, and finally hitting 7% by 2020. It is equally expected that the unemployment rate will reduce from 13% (Q3, 2016) to 11.23% by 2020. Kyarem and Ogwuche (2017) note that the ERGP has some downside risks which are embedded in the 2 macro-structural risks of the ERGP document. In their assertion, the plan which is called a growth plan, it is obvious that the ERGP focuses more on growth out of recession than growth on a sustainable basis towards development. The calculated GDP growth was based on improved oil prices that do not guarantee improvement in real production. As Kyarem and Ogwuche (2017) observed, a policy gap exists in the ERGP and that is the absence of how to manage an after-recession economy which should serve as a springboard for sustainable growth and development. It is obvious that the above gap exists; the Central Bank of Nigeria (CBN, 2017b) announced and celebrated Nigeria's exit from recession, yet the country's socio-economic indices and welfare are worsening. Whilst the objectives of the ERGP are laudable, its vulnerability to political disruption is a key risk that may impact the sustainability and enforceability of the development plan.

Achievement of the Nigeria Development Plan

The achievement of the National Development Plan according to Gwaison (2022) are summarised below

- i. Execution of development projects such as the oil refinery in Port Harcourt, the Niger Bridge at Asaba, the Niger Dam at new Bussa, etc.
- ii. Rehabilitation of farms and plantations, abandoned during the civil war.
- iii. Reconstruction and Rehabilitation of industrial facilities damaged during civil war e.g. the cement company in Calabar.
- iv. Establishment of twenty new Federal Government Secondary Schools
- v. Establishment of the Nigerian National Oil Corporation (NNOC), now Nigerian National Petroleum Corporation.
- vi. Reconstruction of 2,200 miles of roads
- vii. Extension of communication facilities, thus making available a total of 6,400 additional telephone lines
- viii. Establishment of food production companies
- ix. Making the country get out of recession twice, especially the ERGP
- x. Reduced the HIV/AIDS mortality rate in Nigeria

The challenges of national development plans

Some of the challenges of the National development plan according to Gwaison (2022) are stated below

1. Deficiencies in the plan and implementations
2. Financial constraints
3. Lack of mass commitment
4. Corruption
5. Political instability and upheavals
6. Plan Indiscipline
7. Inadequate well-trained planners and executors
8. Lack of information and Data
9. Lack of national interest and political will
10. Institutional weaknesses

Conclusion

The paper has enumerated the various development plans that Nigerian governments had embarked upon since the precolonial era, the post-colonial era, and the present democratic dispensation. The paper equally considered the present administration's development initiative tagged "Economic Recovery and Growth Plan" (ERGP). The paper relied on information sourced from existing records. Most of the developmental challenges that militate against the success of the plans were equally identified. It is obvious that Nigeria has experimented with several development plans from day one to date, yet the needed transformation has continued to elude the citizens despite the robust plans. The failures of these plans are being manifested in the crises that beset the Nigerian economy. Both

economic, political, and social indicators point to the direction of a crisis-ridden economy. There is acute unemployment, widespread poverty, a high level of illiteracy, decayed social and physical infrastructure, technological backwardness, urban congestion, the monumental upsurge of social/political and economic vices, excessive debt burdens, and a high incidence of diseases. Therefore, the search development plan continues.

Recommendations

Based on the above observations which point out that the Nigerian government has got it right in her development plans and initiative, the paper recommends among other things that:

There is a need for disciplined political leadership in Nigerians that can ensure the complete implantation of development plans. The development plans will not succeed if the political leaders are not committed to implementing them to the letter.

Another factor that will enhance the achievement of plans and objectives is setting the priorities right. Most a-times the Nigerian government meddle-up everything it wants to achieve at the same time. Without setting priorities right, the country cannot get beyond where it is.

Government and governance are a going concern, the idea of a particular government setting up a development plan and immediately another administration emerges, the plan from the predecessor will be abandoned immediately had been a major obstacle to development plans in Nigeria. Therefore, Nigerians should see governance as a continuum and not a personal business.

Nigerian government met to set up a development plan that is completely home-grown and devoid of external vagaries and dictates. Most of the development plans and reform policies implemented in Nigeria were by-products of World Bank, IMF dictates as it hardly considered Nigeria's peculiarities in its formulation

A critical factor that can ensure the success of a development plan is cooperation. Nigerians from all facets of endeavor must cooperate and work tougher for us to reap the benefits of a proper development plan.

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**SCENES AND FRAMES THEORY IN TRANSLATION
ÇEVİRİDE SAHNELER VE ÇERÇEVELER TEORİSİ**

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Abstract

The new approach brought by the Scenes and Frames theory to translation carries the functionality of translation to the top. Charles J. Fillmore is the founder of the Scenes-and-frames-semantics theory, which is a linguistic theory. Mary Snell-Hornby brought this theory, which was developed in 1977 by Fillmore and based on the prototype theory, to translation studies. Vannerem/Snell-Hornby considered the scenes-and-frames theory as a dynamic concept in their study in 1986.

Scenes that are meaningful through associations are formed in the mind of the person who reads any text. Although these scenes differ from person to person, they contain fundamentally unchanged elements. The purpose of the scenes and frames theory is to enable the reader to find the correct equivalents of these scenes in the target language and culture for an equivalent translation in the target language. For this, the translator must know both languages and cultures very well. Scenes and frames cause associations by stimulating each other mutually. Just as frames create a scene, a scene also brings a frame to mind. If the same scenes come to life in the minds of the target reader reading the translation text, we can consider the translation successful. This translation strategy aims the translator to visualize the scenes in the source text in his mind and to find frames in the target language suitable for these scenes. Based on this idea, this theory is also used for translation criticism.

The aim of the study is to discuss this new perspective, which has not been studied enough in the German-Turkish language pair, and to discuss the German-Turkish examples. German and Turkish are two languages belonging to different language families. German is an inflected language and belongs to the Indo-European languages. Turkish, on the other hand, belongs to the Ural-Altaic language group and is an agglutinative language. Considering that the speakers of these languages have a very different social structure in terms of culture, this comparative study is important in terms of revealing how effective the theory is in practice.

Keywords: scenes and frames theory, German Turkish translation, Vannerem/Snell-Hornby, cultural differences, cultural elements in translation

GİRİŞ

1977’de Scenes-and-frames-semantics (sahneler ve çerçeveler semantiği) teorisi Charles J. Fillmore tarafından Chomsky’nin üretici-dönüşümsel dilbilgisine reaksiyon olarak geliştirilmiştir. O zamanki dilbiliminde mevcut olan dilbilimin diğer alanlardan ve dil dışı gerçeklerden soyutlanması anlayışının tersine Fillmore dil yapısının, dilsel davranışın, dili anlama, dil değişimi ve dil ediniminin bir bütün olarak ele alınmasından yanadır. Fillmore psikolog olan Eleanor Rosch’un prototip teorisinden etkilenmiştir. Prototip kavramı bir dili konuşan kişilerin gündelik yaşantılarındaki tecrübelerine bağlı olarak belli anlamsal kategorilerin tipik temsilcilerini oluşturmalarına dayanan bir anlayış biçimidir. Örneğin “kuş” dendiğinde farklı coğrafyalarda ve kültürlerde zihinsel temsilci olarak akla gelen kuş türü farklı olabilir, fakat bir canlıyı “kuş” yapan temel özellikleri taşıyan tipik bir temsilcidir. Rosch’un Kuzey Amerika’da yaptığı araştırmasında kuş için prototip temsilci “kızıl gerdan” kuşuyken, Avrupa’da ve Türkiye’de “serçe” olacaktır. Ayrıca merkezdeki prototip olan temsilciden uzaklaştıkça kategori üyelerinin özellikleri zayıflamaktadır. İnsanların doğal olarak oluşturdıkları bu kategorilerin bir “odak

noktası” ve sınırları gittikçe belirsizleşen uç noktaları vardır. Rosch’a göre her ne kadar prototipler kültürlerde farklı olsalar da, kişiler nesneleri prototip kullanarak “doğal yolla kategorize” etmektedir. Disiplinlerarası çalışmaktan yana olan Fillmore, dilbilimde süregelen anlamsal bileşenlerin toplamının oluşturduğu “anlam” kavramını ret ederek, tıpkı doğal dil ediniminde olduğu gibi, bir dili konuşanların tecrübelerine dayalı olan prototip kavramını semantik (anlam bilimsel) teorisinin merkezine koymuştur. Gerçekten de küçük bir çocuk doğal yolla dil edinirken hayata dair tecrübeler eşliğinde öğrenir. Fillmore yaşanmış durumlardan yola çıkarak “sahne” (scenes) kavramını önerir. Dilsel kodlamaları ise “çerçeve”¹ (frames) kavramıyla karşılamaktadır. Fillmore’a göre her dilsel yapıya (çerçeve) göre, bizim için anlamlı olan bireysel tecrübelerimizden ve yaşanmışlıklardan yola çıkarak sahneler (scenes) tasavvur ederiz. Her dilsel yapı çağrışımlar yoluyla zihinde tasavvurlar oluşturur. Bu zihinsel tasavvurlar başka dilsel yapıları çağrıştırır. Kısacası çerçeveler sahneleri, sahneler ise çerçeveleri karşılıklı olarak tetiklemektedir (çerçeve←→sahne, sahne→ sahne ve çerçeve→ çerçeve). Sahneler yalın veya çok boyutlu olabilecekleri için, çerçeveleri bir dilden başka bir dile aktardığımızda çağrıştırdıkları sahneler birebir aynısı olmayabilir.

Fillmore’un *çerçeve* anlayışı, konuşan kişinin belli durumlar hakkındaki geleneksel bilgiyi, aktiviteleri, olayları varsayarak konuştuğuna işaret eder. Çerçeve birçok rolü üstlenen, değişik özellikte katılımcıları olan, tipik bir durumun şematik zihinsel temsidir. Örneğin “satın almak” fiilinin oluşturduğu *çerçevede* en az bir müşteri, bir satıcı ve satılan bir ürün olmak zorundadır. Satılan bir ürünün olması bu *çerçeveyi* aktive eder. Ayrıca artalan bilgisi olarak paranın ve malın el değiştirdiği bir ticari transaksyon söz konusu olduğu bilinir. Bir başka örnek olarak doğum günü kutlamasını verebiliriz. Bu organizasyonun nasıl olacağı doğum günü olan kişinin yaşına bağlı olarak bellidir. Çocuklar için yapılan kutlama büyüklere göre farklılık gösterir. Bir kelimenin çevresinde oluşan artalan bilgisi prototip özellikler gösterir. Fillmore sahneler ve çerçeveler teorisi kapsamında akışı düzenleyen senaryolardan (skript) da bahseder, çünkü çerçeveler genellikle birbirine bağlı, birden fazla kompleks durumların oluşturduğu tasarımlar olabilirler. Örneğin bir market alışverişinde, doktor randevusunda, restoranda yemek yeme gibi durumlarda *senaryo* bellidir ve stereotip davranışın dışına çıkılamaz. *Senaryo* (skript) çerçevenin özel bir şekli olarak görülebilir. Fillmore *sahne* kavramını sadece görsel olarak değil aynı zamanda bildik kişiler arası işlemler, tanıdık düzenler, kurumsal yapılar, deneyimler veya hayaller (Fillmore 1977: 3) için de kullanır. Bu yaklaşım metin analizinde de avantajlar sağlamaktadır. Bir metni okuyan kişinin tecrübelerine bağlı olarak zihninde birbirini takip eden ve mantıklı bir bütünü oluşturan tasavvurlar zinciri oluşur. Aslında bu durum aynı metnin alımlamasının neden farklı şekillerde olduğunu da açıklamaktadır. Çerçeveler statik iken, sahneler tıpkı bir iletişim anında olduğu gibi akışı temsil ederek dinamik sahneleri oluşturur. Fillmore’a göre sözlü veya yazılı bir metnin tutarlılığı o sahneyi oluşturan parçalarıdır. Okurun veya konuşma partnerimizin metnin konusu hakkındaki önbilgisi onda çağrıştıracığı sahneleri belirleyerek artalan bilgisiyle birlikte tetiklenen sahnelerle bir metnin anlamsal bütünü oluşturacaktır. Böylece metin akışında mevcut anlamsal boşluklar zihnimize tamamlanır, metin dünyaya dair edindiğimiz bilgilere dayanarak edinilen bakış açısıyla yorumlanır. Ayrıca çerçeveler ve sahneler okurun hayal gücünü harekete geçirerek, edebi metinlerde olduğu gibi hayali bir evren de yaratabilirler.

Bu araştırma Almanca-Türkçe dil çiftinde yeterince çalışma bulunmayan bu teoriyi çeviribilimsel açıdan irdeleyerek Almanca-Türkçe örnekler üzerinde tartışmayı amaçlamaktadır. Bu dilleri konuşanların kültürel ve toplumsal açıdan oldukça farklı oldukları düşünüldüğünde, yapılan bu karşılaştırmalı çalışmanın adı geçen teorisinin uygulamalı olarak hangi faydalarının olduğunu göstermesi beklenmektedir.

SAHNELER VE ÇERÇEVELER TEORİSİNİN ÇEVİRİBİLİME YANSIMASI

Çevirmenler birer iletişim uzmanı olarak kelime veya cümle değil metin çevirisi yaparlar. Bir metni çevirebilmek için onu öncelikle doğru anlamak gerekir. Burada kaynak metnin düzgün oluşturulduğundan yola çıkılmaktadır. Zira kaynak metin anlaşılabilir bir durumda ise onu anlaşılır bir

¹ Kavramlar Bengi, Işın’dan (1992) alınmıştır.

şekilde çevirmek mümkün değildir. Çevirmen metni çeviri amaçlı analiz ettikten sonra anladığı ölçüde çevirisini yapacaktır. Bu noktada Fillmore'un *sahneler ve çerçeveler teorisi*, çeviri sürecinin bilişsel bir süreç olduğunu tasdikler nitelikte olup çevirmene yaratıcı olma imkânı sağlamaktadır. Çeviri, bir kaynak metnin erek okura uygun bir şekilde yeniden yazılmasıdır. Kaynak metni okuyan çevirmen kendisine verilen *çerçevelerden* ve bireysel deneyimlerinden yola çıkarak metni çözümler ve yorumlar. Metni oluşturan yazar ise kendi artalan bilgisi ve tecrübelerinden oluşan prototip sahnelerden esinlenerek yazmıştır. Çevirmen ideal koşullar altında anladığını erek kitleye bilişsel-sosyal bir süreç sonrasında aktarırken uygun *sahneleri* erek okurda çağrıştıracak *çerçeveleri*, kültürü de göz önünde bulundurarak seçmek zorundadır. Çeviri sürecini başlatan kaynak metin ve onun dilsel bileşenleridir (çerçeveler). Kaynak metin, kendi sahne repertuarından yararlanan yazarın kaynak sahne ve çerçeveleri arasındaki güçlü ve tekrarlayan etkileşimlerden oluşan birbirine bağlı bir çerçeveler zinciridir:

kaynak metnin yazarının sahneleri → kaynak çerçeveler → çevirmenin sahneleri →
çevirmenin erek dilde oluşturduğu çerçeveler → okurun zihninde oluşan sahneler

Yazarın ve çevirmenin sahnelerinin ayrıştığı noktalarda, çevirmende canlanan farklı sahneler sonucunda, çevirmenin aktardığı çerçeveler çeviri hatalarına yol açabilir. Çevirmen her iki dil, kültür ve konu hakkında ne kadar derin bilgiye sahipse, hata yapma olasılığı da o derece düşüktür. Vermeer 1988'de Münih Goethe Enstitüsünde düzenlediği çalıştayda bu modelin çeviri eleştirisi olarak kullanılabileceğini göstermiştir.² Ammann sahneler ve çerçeveler yaklaşımını çeviri eleştirisine uygulamıştır. Ammann, Eco'nun kullandığı anlamda, "model okuru" çıkış noktası olarak alır ve dört farklı sahne olduğunu söyler; kaynak yazarın sahneleri, alımlayıcı olarak çevirmenin kaynak metni okuduğunda oluşan sahneler, çevirmenin erek okura aktarmak istediği sahneler ve erek okurun zihninde canlanan sahneler (1990: 226). Ammann çeviri skoposun da (amaç, hedef) göz önünde bulundurularak çeviri eleştirisinin yapılmasından yanadır. Ancak bu çalışmanın kapsamını aştığı için burada çeviri eleştirisi konusu tartışılmayacaktır.

Fillmore'un *sahneler ve çerçeveler teorisini* ilk olarak Mia Vannerem ve Mary Snell-Hornby (1986: 182-198, 1988: 79-81) 1986 yılında yaptıkları çalışmada dinamik bir kavram olarak ele almışlardır. Daha sonra Hans J. Vermeer ve Heidrun Witte (1990) ve Hans J. Vermeer (1992), Radegundis Stolze (1992: 116-121) ve Paul Kußmaul (2000: 114-116) bu teoriyi çeviribilime kazandırmışlardır.

Vermeer ve Witte için *sahneler* bir kişinin kafasında zamanla oluşan ve daha sonra algıladığı ölçüde var olan, az çok karmaşık fikirdir ve kültüre özgü özellikler taşırlar (1990: 51-52). *Çerçeveler* bilgi içeren ve algılanabilen herhangi bir fenomendir. Fillmore'a göre çerçeve basitçe dilsel bir koddan ibaret değildir. Daha ziyade sahneleri anlatmaya yarayan, mümkün olan tüm ifade şekillerinin bütünü olarak görmektedir (1990: 66). Vermeer ve Witte'ye göre sözlü ve sözsüz iletişim şekillerinin tümü ve algılanabilen her şey; örneğin kılık kıyafet dahi çerçeve olabilir. Fillmore da *çerçeveleri*, *sahneleri* çağrıştıran her türlü ifade şekli olarak görür.

Vannerem/ Snell-Hornby (1986) ve Kußmaul (1994) metnin erek dilde yeniden yazılma sürecinde çevirmenin yaratıcı yazarlık yaptığını vurgularlar. Stolze (2015: 184) çağrışımlar neticesinde oluşan sahnelerdeki boşlukları çeviride doldurmanın her zaman doğru olmadığını söyler. Metinde hayal gücünü harekete geçirmesi için özellikle açıkça belirtilmeyen satır arası unsurların açıkça belirtilmesi, yazarın sahnenin yaratmasını istediği potansiyel hayal gücünü yok edebilir. Bu nedenle bu noktada çevirmenin dikkatli olması gerekir.

Vannerem / Snell-Hornby (1986) çevirinin karmaşık bir iletişim eylemi olduğunu vurgularlar. Bu eylem "kaynak metnin yazarı – okur/çevirmen" ve "çevirmen/ erek metnin yazarı – erek okur" arasında cereyan etmektedir. Çevirmen öncelikle metni anlayabilmek için kendisine verilen çerçevelerden hareket ederek çeviri amaçlı metni çözümler. Kaynak metin kendi tecrübelerinden, kültüründen ve artalan bilgisinden yola çıkarak yazar tarafından kaynak dilin okurları için prototip sahnelerden oluşturulmuştur. Metni oluşturan bütün *çerçeveler* okurun zihninde yazarın amacına uygun bilişsel

² Aktaran Ammann 1990: 225

sahnelerin oluşmasını sağlar. Okur / çevirmen zihninde çağrışımlar sonucunda canlanan sahneleri tecrübelerine ve art alan bilgisine dayanarak prototip sahnelerle eşleştirir. Burada çevirmenin öznel yorum yapmaktan kaçınması gerekir. *Çerçevelerin* çevirmende yaptığı çağrışımlar kendi sosyokültürel menşei ile yakından ilgili olduğu için yazarın eseri anadilinde okuyan okurda hedeflediği amaçtan sapmalar gösterebilir. Profesyonel bir çevirmenin birbirini karşılıklı olarak tetikleyen *sahneler ve çerçevelerin* doğruluğundan emin olabilmek için metne dönüp teyit alması şarttır. Metni okudukça artarda oluşan *sahne* parçaları birleştiğinde, metnin arkasındaki *büyük sahneyi* oluşturur ve böylece çevirmen metni anlamış olur. Sahnenin çerçeveyi çağrıştırmasının yanı sıra çerçeve de bir başka çerçeveyi çağrıştıracaktır. Böylece çevirmen kaynak metni daha okurken zihninde kendiliğinden refleks olarak canlanan *çerçevelerin* uygunluğu çevirmen tarafından kontrol edildikten sonra çeviride kullanılabilir. Hönlğ ve Kußmaul (1982: 26-27) okuma esnasında kendiliğinden ortaya çıkan çağrışımları not etmeyi tavsiye etmektedirler. Her zaman olmasa da genellikle bu çerçevelerin en doğal karşılıklar olduğu ve çevirmenin işini kolaylaştırdığı görölmüştür. Çeviride *sahneler ve çerçeveler* yaklaşımı çevirmene yaratıcı olma imkânı sağlayarak dinamik çeviriyi mümkün kılmaktadır. Artarda oluşan *sahneler* birbirini etkileyerek ilk oluşan sahneyi revize edebilir. Tüm bu *sahneler ve çerçeveleri* çevirmen kendi prototip bilgisi ve edinçleri ile birleştirir sentezleyerek erek metne son halini verir.

ÖRNEK UYGULAMA:

Örnek olarak içinde kültürel referansların bol olduğu bir metin oluşturulmuştur. Kurban Bayramı sabahı bayramlaşma sahnesi ve senaryo Türk kültüründe bellidir. Ancak Alman kültüründe böyle bir bayram ve gelenek bulunmadığı için çerçevelerin özenle seçilmesi ve sahnelerin dikkatle oluşturulması gerekmektedir.

Bayram Sabahı

Kurban Bayramının ilk gününde namazdan gelen Mehmet dedenin çocukları ve torunları bayramlık kıyafetlerini giymiş bayramlaşmak için gelmişti. Herkes sıraya girerek dedesinin elini öpüyor ve bayram harçlığını alıyordu. Sıra Ali'ye geldiğinde izlediği tarihi dizilerden etkilenmiş olacak ki, bir dizini yere koyup Bamsı Beyrek gibi bağıı bastı. Ali'nin bu hareketi dedesinin çok hoşuna gitmişti. Ali'ye sıkıca sarılıp öptü. Tüm aile neşe içinde bayram sofrasına oturdu.

Bayram: (Alm.) der Bairam

Almancaya ödünçleme yöntemiyle girmiş ve Almancanın büyük sözlüğü Duden'de "Bairam" şeklinde yer almıştır. Duden bayramı "İslamiyet'in iki büyük kutlaması için kullanılan Türkçe sözcük" olarak açıklamaktadır. Zira Almancada bu anlamda kullanılabilecek bir karşılık yoktur.

Kurban Bayramı: (Alm.) das Opferfest

"Opfer" kurban ve "Fest" kutlama demektir. Duden'de "en çok dört gün süren İslam dininin bir kutlamasıdır" şeklinde açıklanmaktadır. Ancak "Fest"; şenlik, kutlama, eğlence, şölen vb. anlamlar taşıdığı için bir canlının kurban edilmesi neden kutlanır diye İslamiyet'i bilmeyen kişilerin aklına gelebilir. "Fest" kelimesinin içerdiği bu anlamlar nedeniyle "Bairam" kelimesinden ayrılmaktadır. Burada kurban kesilmesinin nedeninin Müslümanlar arasındaki karşılıksız yardımlaşmayı ve özellikle daha zengin olanların fakirleri düşünerek onlarla varlığını paylaşmayı öğrenmesinin hedeflendiğinin açıklanması gerekir. Burada belki dip notta Hz. İbrahim ve oğlu İsmail ile ilgili anlatılan olaya gönderme yapılabilir. Ancak İslamiyet'i bilen erek okur kitlesi için çeviri yapıyorsak bütün bunları açıklamaya gerek yoktur.

İlk gün: Bayramın bir günden daha uzun olduğuna işaret etmektedir.

Namaz: (Alm.) das Namaz

Duden'e ödünçleme ile girmiştir, zira İslamiyet'in ibadet şekli olduğu için Almancada karşılığı yoktur. "Müslümanların günde beş kere yerine getirdiği ibadet" olarak Duden'de yer almaktadır.

Bayramlık kıyafetleri giymek: Burada okurun zihninde bugünün özel bir gün olması nedeniyle çocukların güzel giyindiği bir sahne canlanacaktır. Alman kültüründe de özel günlerde (noel, paskalya gibi) güzel kıyafetler giyilir.

Bayramlaşmak: (Alm.) sich einander frohes Fest wünschen

Almancadaki bu karşılıktan Türk kültüründeki gibi bir bayramlaşma anlaşılmamaktadır.

El öpmek: Türk ve doğu kültüründe olan bu davranışın erek kitleye açıklanması gerekmektedir. Zira Avrupa’da sadece yetişkin erkeklerin bayanların elini nezaketen öptüğü ve sonrasında başa götürmediği bir davranış vardır. Ancak bu davranış ile Türk kültüründeki davranış arasındaki fark Almanya’da bilinmemektedir.

Bayram harçlığı: Taschengeld/ Bairamgeld (denebilir)

Almanya’da böyle bir gelenek yok.

Bamsı Beyrek: Alman kültürünün tanımadığı bir kahramandır. Cümlelerin başında geçen “izlediği tarihi diziler” bunun eskiden gelen bir gelenek olduğunu vurgulamaktadır.

Bağır basmak: Almancada karşılığı yoktur. “Tek dizinin üzerine diz çöküp, hafifçe başını eğerek, sağ elini yumruk yaparak göğsüne hafifçe vurmak” şeklinde metin içinde açıklanabilir. Günümüzde de benzer bir selamlaşma erkekler arasında Türkiye’de yaygındır.

Bayram sofrası: Bu şekilde her kültürde şenliklerde ailenin bir arada yemek yemesi yaygındır. Burada sahneyi tamamlayan bir unsur olarak önemli bir konumdadır.

Görüldüğü üzere tek tek oluşturulan sahnelerin erek okur kitlesinde istenen etkiyi yaratması için sadece kelimelerin veya sözlerin diğer dildeki karşılıklarını vermek yeterli değildir. Buradaki kaygı erek okurun zihninde hangi sahnelerin canlandığı ve bu sahnelerin anlamlarının doğru aktarılıp aktarılmadığıdır.

SONUÇ

1977 yılında Fillmore tarafından geliştirilen *sahneler ve çerçeveler semantiğinin* çeviribilime dinamik bir bakış açısı kazandırdığı söylenebilir. Aynı metni farklı zamanlarda ve farklı ruh haliyle okuduğumuzda farklı alımlarız. Bu nedenle metnin yorumu kişiden kişiye olduğu gibi, farklı zaman dilimlerinde farklı çağrışımlar yapabilir. Bu nedenledir ki, aynı metni okuyan farklı kişilerin (bazen de aynı kişi) yaptığı çeviriler birbirinden ayrışır. Bu duruma dilin ve dil anlayışının da devingen olduğu ve sürekli diğer diller ile etkileşimi dolayısıyla evrildiğini de unutmamamız gerekir.

Yukarıdaki kısa örnek dahi kültürler arasında yanlış anlaşılmaya müsait durumların olduğunu ve bu kısımların doğru çağrışımları yapması için uygun ve eşdeğer bir şekilde çevrilmesinin ne kadar önemli olduğunu göstermektedir. Bazen yerelleştirme yapılması da gerekebilir. Çevirinin erek okurun zihninde mümkün olduğunca aynı *sahneleri* (veya benzer) canlandırması için amaca uygun *çerçevelerin* kullanılması son derece önemlidir. Bir çeviri çağrıştırdığı sahnelerle erek kitle tarafından yanlış anlaşılıyorsa ve hatta anlaşılıyorsa o zaman çeviri amacına ulaşamamıştır. Bu nedenle bu yaklaşım çeviri eleştirisi için de kullanılmaya uygundur.

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**PRODUCTION AND CHARACTERIZATION OF BORON-REINFORCED
MULTICOMPONENT ALLOYS**

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Abstract

Today, studies on the development of new materials as alternatives to traditional materials continue. Among these new types of materials, the use of multicomponent alloys is becoming increasingly common. Multi-component alloys are more attractive working areas due to their higher strength properties than classical alloy types. In this study, a multi-component alloy containing Cu-Fe-Co-Ni-V elements was produced, and then B element was added to this alloy in different ratios, and its effect on the properties of the alloy was investigated. The production of the multi-component alloy was carried out by powder metallurgy. The properties of the alloy obtained in tablet form after mixing, pressing, and sintering in the vacuum oven were determined by using Scanning Electron Microscope and integrated EDX system, XRF, XRD, and Vickers hardness device. The samples were taken to the arc furnace, vacuumed inside the oven and then filled with Argon gas at atmospheric pressure. Then, the arc was formed and the melting process was performed. The smelting process was performed in at least 5 repetitions. The sample was expected to cool with each repetition and the same vacuuming and Argon gas process was repeated. The same processes were then carried out after the addition of B into the alloy, and the contributions of element B to the alloy were tried to be revealed. As a result of experimental studies, it was observed that different phase regions were formed with the addition of B element. It has also been determined that element B increases hardness by about 50%.

Keywords: Multicomponent alloys, boron, powder metallurgy, hardness.

INTRODUCTION

The alloying method is a method that has been used since time immemorial. A classic alloy can be obtained by adding another element to a base material. Thus, a property of the formed alloy is developed. But recently multicomponent alloys are being studied more. In multicomponent alloys, at least 5 different elements are mixed in close proportions (5%-35%) (George, Raabe, & Ritchie, 2019; Seol et al., 2020). In this way, several properties of the alloy obtained are developed at once. Thus, new materials with more uses can be obtained. Multicomponent alloys can incorporate more than one intermetallic structure. Multicomponent alloys, which cause quite a lot of phases to form, are considered difficult to form mixtures. However, contrary to this idea, the mixing entropies in alloys are quite high (Gao, Yeh, Liaw, & Zhang, 2016; George et al., 2019; Tsai & Yeh, 2014).

The most important properties of multicomponent alloys can be listed as high strength/hardness, superior wear resistance, high temperature resistance, high structural stability, good corrosion and oxidation resistance. The fact that several such properties cannot

be obtained by conventional alloying methods plays an important role in the orientation towards high entropy alloys (Gao et al., 2016; George et al., 2019; Miracle et al., 2014).

The element boron is obtained from compounds extracted in the form of minerals underground. It is never found in a free state in nature. It is a fairly light element. It is used in various semiconductor technologies. But another use of boron is to increase hardness and wear resistance. Due to these properties, it is included in a lot of compounds (Ferrari et al., 2019; Seol et al., 2020; Seol et al., 2018).

There are many methods available for producing high-entropy alloys. The fact that these methods do not require complex technologies is one of the factors that make it attractive to study the subject. It is possible to produce samples by methods such as melting, casting, powder metallurgy and deposition methods (Li & Raabe, 2017).

Due to the fact that it can be produced both simply and allows the development of multiple properties, the areas of use of multicomponent alloys are very wide. It has the opportunity to address many areas, especially in the fields of aviation, industry, manufacturing and nuclear (Ferrari et al., 2019; Gao et al., 2016).

In this study, a multi-component alloy consisting of 5 elements was obtained. By adding Boron in certain proportions to this alloy, some basic properties have been examined. Analyses were performed using SEM-EDX, XRD, XRF and Hardness devices for the examination.

MATERIALS AND METHODS

In this study, Cu-Fe-Co-Ni-V elements in powder form at micron level were used. These elements are mixed in a bowl. Then this mixture is brought into mold form with a simple pressing machine. The samples formed in tablet form were melted in Buhler Arc Melter MAM-1 brand arc furnace. The melting process was repeated 5 times for each sample. After each melting, the samples were expected to cool and solidify. Before melting, the oven is vacuumed. Then, argon gas was filled and melting processes were performed. The samples obtained after the melting processes were subjected to homogenization heat treatment under 900C/6h conditions. Thus, homogeneous distribution of particles and phase formations have been realized.

To obtain the alloy, 40% Cu element and 15% Fe, 15% Co, 15% Ni and 15% V elements were melted. These powders have a purity rate of at least 99.5%. In this way, the first sample was produced. Then, the same processes were repeated by including 1% of the Boron element in the mixture at the rate of 1% of the obtained mass. Then, the process was repeated by adding 3% boron to the Cu-Fe-Co-Ni-V mixture.

The samples were analyzed after the necessary metallographic preparations. For the purpose of layer morphology and determination of phase-forming elements, Zeiss Ultra Plus brand scanning electron microscope (SEM) and the EDX analyzer integrated with it were used. Samples were also subjected to XRD and XRF analysis. XRD was performed with detailed screening for the determination of boron phases in the alloy. Finally, the hardness test of the samples was performed and the results were recorded.

RESULTS

Microstructure examinations of the produced multi-component alloys and the boron element added to them were carried out with SEM (Scanning Electron Microscopy) and the EDX device connected to it. The images obtained with the help of Electrons Scattered Back in the Scanning Electron Microscopy are located at the bottom respectively.

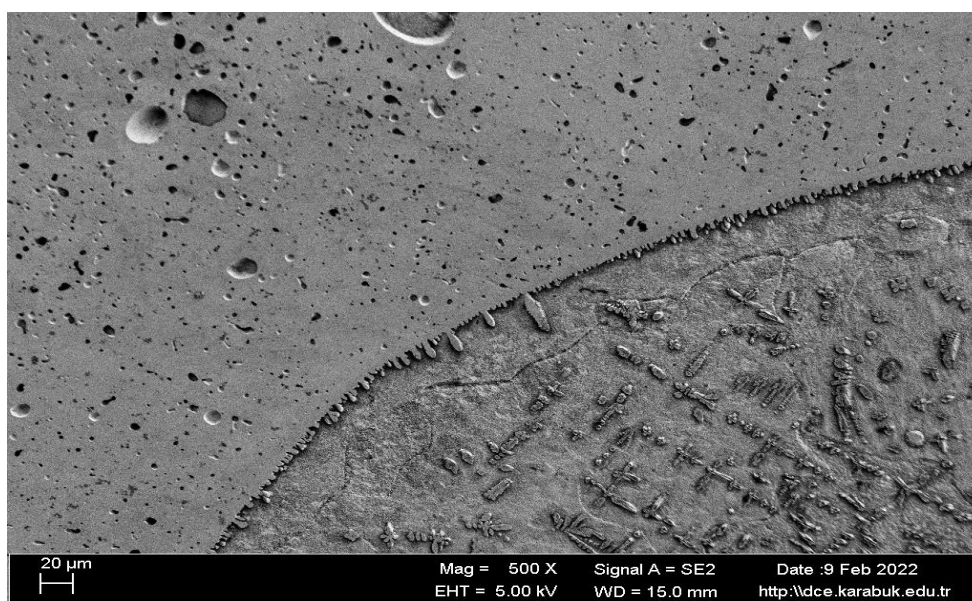


Figure 1. SEM (BEI) of Cu-Fe-Co-Ni-V multicomponent alloys

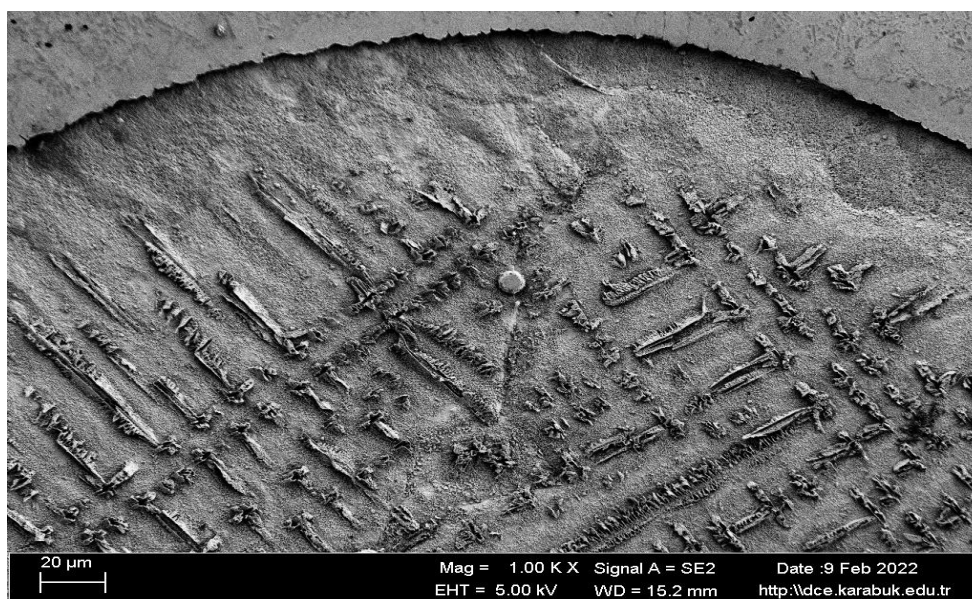


Figure 2. SEM (BEI) of (Cu-Fe-Co-Ni-V) + 1% B multicomponent alloys

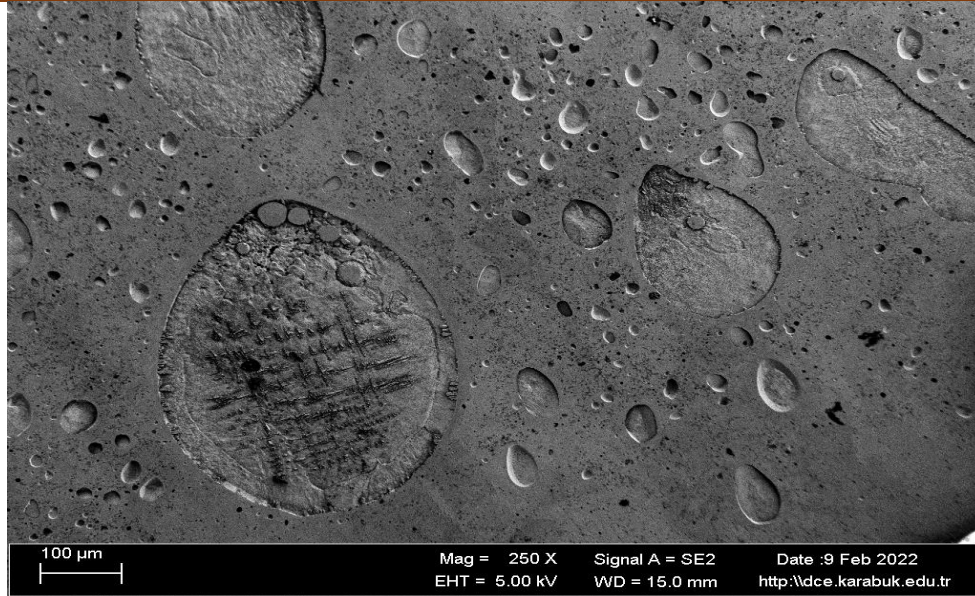


Figure 3. SEM (BEI) of (Cu-Fe-Co-Ni-V) + 3 % B multicomponent alloys

The EDX results of the resulting sample are given in Figure 4.

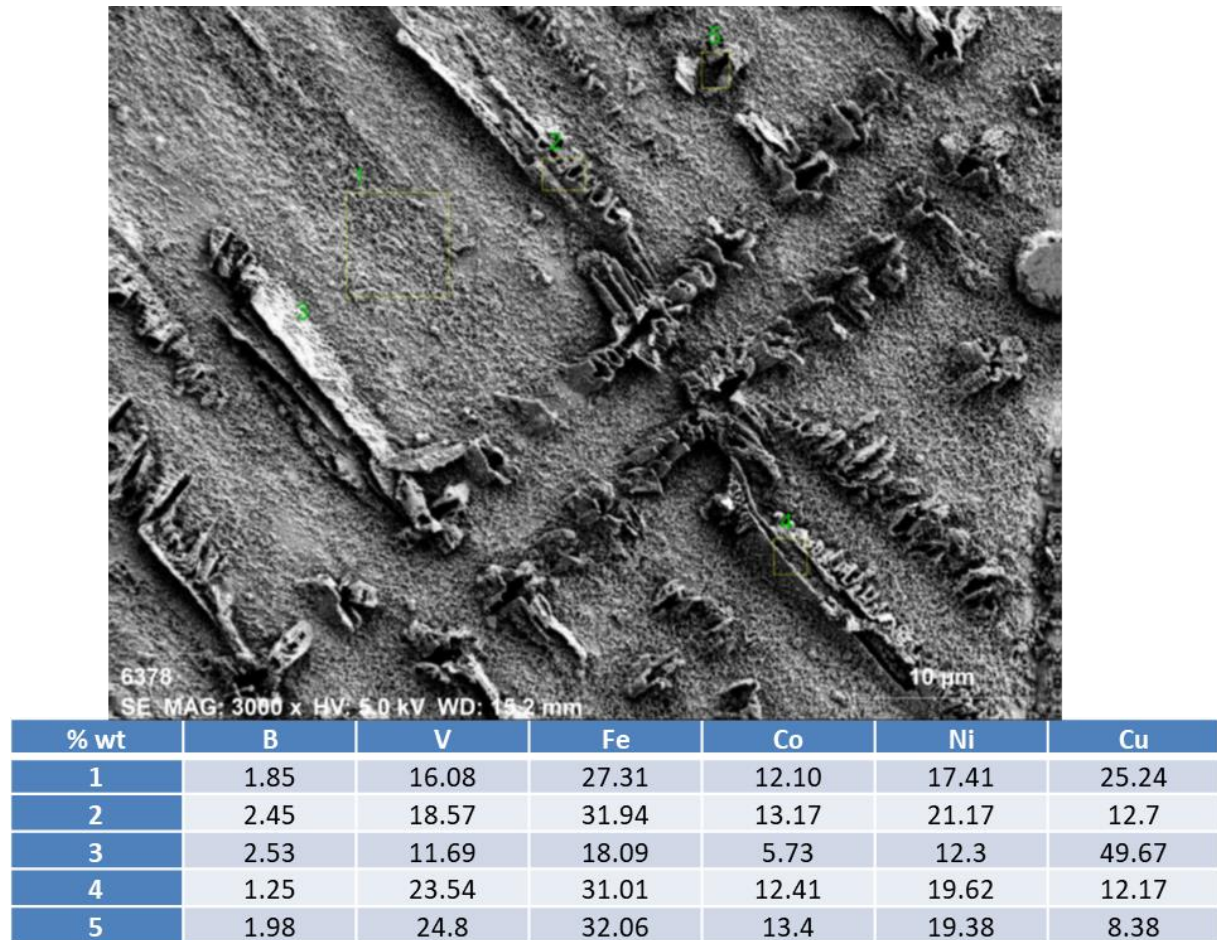


Figure 4. EDX point analysis regions and analysis results of (Cu-Fe-Co-Ni-V) + B multicomponent alloys

The XRF and XRD results of the sample produced are given below.

Table 1. XRF chemical compositions

Cumulative References rates							
	Cu	Fe	Co	Ni	V	C	B
Alloys- 1	39,01072	16,29991	16,29991	14,50062	14,76714	0,001897	0
Alloys- 2	37,36388	14,68247	16,52216	14,99767	15,32821	0,002874	1,102742
Alloys- 3	38,30272	13,60434	15,78044	14,47051	14,85486	0,001857	2,985269

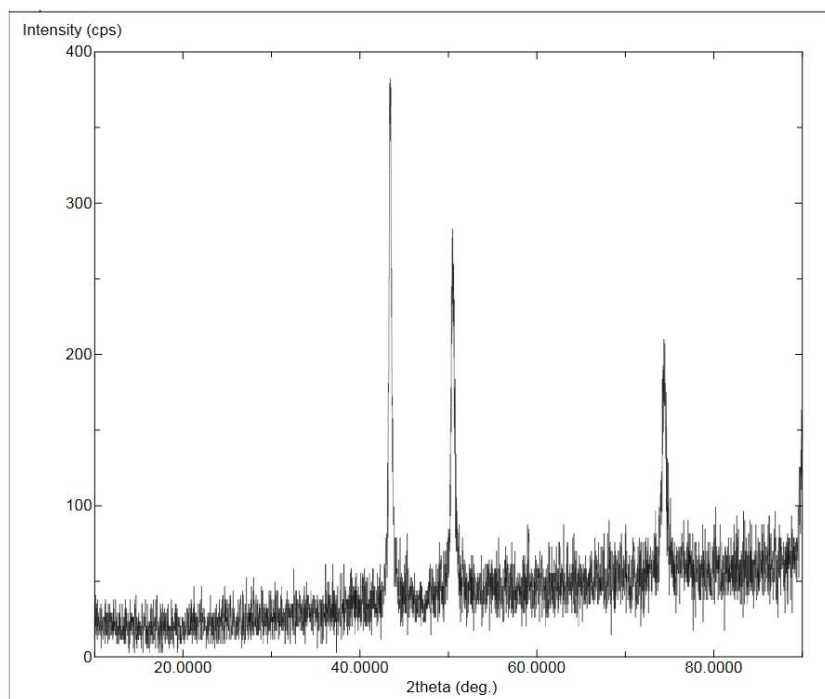


Figure 5. XRD peak for Cu-Fe-Co-Ni-V alloys

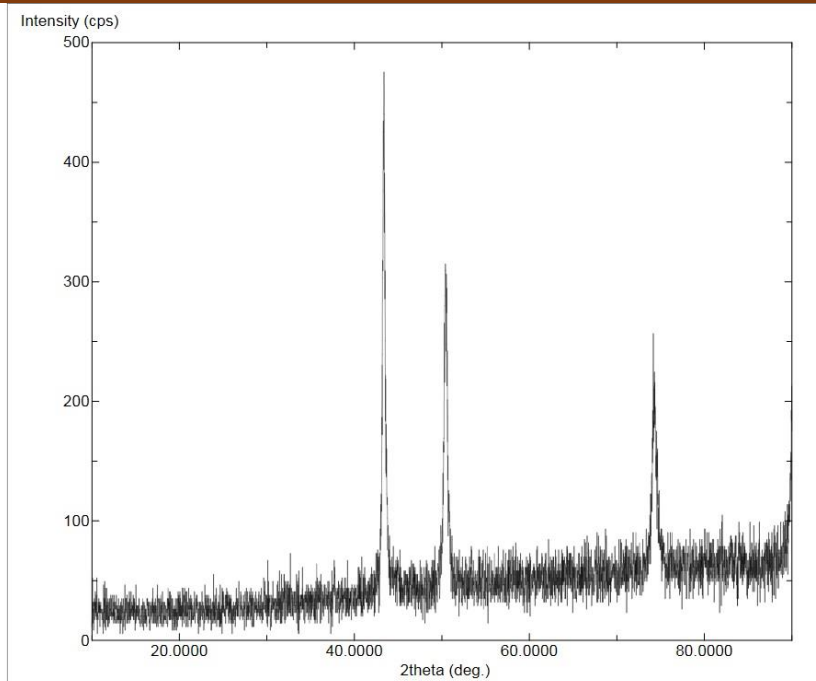


Figure 6. XRD peak for (Cu-Fe-Co-Ni-V) + 1% B alloys

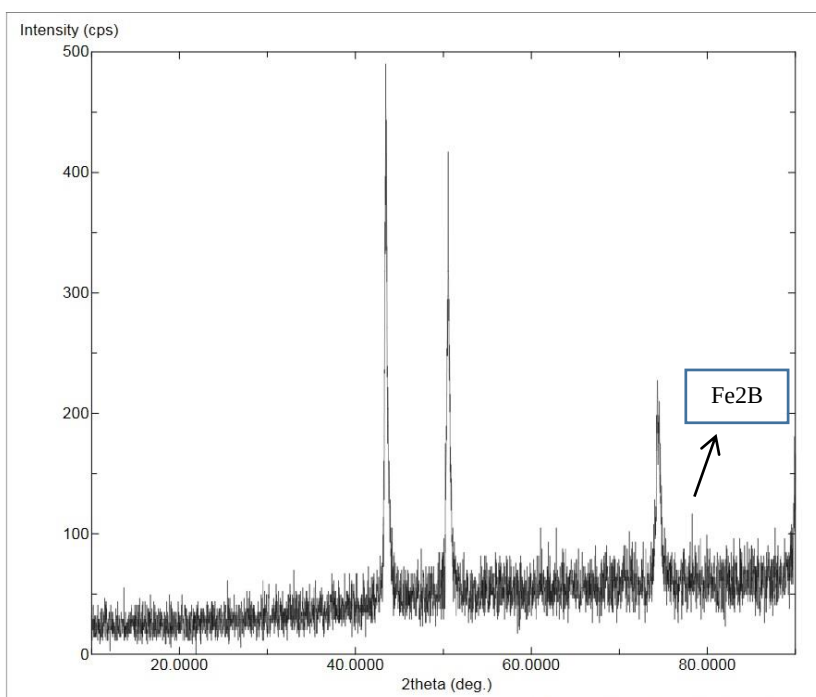


Figure 7. XRD peak for (Cu-Fe-Co-Ni-V) + 3% B alloys

The data of the microhardness test applied to multicomponent alloys are in table 2.

Table 2. Microhardness measurements of multicomponent alloys

Multicomponent Alloys	Average Hardness (Hv 0.1)
CuFeNiCoV	318,6
CuFeNiCoV+1B	425,4
CuFeNiCoV+3B	435,4

DISCUSSION

In this study, the manufacturability of multicomponent alloys with arc melting furnace was examined. In addition, a new alloy was obtained by adding Boron to these alloys.

When SEM and EDX images are examined, the results of 1% and 3% additions of Boron element are seen. It is seen that the element boron forms phases with different structures. One of these phases is the Fe₂B phase. In addition, it is understood from EDX analyzes that the other 5 elements form different compositions in different regions. As a result of the addition of boron, it is clearly seen in Figure 2 and Figure 3 that new compositions are formed between the structures seen in Figure 1. This again proves that the boron additive creates new phases in multi-component alloys (Campos, Islas, González, Ponce, & Ramírez, 2006; Gao et al., 2016; Tsai & Yeh, 2014).

Looking at Table 1, the XRF results show us that the % distribution of the elements that make up the multicomponent alloy is appropriate. The % of the element boron also appears in the same table. Thus, the planned weight-to-weight ratios during alloy formation gave consistent results.

Looking at the XRD analyses, the peaks all appear to be similar to each other. Since the percentage of the alloy consisting of 5 elements is high, the results are expected to be similar. The contribution of the element boron was seen with lower peaks. The expected Fe₂B phase formation has been identified (Campos et al., 2006; Liu, Zhao, Li, Zhu, & Lin, 2019).

Finally, the samples were tested for hardness. The test was repeated 5 times for each sample and the average values were given. The fact that boron significantly increases hardness is a feature that overlaps with the literature (Hou, Hui, Yao, Chen, & Liu, 2019; Li & Raabe, 2017; Tsai & Yeh, 2014).

CONCLUSIONS

The multicomponent alloy consisting of Cu-Fe-Co-Ni-V elements was obtained in a mini arc furnace and the Boron element additive study was carried out. Various analyzes were performed on the samples where melting and homogenization studies were carried out. The results obtained are as follows.

- 1) When SEM images of samples are examined, homogeneous structures are seen
- 2) The chemical distributions in the EDX analyses show that different phase fractions occur.
- 3) As a result of XRD and XRF analyzes, the elements in the alloy and the Boron additive were observed.

- 4) As a result of hardness tests, the addition of boron increased the hardness of the alloy by approximately 36%.

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**PUBLIC SENTIMENT ANALYSIS FOR HIV, HERPES, AND OCD ON THE REDDIT
SOCIAL MEDIA PLATFORM**

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Abstract

Purpose/Design

Understanding the challenges that people living with HIV, STDs like Herpes, and mental health conditions like obsessive compulsive disorder (OCD) is significantly important. People that don't have any first-hand knowledge or experience with people affected by these diseases or conditions receive much of their information about them via social media platforms. Increasingly, many people form opinions based on information they obtain through online social media. As a result, understanding the type of content that attracts people's attention on social media and drives discussions for these diseases and conditions is very important.

This research analyzes the sentiments of people who use online social media platforms such as Reddit and measures the rate of sentiment analysis of three health situations: knowledge, attitude, and practice. It specifically examines the impact of positive and negative sentiments on the patients with these conditions and diseases and the public's reaction to them.

Methodology/Approach

The principal origin for the datasets collected on keywords for HIV, Obsessive Compulsive Disorder (OCD), and HERPES were reprocessed using trends from Reddit. The data was legally obtained from the public resources. The research attempts to employ a lexicon-based approach to track the prevalence

of keywords indicating public interest in various categories of topics such as health, economics, politics, and other social issues.

Findings

Among the three diseases analyzed, HIV seemed less investigated when compared to the others despite its negative implications. Herpes showed the most negative implications. While Herpes is the one people were commenting upon the most. Although these diseases are perceived as more private, Reddit usage was observed mostly during the late evenings of the day.

Discussion

The data retrieved from Reddit needs deeper analysis to draw conclusions. Reddit data can be used to better understand user reactions and attitudes towards the disease posted on the platform. Positive, negative, or neutral responses give insights of how people feel and help guide the treatments of people with these health concerns.

Keywords: Social media, Reddit, sentiment analysis

1. INTRODUCTION

As the world increasingly connects through communication technology, there is a variety of opinions, ideas, and communication through the Global System for Mobile Communication (GSM) and the internet. This has led to various social media platforms such as Facebook, Twitter, WhatsApp, LinkedIn, and Reddit and these platforms have given users worldwide access to contributions on many different subjects. The internet continues to influence the way people communicate and conduct business globally.

Several of these platforms offer users the avenue to express their thoughts and converse with interested people around the world. These conversations cover a wide variety of subjects ranging from daily events to diseases and public health concerns. Due to the increasing development and dynamism of social media such as Reddit, it has been recommended that social media be utilized for public health conversations to promote awareness and share treatment advances. Furthermore, social media gives users both the opportunity to express their feelings and sentiments on sensitive issues such as health which will be the core focus of this research (Yue, et.al., 2019).

With a growing number of people affected by disease across the world, Reddit has provided opportunities for decision makers to understand the emotions of the public on these diseases (S. Li et al., 2020, Pastor, 2020, Raamkumar et al., 2020, Seltzer et al., 2017). A significant part of this research will concentrate on these health situations and contrast the sentiments of commentators on Reddit about them. In recent times, Reddit, owing to its Application Programming interface (API) has been able to access the data needed to conduct the needed research. For instance, Reddit users can freely and openly interact and exchange information on issues such as diseases and treatments. This has led to increases in communication traffic.

There are related works that have been done in sentiment analysis in the aspect of natural language processing. Several machine learning techniques and a bag of features structure for sentiment classification of a movie review data were applied by Pang, Lee and Vaithyanathan. Hutto and Gilbert (2014) made use of Long Short-Term Memory Networks (LSTMs) to identify Influenza speech and Twitter data. Conversely, Sommar and Wielondek (2015), detect Influenza inside micro-blogging sites by making use of convolutional neural networks as well as to factor graph models using a suite of discrete components. Similarly, Reddit data has been used to examine several medical and health issues that deal with mental stability like depression and anxiety.

The focus of this research is sentiment analysis on HIV, Herpes and OCD diseases. This research utilizes information taken from Reddit and is both very long without being advantageous to longer labeling such as micro-blogs. Therefore, the length of posts will eventually help to identify the causes of the previously mentioned medical conditions, indicators, and dominant opinions about them. The research will be

limited to text-data as well as analyzing the metadata such as time to post and number of responses (Diesner, 2013).

Some studies have been conducted on sentiment analysis mainly in the movie domain and review of products was applied by Pang, Lee and Vaithyanthan to inform potential consumers while others questioned and tested whether microblogs were better for sentiment analysis. Another study examined whether the sentiment analysis technique could be employed to gain insight into the Presidential Election of 2012 in the U.S. In another study (Choudhury et al., 2013c), Facebook data was used to construct a set of statistical models that could predict postpartum depression.

2. METHODOLOGY

The research data is sourced mainly from the Reddit platform using an Application Programming Interface (API) code. It is presented to the public in a relative search volume format but does not provide an exact number of the total searches. Through Reddit, an unbiased sample of data from Google searches can be obtained and it is updated in real time. This can help researcher understand the global reaction to major events and topics. Reddit, like other social media platforms, is considered the global center of big data because people use their applications and spend excessive hours on these outlets (Alamoodi et al., 2021). Normalization of data such as conversion to non-standard words to their canonical form of prolonged words, acronyms that are informal, misspelled words, negative handling into relative value all help in the data evaluation that will be conducted to analyze the performance (Gupta & Joshi, 2017).

With an API code, more data was gathered and the extractions on the searched diseases that showcased reactions, comments, and sentiments. The purpose of conducting the research on the three selected disease patient groups (HIV, HERPES and OCD) is to establish a better understanding of these online users and to conduct, post, and trend analysis using several tools to determine necessary and right conclusions.

The methodology design for this study as shown in Figure 1 will begin by researching the diseases where most people were not able to express their emotions and thoughts or were uncomfortable discussing with an individual but were willing to share a post of concern. Several diseases were covered. However, three diseases were identified for further analysis.

The research started by reviewing the observation on these topics on sentiment analysis and the ten most googled diseases were included into the examination. The Reddit platform data is available to download by the public directly through their portal or it can also be extracted using Application Programming Interface (API) which is designed for data extraction from Google Trends. As a result, social media sites are often targets of campaigns for dissemination of information as well as mis- information (Ociskova et al., 2013).



Figure 1. Methodology flowchart

These diseases were searched for ‘HIV’, ‘obsessive compulsive disorder’ and ‘Herpes’. Data was collected from the Eastern Standard Time data (EST), Central Standard Time (CST), Mountain Standard Time (MST) for the analysis.

2.1 Data extraction

Throughout this research, data from the Reddit platform was gathered and extracted to analyze these diseases for several characteristics which were listed in different categories. A lexicon based approach was used to extract data from Reddit such as post id, post text, total comments, post created date, comment text, comment created date and scores were obtained to show the reactions (Pagolu,et.al.,2016), sentiments and emotions of individuals towards the disease. This achieved its stated

purpose by allowing users to *post* news, questions, and other information in the form of written language, texts, images, and links to external websites to analyze people's attitudes, emotions, evaluation, and opinions.

Users often engage with the posts by getting involved in reading or discussions consisting of comments made by other users in the community. Discussions are a vital and valuable feature of Reddit. Posts often generate lengthy and vibrant discussions, and comments help users analyze and engage with the content, through the different perspectives and interpretations provided by members of the community. Voting is the main mechanism Reddit provides its users to affect the ranking and the visibility of posts and comments. On Reddit, every post or comment is given a *score* based on the number of votes it gets. An *upvote* raises the score by a point and a *downvote* lowers it ("Source credibility in social media: A case study of Reddit community," 2021). Posts and comments are sorted and presented to users in order of the score they receive. The score is the primary and most significant factor in ordering posts and comments made within a small period and is directly correlated with the votes. Voting allows users to steer the discussion and drive the most relevant, interesting, and insightful comments to prominence in the discussion.

2.2 Data cleaning and data preprocessing

Data cleaning and preprocessing was developed by the software program, Python, which includes the Pytrends open-source library that provides access to Google Trends (Rogers, 2021). Since Google trends real time data for only seven days prior, an unofficial Google Trends Application Programming Interface called Pytrends was used to extract hourly data for a longer time frame. It is based on the Python programming language which helps in gathering data in a short amount of time. Most of the Python code was executed on Google Colab. Google made Google Collaboratory, which is an online framework where one can write, execute Deep Learning and Machine Learning codes (Tul et al., 2017).

The data was extracted to Google sheets for further analysis. Sentiment analysis involves getting data from the real world which in most cases is data that is not cleaned. It can contain incomplete variables where certain attributes of concern are lacking as well as values and thereby contains errors or outliers and data that is inconsistent.

In cleaning data, there are various attributes that are checked which involve missing values which can occur as a result of equipment malfunction, data not entered due to misunderstanding, data that may not be considered necessary at the time of entry, or inconsistent with other recorded data. Data can also be discarded which also leads to duplicate values that might be recorded multiple times, remove deleted comments and scaling. Data processing helps to transform the data into an adequate model for a mining procedure. The purpose of the preprocessing is to normalize the data, to find the relations between data, extract features for data. and remove outliers.

There are different methods in data preprocessing such as data cleaning, reduction, and transformation (Peterková & Michalčonok, 2016). It plays a vital role in processing huge data scales, preparation, analysis, and a better training set. In sentiment analysis the preprocessing that was done is converting into lowercase, removing punctuations, having multiple punctuations and hashtags to intensify the sentiments than a word without punctuation or autocorrect. Tokenization is a method of transforming text into tokens before converting it into vectors and cleaning (E.H. J, kim et al., 2016) that is correction of text, removal of repeated letters, removal of stop words, language detection, and lemmatization. According to Mostafa (2018), the purpose of sentiment analysis is to distinguish and extract subjective information from huge volumes of unstructured data by combining data mining techniques and machine learning.

2.3 Natural Language Toolkit

The Natural Language Toolkit (NLTK) is a Python programming language that is known for working with human language data. It encompasses text processing libraries for classification, Tokenization, stemming, tagging, parsing, and semantic reasoning, wrappers for industrial-strength NLP libraries, an active discussion forum, and an easy-to-use interface to over 50 corporate and lexical resources like WordNet. NLTK provides several tools that enable it to effectively manipulate and analyze linguistic

data. Text classifiers are one of its more advanced features; using a pre-trained sentiment analyzer called valence aware dictionary and sentiment reasoner (VADER) to sort the data into positive, neutral, and negative categories. Four values will be returned by the VADER library: pos: the likelihood of a positive attitude, neu: the likelihood of a neutral sentiment, neg: the likelihood of a negative sentiment, and compound: the normalized compound score, which calculates the sum of all lexical ratings (Khemani & Adgaonkar, 2021).

3. RESULTS

This research goal is to determine the comfort of the people in the US to share their sensitive information regarding the three types of medical issues which are typically not openly spoken about in public where most people use social media platforms to share this information. They seek help from others suffering from the same problems or redirect them to the doctors who can assist them. The visualizations of the results in next the sections show a combination of words and how people feel about sharing their information on the internet. The results are presented in terms of word clouds, time series distribution, user reaction analysis, sentiments analysis and emojis distribution.

3.1 Word cloud impacting post

Word clouds are useful tools to highlight the main pain points to illustrate the concerns by looking at the negative results while positive results of word clouds indicate the needs of patients.

Figure 2a results show the positive word frequency that appears more frequently. As seen in the figure, the words which are shown in the bigger font are more frequently used. The positive words for HIV are 'got test', for Herpes. it is 'sex' and 'know' and for OCD, the words are 'feel', 'first', 'thing', and 'real'. The most frequently used word in user interaction indicates the main topics they use to speak up about their illness. 'Test' is a common word used for HIV. Herpes can be an awareness area to be developed as well as 'sex'.



Figure 2a. Positive result using word cloud for HIV, herpes, and

OCD

Figure 2b results show the negative word frequency impacting each post's comments. User negative comments including words like 'cold', 'outbreak', 'sore throat', 'scare', 'bad', and 'unprotect'. This result provides a quick understanding of what the user is really thinking about a particular topic.

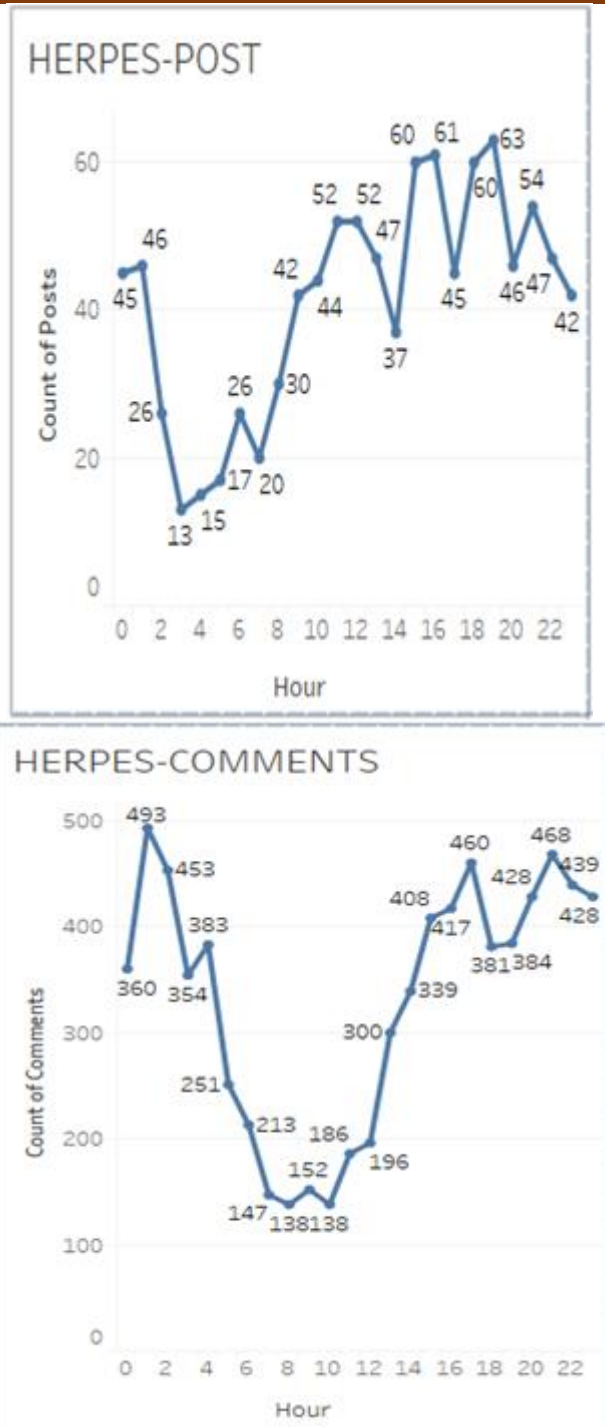


Figure 3a: Hour wise post count for Herpes

Figure 3b: Hour wise comment count for Herpes

Regarding HIV, Figure 3c shows the distribution of post count. When compared to Figure 3a and 3b, people are more interactive at 9.00 am followed by 11.00 am with the lowest between 1.00 am to 8.00 am. Figure 3d shows the count of comments per hour for HIV. As seen in the visualization, people are more interactive at 5.00 pm followed by 7.00 pm with the lowest between 7.00 am to 12.00 pm. Again, it increases between 5.00 pm to 9.00 pm.

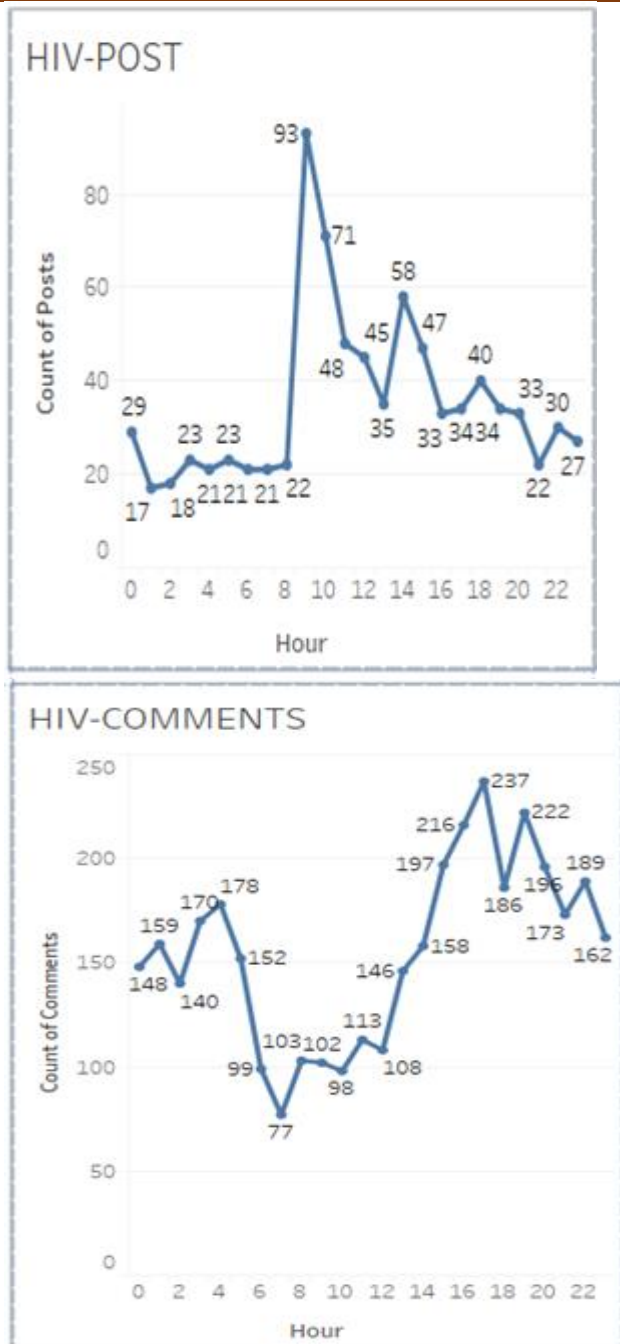


Figure 3c: Hour wise post count for HIV

Figure 3d: Hour wise comment count for HIV

Figure 3e presents the OCD time series trends which show the time series distribution. Peoples' interactions are higher at 4.00 pm followed by 6.00 pm with the lowest between 5.00 am to 11.00 am. Figure 3f shows the comments count for the OCD population. It shows that people are more interactive at 4.00 pm followed by 8.00 pm and the lowest between 7.00 am to 12.00 pm.

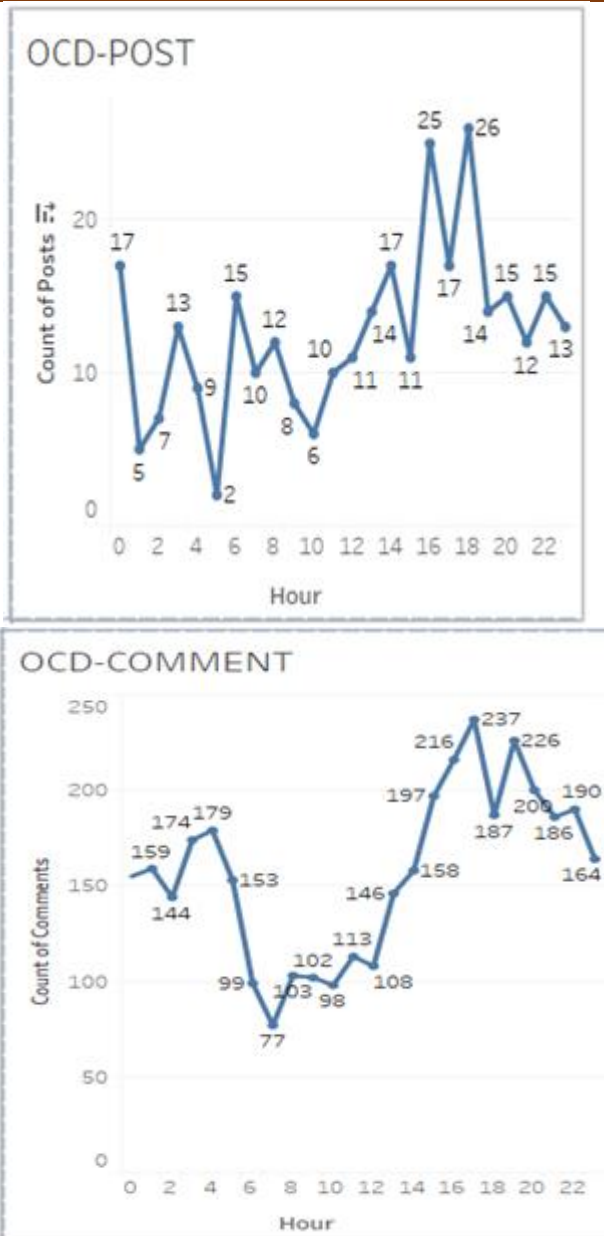


Figure 3e: Hour wise post count for OCD

Figure 3f: Hour wise comment count for OCD

It is understandable that this type of disease is more personal and requires privacy. Similar patterns have been observed stating that people like to post when they are more likely alone during late night hours. Although comments posted during the day show a different pattern by people who do not mind posting.

3.3 User reaction analysis

Figure 4a shows the bar graph count of posts that reflect peoples' interest. This visual suggests people are more interested in mostly talking about OCD (3000+ post), followed by OCD (990 + posts). Herpes (need a number here), followed lastly by HIV (845 posts).

Figure 4b indicates the comments count which shows the peoples' reaction to each post. It suggests people are more interested in reacting to the posts related to Herpes (7,916 comments), OCD (3,771 comments), and HIV (3,729).

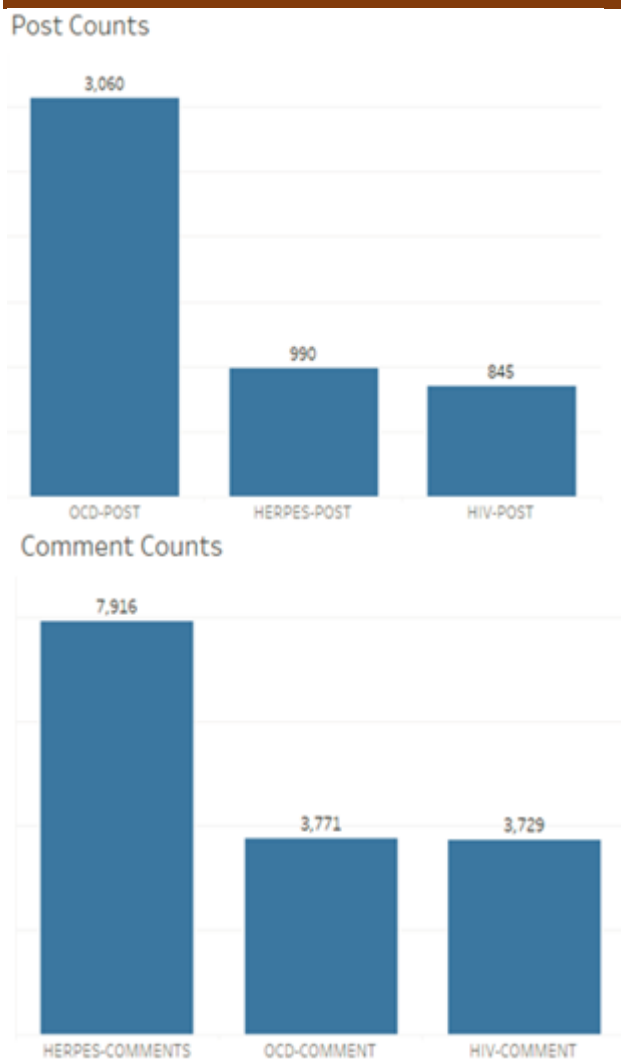


Figure 4a: Post counts

Figure 4b: Comment counts

Posts, comments, and votes are three main indicators for the Reddit social media platform. Votes are methods on the Reddit website by which users can signal their approval or support for a post. Figure 4c shows the average count of votes for each health issue. People's votes are higher in Herpes (4,500+), followed by OCD (3,667) and HIV (1,411).

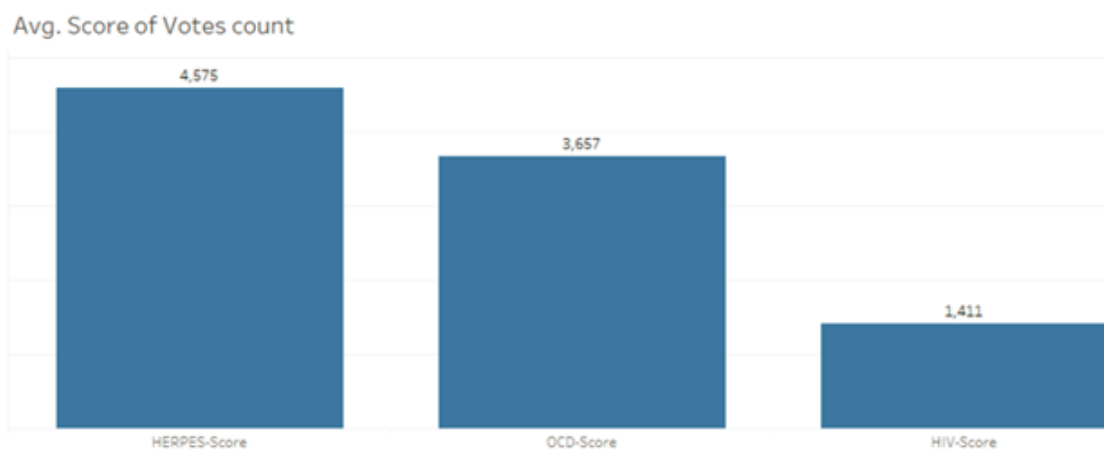


Figure 4c: Average counts of votes for Herpes, OCD and HIV

The user reaction analysis indicates that HIV is best known among three diseases. It may be concluded that people are more educated on this disease and its treatments as compared to other two diseases.

3.4 Sentiment Analysis

Figure 4a shows the positive, negative, and neutral distribution of words for each post. Positive sentiment (41%) is represented in green, negative sentiment (23%) is represented in red and neutral sentiment (35%) is represented orange. Comparative checking of the comments shows 7% or higher. 10% are negative and more than 82% are neutral.

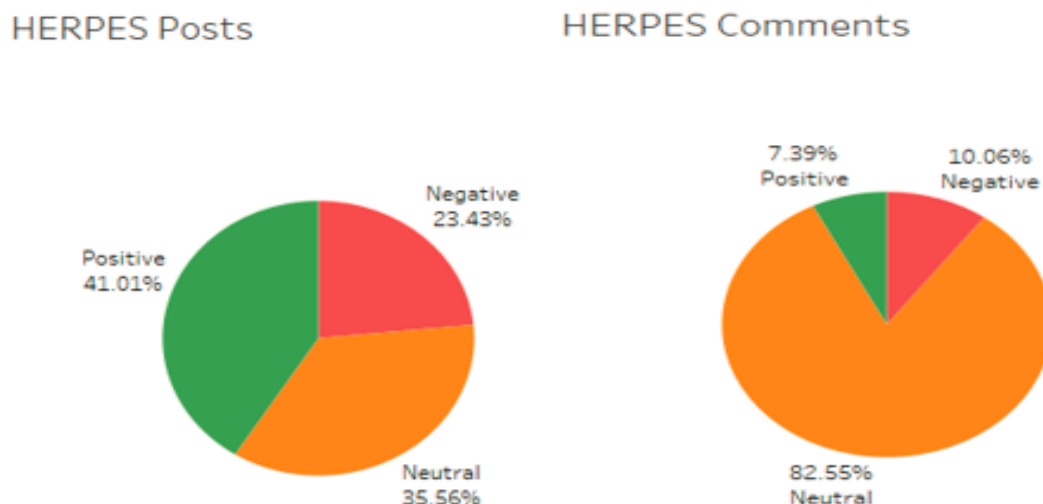


Figure 4a: Positive, negative, and neutral score for Herpes

Figure 4b shows the positive, negative and neutral distribution of words for HIV. When compared to Figure 4a, there is a decrease of more than 10% of positive sentiment followed by a decrease of 5% of negative sentiment and more than 10% of increase in the neutral sentiment score. Simultaneously there is a slight difference in comments. The number of positive sentiments decreased by 1%, negative sentiment shrunk by 2%, and there was a slight increase of 3% in neutral sentiment.

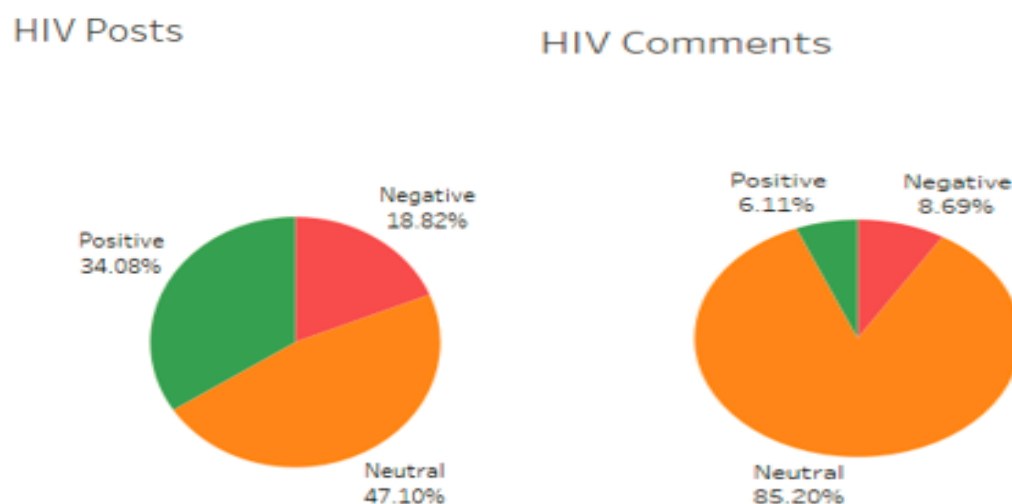
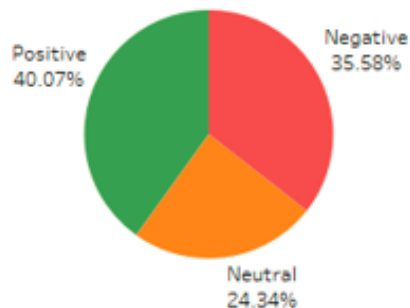


Figure 4b: Positive, negative, and neutral score for HIV

Figure 4c shows the positive, negative, and neutral distribution for OCD. When compared to Figure 4a and 4b, the positive rate of OCD is very low (33%) and there is an increase of 20% in negative comment count and a decrease of 15% in neutral comments. The scores of comments are almost identical to the Herpes and HIV comments.

OCD Posts



OCD Comments

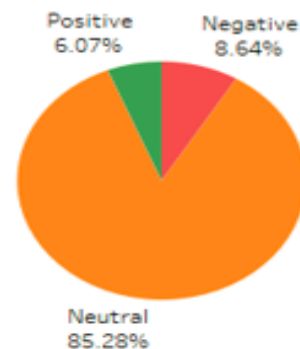


Figure 4c: Positive, negative, and neutral score for OCD

This analysis proves that people are more interactive on HIV and OCD topics when compared to the counts that Herpes overtaking the total count value when comparing positive and negative distribution. Herpes has positive posts of 41% and OCD posts have 33% of positive comments HIV has 6% of positive comments which demonstrates their status in social media.

3.5 Emojis distribution

This section results show the expressions and emotions of the people with emojis using the word cloud. The different symbols of the emojis signifies different meanings. For example, the red heart means most of the people like and are in accordance with the posts while the loudly crying means they show their concern and displeasure with the post. The Emojis are simply a way to save time in writing a lot because most people can understand and relate easier with them.

Most of the emoji sentiment shares overlapping words. The emojis which appeared most frequently are 'loudly_crying_face', 'face_with_tears_of_joy', and 'folded_hands' as shown in Figure 5a. The sentiment shows most of the people have negative emotions for HIV while Figure 5b shows the emoji sentiment for OCD. The emoji that appeared more frequently was 'face_with_rolling_eyes', 'grinning_face_with_sweat', and 'folded_hands_light_skin_tone'. When compared to HIV, the results show that most of the people have neutral emotions for OCD.

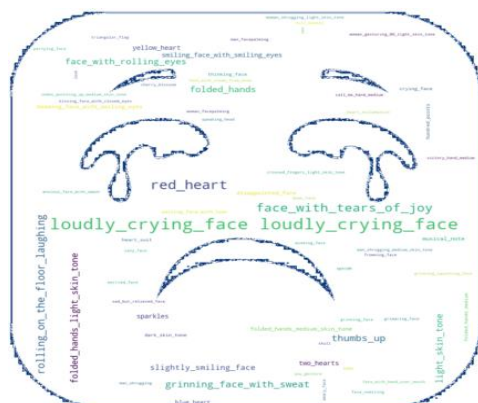


Figure 5a: Emojis result for HIV



Figure 5b: Emojis result for OCD

Figure 5c shows the distribution of emoji for Herpes. Since the frequency of comments is higher for Herpes as shown in Figure 4b, the count of emoji is also higher. When compared to Figure 5a and 5b, the result for Herpes shows people are more likely to discuss this with the positive emotions. The most frequently used positive words are 'Smiling_face_with_smiling_eyes',

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Authors contributions

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Abstract

This study aims to improve the falling performance of a high-pressure boiler feed water pump (HPBFWP) in a multi-pump system used in power plants and make a comparative analysis of maintained and non-maintained pumps. Implementing a comprehensive and ongoing maintenance program can solve many problems. Stator, rotor, and bearing defects are responsible for more than 90% of motor failures. Pump performance may suffer from a variety of defects, including shaft misalignment, eccentricity, bearing faults, stator faults, and rotor faults. By using developments in mechanical engineering and artificial intelligence-based techniques, malfunctions of rotating machines can be detected early, and at this point, periodic maintenance and follow-ups are highly beneficial. This study compares the performance of a high-pressure boiler feed water pump utilized in a power plant's boiler feed water system before and after maintenance. It was determined that the performance improvement ratio (PIR) changes between 23% and 29% for the ideal value of a valve opening ratio and has a maximum value of 29% at a valve opening rate of 70%. It was determined that the pump showed 8% better flow performance than before the maintenance due to an improvement in the flow rate of the HPBFWP after the maintenance. Therefore, it has been observed that regular maintenance of the pumps can lead to significant performance increases in the pumps after the maintenance.

Keywords: Feed water boiler pump, maintenance, service, performance enhancement.

BAKIMIN POMPA PERFORMANSI ÜZERİNDEKİ ETKİSİ

Özet

Bu çalışmanın amacı, güç santrallerinde kullanılan çok pompalı bir sistemde yüksek basınçlı kazan besleme suyu pompasının (YBKBP) düşen performansını iyileştirmek ve bakımlı ve bakımsız pompalarının karşılaştırmalı analizini yapmaktır. Kapsamlı ve sürekli bir bakım programını yürürlüğe koymak, birçok problemi çözebilir. Stator, rotor ve yatak kusurları, motor arızalarının %90'ından fazlasından sorumludur. Pompa performansı, mil hizasızlığı, eksantriklik, yatak arızaları, stator arızaları ve rotor arızaları dahil olmak üzere çeşitli kusurlardan zarar görebilir. Makine mühendisliğindeki gelişmeler ve yapay zeka tabanlı teknikler kullanılarak, dönen makinelerin arızaları erken tespit edilebilmekte ve bu noktada periyodik bakım ve takipler oldukça faydalıdır. Bu çalışma, bir enerji santralinin kazan besleme suyu sisteminde kullanılan yüksek basınçlı bir kazan besleme suyu pompasının bakım öncesi ve sonrası performansını karşılaştırmaktadır. İdeal bir valf açılma oranı değeri için performans iyileştirme oranının (PIR) %23 ile %29 arasında değiştiği ve %70 valf açılma oranında maksimum %29 değerine sahip olduğu belirlenmiştir. Bakım sonrası HPBFWP'nin akış hızındaki iyileşme nedeniyle pompanın bakım öncesine göre %8 daha iyi akış performansı gösterdiği belirlenmiştir. Bu nedenle pompaların düzenli bakımlarının bakım sonrası pompalarda önemli performans artışlarına yol açabileceği gözlemlenmiştir.

Anahtar Kelimeler: Besleme suyu kazan pompası, bakım, servis, performans iyileştirmesi.

1. Introduction

Pumps are the most basic and practical equipment used to transmit fluids from one place to another. However, around 20% of the electricity produced worldwide is used by pumps [1]. The cost of the electricity a pump uses makes up the majority of its total life-cycle cost. The expenditures of a pump unit's life cycle are also significantly influenced by maintenance and repairs [2]. Fig. 1 shows the

expense components during the lifespan of the pump. Because the reliability of the pump has an impact on maintenance and repair expenses, these costs must also be considered [3]. Fig. 2 shows the fault percentages in induction motors. Since the power requirement of a boiler feed water pump for a typical 500 MW unit is about 10 MW [6], it can be clearly seen that pumps play an important role in the system. A critical indicator of whether a pump is being run effectively is the Best Efficiency Point (BEP), the flow rate at which a pump operates most efficiently. Due to the non-uniformity of process variables in a production environment, few pumps consistently function at their exact BEP. However, a pump that is appropriately suited for its purpose will keep the flow close to its maximum efficiency [7].

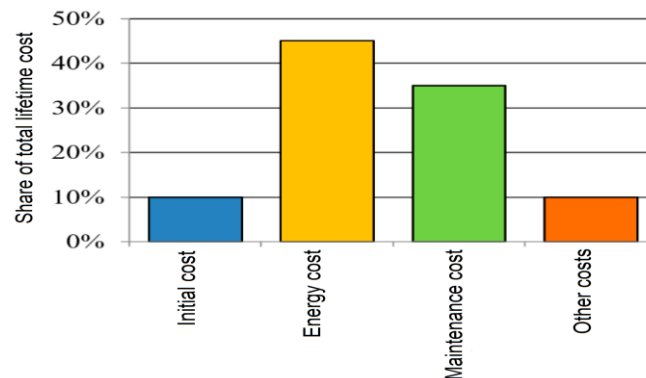


Fig. 1. Expense components during the lifespan of the pump [4]

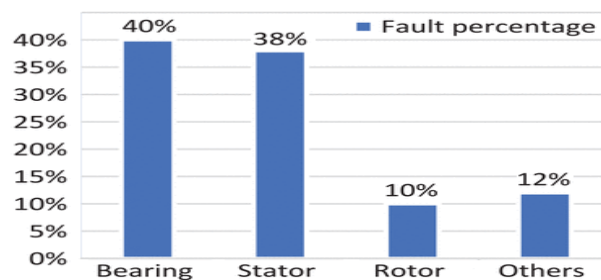


Fig. 2. The fault percentages in induction motors [5]

Stator, rotor, and bearing defects are responsible for more than 90% of motor failures. Pump performance may suffer from a variety of defects, including shaft misalignment, eccentricity, bearing faults, stator faults, and rotor faults. By using developments in mechanical engineering and artificial intelligence-based techniques, malfunctions of rotating machines can be detected early, and at this point, periodic maintenance and follow-ups are highly beneficial. Studies in the literature generally focus on fault detection or intelligent fault detection, however, much simpler solutions such as periodic monitoring and energy efficiency are often used to detect problems before they happen. The aim of this study is to determine the performance degradation of HPBFWPs in a multi-pump system used in power plants and to make a comparative analysis of their importance.

2. Material and Method

The boiler feed water pumps are designed to produce a much higher feed water flow than is required by normal boiler design conditions to cope with wear and transient conditions and to function as an operational margin. Fig. 3 shows the performance monitoring diagram of HPBFWPs. Fig. 4 shows the schematic diagram of the HP boiler feed water pumping system, which is the subject of this study. Fig. 5 gives a simple illustration of the HP boiler feed water pumping system line. In the system, 2*110 kW

high-pressure (HP) boiler feed water pumps, one of which is spare, are used. In addition, two low-pressure (LP) boiler feed water pumps, one of which is backup, are used. As known, the performance of pumps decreases over time. Therefore, periodic maintenance or monitoring is needed.

The HPBFWP system is designed to provide sufficient pumping capacity to meet flow requirements under all operational conditions. Also, HPBFWPs are designed in a redundant configuration to prevent interruption of operation. In this study, it was suspected that the pump was operating at low flow. The pump was followed up, and subsequent investigations and due diligence were made from old data. It has been detected that the pump is operating at low flow. The pump was disassembled and transferred to a workshop for detecting the failure reasons. The fault was fixed and the pump is mounted in place.

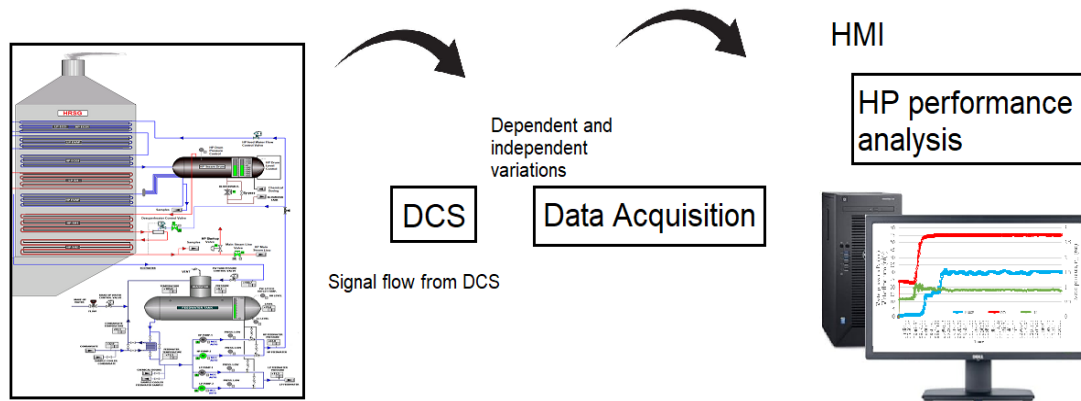


Fig. 3. Performance monitoring diagram of HPBFWPs

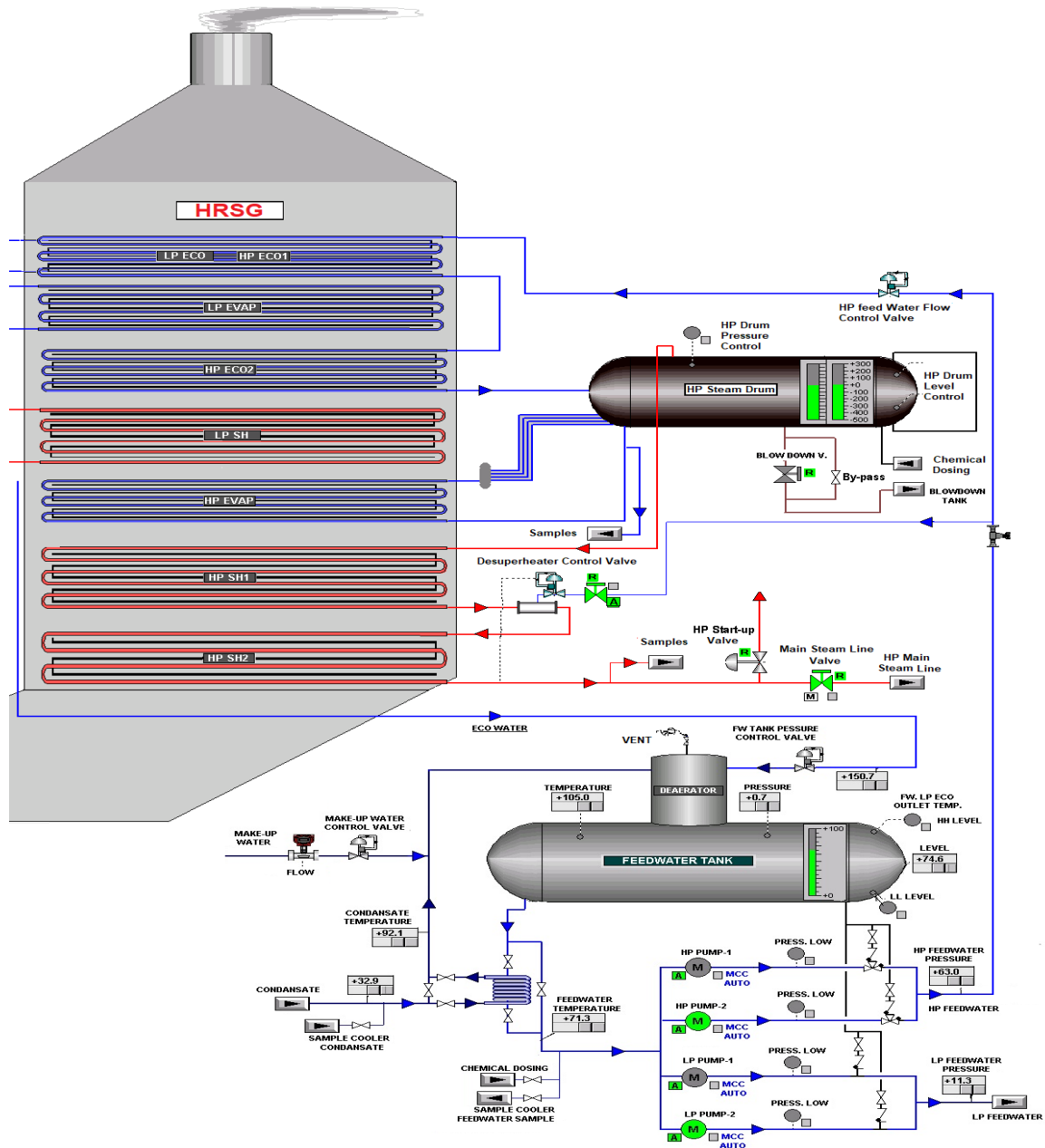


Fig. 4. Schematic diagram of HP boiler feed water pumping system

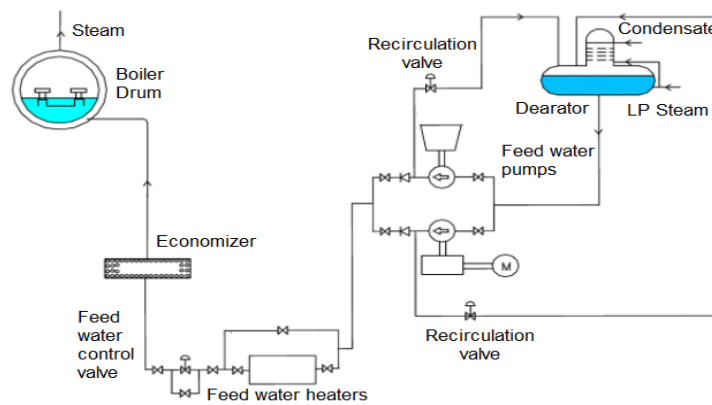


Fig. 5. HP boiler feed water pumping system line

The quality of water is as important for human health as it is for devices working with water. The use of soft water and/or pure water in power systems is extremely important for system efficiency and equipment life [8]. Manufacturers of steam turbines set high standards for the purity of the steam used in their equipment. [9]. For boiler feed pumps, the quality of the feed water is also crucial. In this context, it should not be forgotten that the pumps that are the subject of this study press the processed water. Table 1 shows the purity requirements for some manufacturers of steam turbines. Therefore, the properties of water used in boiler systems will be similar. Accordingly, it should not be forgotten that feed water pumps operate with different water than normal and under harsh conditions.

Because of its crucial role in the system, it is clear that periodic pump maintenance is significant. Periodic pump maintenance; is a type of maintenance that should be done regularly at a certain time interval and the end of a certain working period. These processes increase efficiency and extend the life of the equipment. Table 2 shows the periodic maintenance in centrifugal pump systems.

Table 1. Purity requirements for some manufacturers of steam turbines [9]

Parameter	ABB	GE	Westinghouse
Cation conductivity, mmhos/cm ($\mu\text{S}/\text{cm}$)	<0.5	<0.2	<0.3
Dissolved oxygen, ppb (mg/l)			<10
Sodium, ppb (mg/l)	10	20	<5
Chloride, ppb (mg/l)			<5
Silica, ppb (mg/l)	50	20	<10
Copper, ppb (mg/l)			<2
Iron, ppb (mg/l)			<20
Na: PO ₄ molar ratio		2.3-2.7	
Total dissolved solids, ppb (mg/l) max.		50	

Table 2. Periodic maintenance in centrifugal pump systems [10]

<i>Daily Checks</i>	<i>Monthly Checks</i>
• Check the bed temperatures. • Check the lubricating oil for water penetration and oil color • Check for oil leaks in the seals • Check the sealing elements • Check the cooling system temperature • Control noise in cavitation and bearings • Check motor amps and mains voltage	• Top up bearings with oil (if necessary) • Clean the oil gauge and filler plugs • Adjust the oil level to the required position • Remove the guards and check the shaft and other components • Check alignment (coupling adjustment)

<i>Annual Checks</i>	<i>2 Years or 10000 Hours</i>
• Check the condition by running the backup pump • Treat treated surfaces with an anti-corrosion • Clean the pump auxiliary equipment (valves, lubrication equipment, etc.) • Inspect the rubbers and wears by loosening the coupling connections, renew if necessary • Check alignment (coupling adjustment) • Control axial play of pump and motor shaft • Disassemble and inspect auxiliary equipment	• Disassemble the pump and take it for general inspection • Inspect and replace with new ones if necessary - Beds - Wheels - Shaft Bushings - Wear Rings

The advantages of periodic preventive maintenance are as follows;

- Extends the life of the pump
- It reduces the risk of failure of the pump
- Reduces energy consumption
- Reduces repair costs
- Minimizes leaks

Pumping system efficiency (η_{sys}), life cycle cost (LCC) and are two key factors considered while assessing pumps. Pumping system efficiency is defined as follows:

$$\eta_{sys} = \frac{Q_{req} H_{req} SG}{5308 P_e} \quad (1)$$

where, Q_{req} = required fluid flow rate, in gallons per minute, H_{req} = required pump head, in feet, SG = specific gravity, and P_e = electrical power input.

LCC is calculated as follows.

$$LCC = C_{ic} + C_{in} + C_e + C_o + C_m + C_s + C_d + C_{env} \quad (2)$$

where, C_{ic} = Initial investment cost, purchasing cost (pump, pipe, etc.), C_{in} = Cost of installation and commissioning, C_e = Energy cost, C_o = Operating costs, C_m = Maintenance and repair costs, C_s = Downtime cost due to failure, C_d = Disassembly and removal cost, and C_{env} = Environmental costs.

3. Findings and Discussion

In this study, the performance change of the high-pressure boiler feed water pump in the boiler feed water system used in a power plant is monitored before and after maintenance. Pumps are at the heart of most industrial processes and are among the most widely used machines in the world and can incur excessive costs if not operated properly. Centrifugal pumps have efficiencies that range greatly, from 35% to 90%, which efficiencies depend on various design factors [11]. The Finnish Technical Research Center examined approximately 1700 pumps at 20 process plants in various industries. According to the research, more than 10% of pumps were operating at less than 10% efficiency, and the average pumping efficiency is below 40%. [7].

Fig. 6 shows the surface temperature and vibration values measured on the motor, without observing a

certain period. In general, no significant change was observed in the measured values. Small temperature variations often don't cause any concern. The cooling process of the motor is done with the help of an integrated fan. Depending on the motor construction, the motor surface is slightly cooler than the winding temperature, and the difference can be about 10-25 °C. Every 10 °C increase in the operating temperature of the motors can cut the insulation life in half, so it is important to monitor the motor temperatures. The life of the lubricant might be reduced by 50% for every 8 °C above 65 °C. Similarly, an increase in vibration may be a sign that something is wrong.

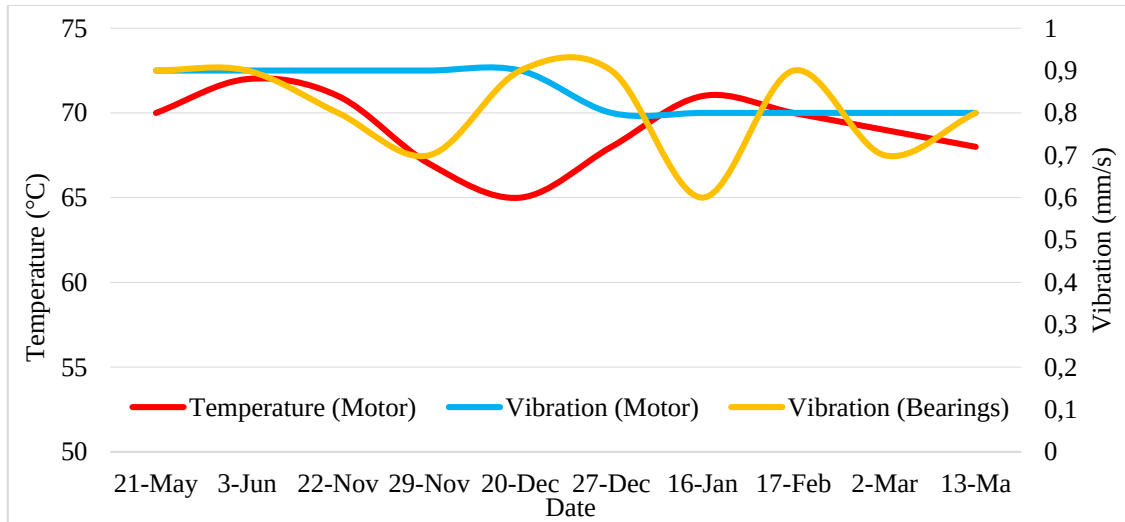


Fig. 6. Vibration and surface temperature measurements of the motor

Fig. 7 shows the data received during the operation of the HP feed water pump. It is seen that the mentioned values become stable depending on the valve opening after the start of the pump. The figure shows a period of about 6 hours. Since this period is short, the data appear to be stable, but when the period is extended to three or six months, the change in performance values can be seen more clearly. However, different data such as power, levels, and diverter opening ratio should be added to the chart and the start, stop, trip, load-shedding, and scheduled/unscheduled load reduction periods in the power plant should be extracted from the chart.

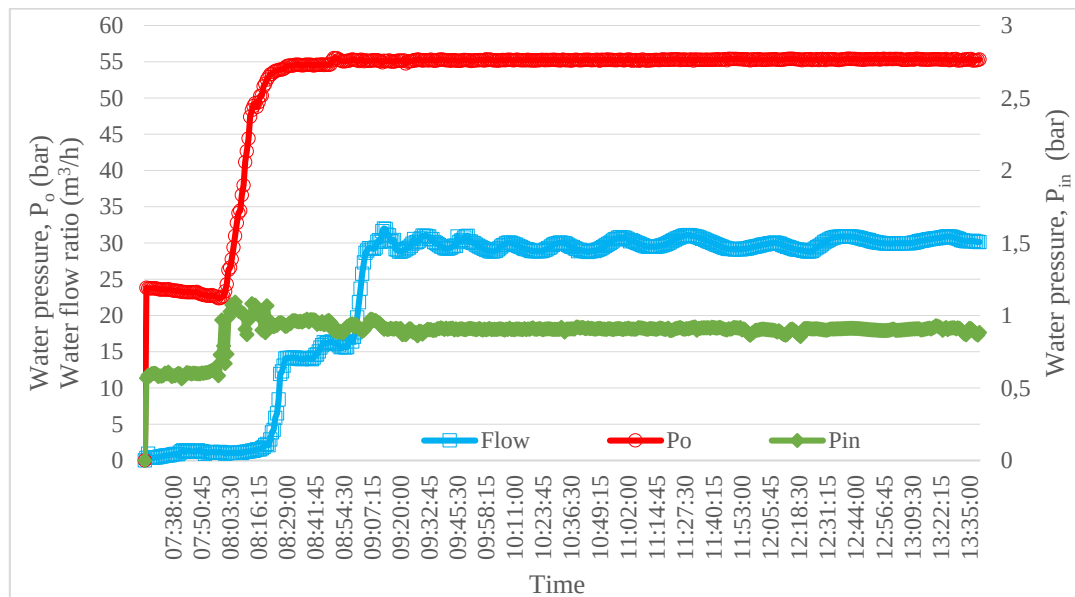


Fig. 7. Data received during the operation of the HP feed water pump

Fig. 8 shows the flow rate and pressure variation versus valve opening ratio for before and after maintenance. When the valve ratio is increased from 45% to 100%, the change in pressure and water flow is clearly visible. It is seen that there is a significant improvement in post-maintenance values.

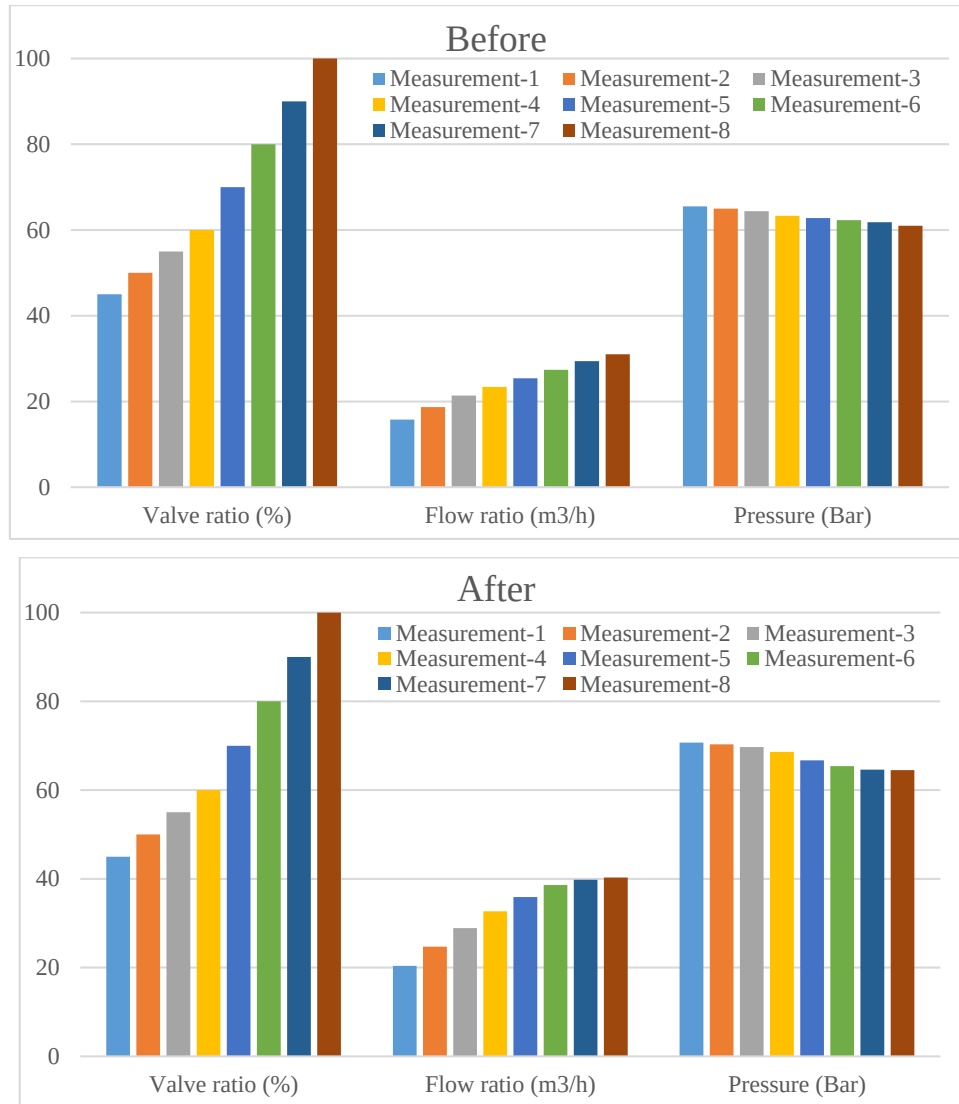


Fig. 8. Flow rate and pressure variation versus valve opening ratio for before and after maintenance

The performance improvement ratio (PIR) is calculated, which is defined as;

$$PIR = \frac{\text{Value before pump maintenance}}{\text{Value after pump maintenance}} \quad (3)$$

Fig. 9 shows the values of the performance enhancement ratio for all values of valve ratios and several flows considered. It was observed that the performance improvement ratio at the valve opening rate of 70% has a maximum value of 29% and the optimum value of a valve opening rate lies between 23% and 29%. With the increase in the flow rate of the pump after the maintenance, it has been observed that the pump has 8% more performance than before the maintenance. Therefore, if the pumps are maintained at certain intervals, it can lead to significant performance improvements in the pumps after

the maintenance. Similarly, a feed water pump was retrofitted by Aronen et al. The pump has met full load production demands, the risk of metal-to-metal seizure has been significantly reduced and the pump operates with less vibration.

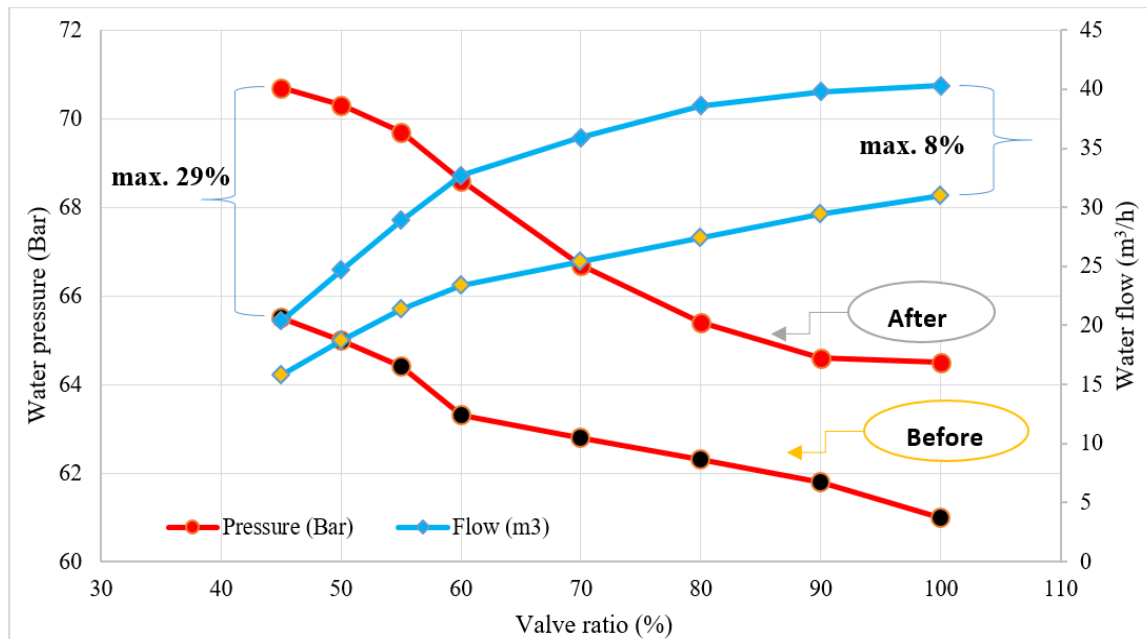


Fig. 9. Performance improvement ratio

Conclusions

This study aims to examine the effect of maintenance on HP boiler feed water pumps, whose efficiency decreases over time. More than 90% of motor failures are caused by rotor, stator, and bearing problems. A number of faults, such as shaft misalignment, eccentricity, bearing flaws, stator flaws, and rotor flaws, can impair pump performance. Early detection of rotating machine problems is now possible because of advancements in mechanical engineering and artificial intelligence-based techniques.

It has been found that the pump performs 8% better than the previous state thanks to an improvement in flow rate after the maintenance. Therefore, if the pumps are maintained at regular intervals, the performance of the pumps might significantly improve as a result. It is thought that the results of this study will be beneficial for users to motivate engineers and investors.

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ABSTRACT

Agriculture is a priority area for Azerbaijan. The Karabakh region is of great importance in this field. Due to the development of agriculture in the territories freed from occupation, unemployment will be eliminated, local production will be developed, and the country's economy will be more stable. Considering that approximately 50 percent of the population of Azerbaijan lives in villages, this is a big social issue. Therefore, in the next years, of course, all these issues will be considered in the state investment program. In the coming years, more attention should be paid to the development of villages. The natural resources of the liberated territories, especially the agricultural potential, are of great importance for the economic development of our country. Work on the development of agriculture has already started in these lands. Residents who once owned farms in Karabakh plan what they will do after returning. In the pre-occupation period, the territory of Karabakh had high agricultural indicators. Most of the production of grain, cotton, grapes, meat and milk, wool and cocoons in the country fell to those areas. Preparations are now being made to restore the region to its former agrarian glory. Plans have been prepared to provide agricultural machinery, seeds, fertilizers and other necessary tools to the residents who will be engaged in agriculture after the settlement process begins. The region has great potential for the production of export-oriented agricultural products. In the article, factors such as crop production, animal husbandry, soil structure and climatic conditions were included in the context of the agricultural area of the territories freed from occupation.

Keywords: Azerbaijan, agriculture, occupation, liberated, territories, development, priority.

1. INTRODUCTION

Agriculture is an important sector of the world economy. This feature is also typical for the economy of Azerbaijan. As we know, in connection with the victory of the Azerbaijani Army in the 44-day Second Karabakh War, significant steps will be taken in the field of agriculture in the country, and the country's economy will experience a huge pace of economic development.

According to the information released by the Center for Analysis and Communication of Reforms, as a result of the occupation of our regions, 280 thousand hectares of forests, nearly 1 million hectares of fertile land, including 127 thousand 700 hectares of irrigated land, 34 thousand 600 hectares of vineyards and orchards, and 1200 kilometers of irrigation system were taken into the hands of the invaders. 120,000 hectares of arable land in 5 districts located outside the occupied territories remained unirrigated and practically excluded from economic circulation. 220,000 cattle were taken away by the invaders.

Despite the fact that there are more than 250 thousand hectares of fertile land in the territory of Karabakh alone, only 7 percent of these areas have been used. Thus, the rivers are mainly located in the northern part, and the agricultural fields are in the south, and the underground water is located deeper in those areas, and the destruction of the irrigation system that existed before the occupation resulted in these areas remaining unused. The productivity in the cultivated areas was low and only 10-12 centners of grain were taken from each hectare. However, this figure was 21-25 centners before the occupation. Azerbaijan has great potential for the development of grape growing, tobacco growing, cotton growing, cocoon growing, fruits and vegetables, horticulture and animal husbandry in the lands freed from occupation. At the same time, there is a potential for the development of the processing and food industry here."

Currently, the level of self-sufficiency in our country is 82.5 percent for meat and meat products, and 86.2 percent for milk and dairy products. According to our forecast, we will be able to provide ourselves with these products after economic activity is restored in the territories freed from occupation. Also, the level of self-sufficiency in grain crops (not including rice) in Azerbaijan reaches 70 percent.

We should be noted that according to official information, during the Soviet period, the basis of Gubadli's economy was grain farming, animal husbandry, tobacco farming, cocoon growing and grape growing. Up to 15,000 tons of grain products, 12,000 tons of fodder, 2,000 tons of tobacco, 1.2,000 tons of meat and 2,000 tons of dairy products were produced in the region. An average of 3,000 tons of grapes were sold to the state per year. One of the fields of production was cocooning. 60-70 tons of cocoons were produced per year and handed over to the state. Until the 1960s, the district was engaged in rice farming. Gubadli rice was popular in the republic at that time.

Being located in the foothills of the republic, Zangilan district was mainly agricultural in terms of economy and included 29 collective farms, 1 beekeeping farm, 4 cooperatives and 3 peasant farms. 35548 ha suitable for cultivation. 7204 ha of the land was used for annual crops, 2667 ha for perennial crops, 207 ha for hayfields and 22873 ha for pastures. 4000 ha of grain, 307 ha of tobacco, 41 ha of sugar beet, 56 ha of potatoes, 33 ha of vegetables, and 10 ha of melons were cultivated on the 7204 ha area under cultivation. 41 ha consisted of fruit and berry gardens, and 2047 ha of vineyards. During the year, the average production of cereals was 3180 tons, tobacco production was 1700 tons, cocoon production was 80 tons, melon products were 30 tons, potato production was 20 tons, and grape production was 18000 tons. 9340 cattle, 12000 sheep and goats, including 1300 cows and buffaloes, 30 pigs, 310 tons of meat, 1700 tons of milk, 11.5 tons of wool were produced in public farms of the region. 43,000 head of cattle, 92,000 head of sheep and goats, 1,400 bee hives, and 287,000 fruit trees in individual farms. There is 1 poultry complex with the capacity to raise 12,000 birds in the region.

Before the occupation, there were 40 39 hectares of forest land, 58 585 hectares of arable land, and 1 079 hectares of garden land in Jabrayil district. Two large irrigation canals in the region ensured the intensive development of agriculture. In the pre-occupation period, the population was mainly engaged in viticulture, animal husbandry, grain farming, poultry farming and cocoon farming in the economy of the region.

The basis of the economy of Fuzuli region is agriculture. This is explained by the presence of gray, chestnut, and gray-brown land suitable for agriculture in terms of productivity. Before the occupation, grain farming, animal husbandry, grape growing, sheep farming, poultry farming, and cocoon farming were widely developed in the region. Agricultural land was 85 thousand hectares. There were 50.9 thousand ha of grazing land. The Kondalan reservoir was built on the Kondalan river in the region, and irrigation canals were built. Irrigated land was 24 thousand hectares. Before the occupation, 17,600 head of cattle, 70,000 sheep and goats were kept in farms.

70 percent of Aghdam region was under occupation. Most of the cultivated area of the region, which is more than 40 thousand hectares, was occupied, and Azerbaijan was able to cultivate only 17 thousand hectares. The region has a favorable area for the development of agriculture.

The basis of the region's economy is animal husbandry, plant breeding, beekeeping, and partly horticulture and horticulture. Until 1992, there were 40,211 large and 244,000 small horned animals, 44,235 bee colonies, and 1,470 hectares of fruit trees in public and private farms of the region. In the region, grain was planted on 3438 hectares, perennial herbs on 245 hectares, and potatoes on 31 hectares. In general, 29.5 thousand of the 36.1 thousand working-age population of the region worked in agriculture during that period. Every year, 6000 tons of milk, 5000 tons of meat, and more than 400 tons of wool were sold to the state.

2. SOIL COMPOSITION OF TERRITORIES LIBERATED FROM OCCUPATION

Starting from 1992, as a result of the military aggression of Armenia, up to 20% (1670.3 thousand hectares) of the most productive lands of our republic, including Nagorno-Karabakh and 7 districts adjacent to it (including 73.0% of the territory of Aghdam district, 73.0% of the territory of Fuzuli district) 79.3%), 13 villages of Tartar region, 7 villages of Gazakh region, 1 village of Nakhchivan MR

were occupied. However, as a result of military operations carried out by the Azerbaijani army on September 27, Karabakh was liberated from occupation. 680.8 thousand hectares of the freed territories are agricultural lands, more than 10.7 thousand hectares are backyards (these lands are also suitable for agriculture), and 247.3 thousand hectares are forests.

207,000 hectares (30.4%) of the land suitable for agriculture in the territories freed from occupation are cultivated, 54.7 thousand hectares (8.0%) are under perennial crops, and more than 380,000 hectares (55.9%) are of special importance in the development of animal husbandry. can be used as grazing areas. Most of the pasture lands are summer pasture lands. 37.8 thousand hectares of the land under perennial crops are one of the most profitable fields of agriculture, vineyards, more than 2 thousand hectares are orchards, and the rest are mulberry trees and other perennial crops, which are of exceptional importance for the development of cocooning. 128.2 thousand hectares of agricultural land, 80.5 thousand hectares of arable land, and 38.2 thousand hectares of perennial crops are irrigated (Əmlak Məsələləri Dövlət Komitəsi, 2020: 4).

2.1. Soil Suitability Characteristics For Agriculture

Due to the fact that these lands were under occupation for nearly 30 years, they became almost unusable due to improper use, pollution, and destruction of the structure by the occupying "vandals", and their direct use in the agricultural cycle became impossible. Currently, these lands have been freed from occupation, and one of the most important problems ahead is the restoration and maximum efficient use of these lands. It is very important to take into account the characteristics of the land cover and its level of agricultural suitability in order to correctly determine the direction of agricultural development in our liberated territories, to ensure the efficiency of the use of agricultural lands.

The influence of soil-cultivating factors, the diversity of natural conditions and the development of ancient farming culture have led to the formation of a complex soil cover in our occupied territories [3]. Here, the areas above 3500 m above sea level have almost no soil cover. In these areas, there are faint traces of the initial soiling process on the sunny parts of the sharply divided steep cliffs and stony-gravel steep slopes. As the process of tillage is in the beginning stage, they are not so different from the tillage rocks, only mosses can be found in favorable places.

The mountain-meadow soil type was formed under the alpine and subalpine meadows at the altitudes of 2000-3200 m above the sea level of the Lesser Caucasus Mountains. The influence of soil preparation process, physico-chemical characteristics of soil composition, etc. factors caused the formation of semi-type soils in the area: primitive mountain-meadow, grass-peat mountain-meadow, grassy mountain-meadow. Mountain-meadow soils are very rich in organic matter, its amount in the upper A layer is 10-15%, and sometimes more, and decreases sharply with depth, nitrogen content is 0.50-1.16%, pH = 4.7-6.1 contane. The total of active temperatures is lower than 800C0, the average annual temperature is minus 12C0, the absolute minimum temperature is minus 24-30C0, the absolute maximum temperature is 17-19C0, the annual amount of precipitation is 1000-1300 mm. These lands are characterized by high productivity, they can be used mainly as summer pastures, and partly as mowing fields, planting (plowing) is strictly prohibited. Care must be taken even in using them as pastures, otherwise they may be subject to the erosion process (Məmmədov Q.Ş, 2007: 258).

From 700 m to 2000 m below the alpine and subalpine zone, the mountain-forest zone is located in large areas on the northern and northeastern slopes of the Lesser Caucasus in medium and low mountainous areas. According to its geobotanical composition and moisture conditions, the zone is divided into two subzones: mesophilic and xerophilic forests. The mesophilic forest subzone covers the upper part of the forest belt and is characterized by its mild warm and humid climate. This diversity has led to the formation of the main brown mountain-forest soil type, which is relatively widespread in the forest belt, and brown mountain-forest soils under the xerophilic oak-beech forests, which have dry and moderately warm climate characteristics.

Although these lands have high fertility, they cannot be widely used in agriculture because they are mostly covered by forest. Only the relatively flat areas freed from the forest (interforest clearings) can be used mainly for the cultivation of grain and fodder crops.

The mechanical composition of mountain-glacier soils is clayey and loamy, with a silty-granular structure. The absorption capacity of these soils is also high, the total amount of absorbed bases is 32-45 mg in the upper humus layer. is equal to eq. and Ca dominates among the absorbed bases. The reaction of the soil environment is mostly neutral (pH=7.0), becoming weakly alkaline towards the lower layers (pH=7.2-7.5), and sometimes weakly acidic (pH=6.5-6.8) in the upper layer. The climate is characterized by mild hot and dry cool winters. The average annual temperature is 12.0-14.0C0, the absolute minimum temperature is minus 15-20C0, the absolute maximum temperature is 32-34C0, the annual amount of precipitation is 600-900 mm.

These soils are considered to be high and good quality soils due to their productivity and can be widely used in rice cultivation mainly under cereals, potatoes, vegetables, fodder, and partly under tobacco plants. Although they are of high quality, they are considered unsuitable for cotton, grapes, and dry subtropical plants.

Gray brown (chestnut) soils are widespread in the dry steppe foothills and low mountain areas (200-400m) of the Lesser Caucasus and Karabakh. Gray-brown (chestnut) soils have dark, ordinary and light subtypes according to their formation characteristics and diagnostic properties. In terms of mechanical composition, these soils are mainly clayey and heavy loamy. One of its characteristic features is the accumulation of humus in the upper, 60 cm layer, its amount sharply decreases as it goes to the woody layers. Depending on the subtypes, the amount of humus in the upper layers varies from 2.0 to 5.0%, and nitrogen from 0.15 to 0.38%.

Gray-brown (chestnut) soils are rich in absorbed bases and their total Ca is 85-90%. These soils are carbonated along the entire profile, while the soil solution (pH=7.2-8.3) has an alkaline environment. Despite the fact that they were formed in the foothills, these soils also show signs of salinity and acidity.

Since gray-brown (chestnut) soils are rich in compounds (nutrients) for the normal development of agricultural plants, they are suitable for viticulture, grain growing, fodder growing, fruit growing, tobacco growing, potato growing, vegetable growing, melon growing, cocoon growing, etc. in short, it is suitable for all plants except tea and humid subtropical plants. Although it is not considered very useful for cotton, it can even be used in the development of cotton cultivation.

2.1.1. Quality Characteristics Of Soils

Soils that have been under occupation for a long time were widely used in agriculture and they differ from the lands of other territories of the republic by their quality characteristics. It was determined that most (up to 17%) of the lands included in quality group I (high quality lands) in the republic, and more than 24% of lands included in quality group II (good quality lands) were occupied in the territory of the Upper Karabakh economic region. is spread.

71.8% (489.0 thousand hectares) of agricultural soils freed from occupation are high and good quality lands belonging to the I and II quality groups. In the area, 24.0% of lands belonging to the III group - of average quality, 4.0% of the lands belonging to the IV group - low quality lands, and 0.2% of the lands belonging to the V group - conditionally unusable are only 0.2%. Most of the medium and low-quality soils - 16.0% - consist of pasture lands. The condition of the quality indicators of these lands freed from occupation is very high compared to other economic regions of the republic (Məmmədov Q.Ş,2007: 254).

Of course, the high quality of land suitable for agriculture in the territories freed from occupation also had an impact on productivity. Studies show that in the occupied territories until the 1990s, compared to other regions, the yield per hectare for grain was 11-18 centners, for potatoes 22-35 centners, for vegetables 40-55 centners, for melons 35-60 centners, for fruits 40-52 quintals, 45-50 quintals of grapes were more.

2.2. Climatic Features Of The Region

Along with soil resources, one of the natural factors that have the strongest impact on agricultural production is agro-climatic characteristics. It is no secret that the productivity of agricultural crops is highly dependent on weather conditions. Planting and cultivation of plants, vegetation period, harvest

and transportation, implementation of important agrotechnical and reclamation measures, etc. such issues are determined by taking into account the climate characteristics.

The role of the Lesser Caucasus mountain systems in the formation of the climate of the territories freed from occupation is very important. The Lesser Caucasus mountain system is distinguished by the diversity of its climatic conditions and, in turn, has a great influence on the climate of the plain areas of the republic. Areas of the Lesser Caucasus Mountains up to 300-400 m high have hot summers and mild winters. The average temperature of the hot months (July, August) fluctuates between 24°-26°C, the maximum temperature is 35-37°C. The average temperature of the coldest month (January) is 1.0-3.9°C, the absolute minimum temperature is minus 15-25°C. In the foothills of the Lesser Caucasus, the first frosts occur in the third decade of November, and the last frosts occur in the middle of March.

The low and mid-mountain areas of the Lesser Caucasus Mountains in the territory of Azerbaijan are characterized by their mild climate. Here, the total of active temperatures is equal to 3000-3500°C°. The average temperature of the warm months varies between 12-10°C, and the maximum temperature between 35-38°C. The average temperature of the coldest month is 1-2°C, and the absolute minimum temperature is minus 27-28°C. Frost-free days last 200-230 days, frosty days can be found from mid-November to the second half of April. The amount of annual precipitation varies between 300-800 mm. During the warm months, intense showers often fall, and these rains are sometimes replaced by hail. Permanent snow cover does not exist every year, the falling snow melts almost immediately. When the winter is harsh, the snow cover remains on the ground for 30-40 days. There are not many winds here, mostly weak and moderate winds, and their average annual speed reaches 1.5-3.0 m/s [4]. The areas of agriculture in the area, mainly grain growing, grape growing, potato growing, tobacco growing, fruit growing, partially sericulture and animal husbandry, can be widely developed. Climatic features here allow the development of agricultural plants under favorable conditions.

The middle and some highland parts of the Lesser Caucasus are characterized by a relatively mild hot summer. The sum of active temperatures is equal to 2500-3000°C° here. Depending on the altitude and the steepness of the slopes, the average temperature of the warm months fluctuates with a large amplitude and is equal to 16-20°C°. The maximum temperature reaches 30°C°, and the absolute minimum temperature reaches minus 22-25°C°, in some places even minus 27°C°. The average temperature of the coldest months is minus 2-4°C. The first frosts usually start from the end of October and last until the end of April. The number of frost-free days is equal to 150-200 days. The amount of annual precipitation varies from 300 to 1000 mm and is often observed with hail, 4-6 days of hail during the year. The territory can be widely used in cereal cultivation, potato cultivation and animal husbandry. It is also possible to develop fruit growing in relatively warm areas.

We believe that it is important for the population to pay attention to some of the following issues in order to know the impact of climatic conditions on agricultural production during the use of the lands of the liberated territories. Even in ancient times, our farmers saw the suitability of land for cultivation in its location, i.e., in its sunshine, and planted the most important plants for living in those areas. Later, the development of science confirmed these ideas of our farmers in reality. In recent times, special attention has been paid to the issue of the influence of climate conditions on many areas, especially on agricultural production. From this point of view, every household head (entrepreneur) should be able to assess the impact of weather conditions on production efficiency. In other words, weather conditions should be taken into account in the organization of the farm and the efficiency of its activities, along with other factors. For this, first of all, he should know what weather factors to consider and how to get them (<https://azertag.az>).

Climatic conditions also affect the specialization of production. After collecting and summarizing the climate data, it is quite easy to determine their effect on the performance of each farm. At this time, the information about what types of plants are used for the plots of land should also be taken into account. According to the conducted studies, recent climate changes have caused considerable damage to agriculture. Excessive precipitation, hail, unexpected frosts, high-speed winds and other unexpected climate changes have a negative impact on the development of agricultural crops, as well as their productivity and production. However, in modern times, it is possible to fight against the negative

effects of climate factors by doing the work on the agricultural field correctly and according to the relevant rules.

3. THE ROLE OF TERRITORIES FREED FROM OCCUPATION IN AZERBAIJAN'S AGRICULTURE

3.1. Issues Of Restoration Of Agricultural Land In Territories Liberated From Occupation

Since the liberated territories cover large and fertile land areas, there is no doubt that the development prospects of the agrarian sector are higher in these areas, along with other areas of economic activity (Dang, T, 1975: 45). On the other hand, it should be taken into account that the agricultural sector is the traditional field of employment of a significant part of the people living in these areas. However, it should be taken into account that the resettlement of the territories freed from occupation and the development of the agricultural sector in these territories require the solution of several important issues. The most important of these issues can be listed in the following order:

- 1) making the territories suitable for agricultural production;
- 2) determining the form of land use suitable for agricultural production;
- 3) creation of a mechanism for providing necessary assistance to land users;
- 4) transfer of land plots to the user.

In the current conditions, each stage we have listed for the development of the agricultural sector can certainly be realized with the direct support of the state. Thus, making the territories occupied for nearly 30 years suitable not only for living, but also for agricultural production, requires serious technical preparation. Conducting direct land reforms and distribution to individual households on the plots of land made suitable for use may be a hasty and unscientifically justified step. The form of use of such land areas should be realized taking into account the 25-year experience of land reforms carried out in other areas of Azerbaijan. This experience, first of all, can be based on the comparison of the level of productivity in the agricultural sector of Azerbaijan with some countries. It is after the scientific justification of the form of land use that reforms and state support mechanisms for land users can be created. The success of the aforementioned stages of agrarian development should be optimized on the basis of two factors - cost minimization and maximization of the number of highly qualified personnel to be attracted to the regions. Both limiting conditions are necessary but not sufficient for productivity growth in the agricultural sector. One of the sufficient conditions and the most important one is the correct selection of the organizational and legal form of economic subjects for the reformation and development of the agricultural sector in the territories liberated from occupation. The 25-year experience of the land reform implemented in Azerbaijan suggests that the success of agrarian reforms and the volume of production and productivity in the agricultural sector depend very much on choosing the optimal organizational and legal form of economic entities.

The revitalization and development of the liberated territories is undoubtedly more related to the return of people to their native land and the large-scale settlement of the territories (Teodosijevic, S. B, 2003). However, if we take into account the history of the development of the agricultural sector in these areas and the rich experience of the population who will settle in these areas, we can be sure that the settlement and future development of the areas depends more on the level of development of the agricultural sector. As we mentioned, the development of the agricultural sector depends on the nature of the agrarian reforms, including the organizational and legal form of the agricultural subjects. Considering that the agrarian reforms carried out in other regions of Azerbaijan, in particular, the practice of dividing the ownership of "state farms" and "collective farms", including farmland between employees of these enterprises or residents of the administrative area where the enterprise is located, is not valid for the regions liberated from occupation and may not be successful. Because such administrative areas are only on the map and in most cases do not actually exist. The population is returning to land that has practically no infrastructure and is completely destroyed. Nevertheless, the families who lived in these regions are ready to return to their homeland. Such psychological preparation is a good starting point for building a higher level of restoration and reconstruction work. However, it is widely accepted that the return process should begin after the basic infrastructure is in place. Such infrastructure includes

construction of roads, electricity, gas and water lines, hospitals and schools, etc. A certain part of the population is willing to return at any time provided they are given some funds for building houses and land for cultivation, along with infrastructure. At first glance, it seems natural that the agrarian reform in the liberated areas will be carried out in the same way as in other regions of the country, i.e. in the form of distribution of existing land plots belonging to the administrative area among the population living in this area, and this is exactly what the population expects. However, in contrast to the regions with the necessary facilities for initial activity, the distribution of the plots of land made suitable for cultivation at great expense to individual individuals or households in the regions freed from occupation is scientifically flawed. Experience shows that despite the presence of modern infrastructure in most agrarian regions of Azerbaijan, individual entrepreneurship, with some exceptions, cannot be highly productive. This aspect is not unique to the agricultural sector in Azerbaijan (Zurayk, R, 2018). After the agrarian reforms in almost all of the republics of the former USSR, both the productivity and the total volume of production decreased sharply in the short term, and the demographic situation of the population in the regions worsened. Taking this experience into account, physical distribution of agricultural land plots among the population living in the territories freed from occupation cannot be allowed. However, it is necessary to carry out land reform and land privatization in these areas as well. Because it will not be possible to attract investment to the region without privatization. On the other hand, the reformation of the agricultural sector in the liberated territories has important advantages, although it requires a lot of expenses. These are includes:

1. Making the territories free of occupation suitable for agriculture can be realized for the production of agricultural products planned in advance and intended for a long time. For this purpose, the irrigation and irrigation system can be reconstructed and the advantages of modern technology can be used. This process can be ensured by the joint activity of relevant state bodies, for example, the Reclamation and Water Management JSC with other institutions.
2. Since land plots are not divided between individual small users and the population does not have property related to agricultural production, the newly created agrarian capital can be used collectively in the initial period. This can lead to drastic cost reductions. For example, instead of making the plots of land given to individual users useful, the possibilities of making the land belonging to any administrative village or settlement as a whole are generally higher;
3. Since settlement in the regions cannot be realized in a short time, the shortage of labor force in the agricultural sector will be acutely felt at first, and this will allow the use of the potential in the agricultural sector to a lesser extent. Therefore, efficient use of capital and labor is important. In these regions, young people working in the agricultural sector can be given discounts during admission to higher schools or during military service, etc.;
4. Since it is not possible to fully settle the population in the regions, and individual households will have limited opportunities to use credit to expand production in the agricultural sector. Therefore, providing access to credit funds for the development of the agricultural sector should be the focus of the state;
5. There will be a great need for technical equipment for individual households to work with high productivity on the plots of land allocated to them. On the other hand, when any household acquires such equipment, the marginal revenue of technical resources will not be high. Because there are usually many cases of idleness during the use of technical equipment by individual households. The state should pay special attention to supplying the agricultural sector with the necessary equipment in these regions.
6. There is another drawback to the household-scale production process. This is related to placing the manufactured product on the market or keeping it for a certain period of time. Both stages are beyond the means of any average household. Public procurement should be applied in this area.
7. One of the main problems of the settlement of the population and the development of the agricultural sector in the territories free from occupation is related to the effective placement of the workforce. So, since a large part of the families from these regions settled in cities or urban-type settlements during the last 28 years, a certain part of them work more in the service, construction or transport sectors, as well as in the industrial field. It will not be possible for such labor potential to immediately work in the agricultural sector in the regions. In the short term, the intervention of the state will be necessary to ensure the division of labor in the region. Thus, taking into account the above-mentioned problems and advantages for the reconstruction of the agrarian sector, we can note that in

the short term, conducting land reforms in the regions freed from occupation and making them available to individual households can create serious difficulties for the development of the agrarian sector. Therefore, according to the legislation currently in force in the Republic of Azerbaijan, it is more appropriate to privatize the plots of land intended for private ownership as the property of open or closed joint-stock companies. In this case, each household should be provided nominally valued (or unnamed) shares in accordance with the plot of land intended to be given as "share land".

The new type of agrarian collective farms, such as open or closed joint-stock companies, will be fundamentally different from the Soviet-era "state farm" or "collective-farm" type collective farms. The main difference from "State farm" type enterprises is that the joint-stock company is not owned by the state and is private. In this enterprise, each shareholder is an owner and has a share in the profits of the agricultural enterprise. It can sell its shares or buy new shares at any time. The management of the joint-stock company is carried out by the board of directors elected at the general meeting of shareholders. The newly created agrarian joint-stock companies will also differ from collective farms of the "collective-farm" type. So, even though the "collective-farm"-type collective farm is private and its management is decided at the general meeting of the collective farm members, the collective farmer had to work in this farm. Otherwise, he was deprived of membership of the collective farm (Әюбәв А.А, 1968: 38). On the other hand, members in "collective-farm" type collective farms lacked motivation to invest and expand production. However, in joint-stock company-type agricultural enterprises, since each share is related to the investment made by the shareholder and the dividend received, the member of the joint-stock company is interested in acquiring new shares or increasing the value of the shares. In this case, even wealthy people who do not live in the region have the opportunity to invest in agricultural joint-stock companies as investors. The advantages of creating agrarian joint-stock companies in the territories liberated from occupation can be grouped as follows:

1. Such an agricultural enterprise has a large land area.
2. State bodies can establish easier and guaranteed cooperation with joint stock companies even in the short term.
3. Banks will feel less risk in allocating financial assistance to such joint stock companies.
4. Such joint-stock companies will be interested in attracting younger and more highly educated managers to their management.
5. Marginal return of capital is high during the use of machinery in such large agricultural farms.
6. Division of labor is easier in large farms and people have more spare time for other economic activities, such as their household activities.
7. Such joint-stock companies can effectively use labor force and expand other links of agrarian business, for example, processing industry, transportation, packaging, storage, sale of finished products, etc.

In the current conditions, the weaknesses of the establishment of agrarian joint-stock companies in the territories freed from occupation can be grouped as follows:

1. A wide segment of the population has little information about the creation and management of joint stock companies in the agricultural sector.
2. Since the land reforms in other regions of Azerbaijan have been completed and the majority of the population in the rural regions have their own small agricultural farms, a certain part of the population of the regions free from occupation believe in this form of ownership.
3. Since the securities market in the country is poorly developed and in many cases the lack of transparency in the management of joint-stock companies creates serious obstacles for the joint activities of people in collective farms.

However, the development dynamics of the agrarian sector during the last 25 years after the land reform suggests that the development of the agrarian sector in the country goes through the concentration of capital and labor in this sector. Consolidation of land plots with the condition of retaining ownership rights, extensive use of new techniques and technology in the agricultural sector, expansion of the agricultural processing industry, application of innovative management in the agricultural sector, formation and management of the supply chain, expansion of agrarian business and creation of agrarian clusters are the requirements of the modern era. Currently, the process in this direction is already

underway, but it is more spontaneous and accompanied by social problems. Some of the private entrepreneurs with small land plots sell their land plots at their value and either work as wage earners on those plots or change their fields of economic activity. Another group of individual entrepreneurs with small plots of land operate with low productivity in their fields with great difficulty. In most cases, they cannot afford to buy new machinery or they cannot afford to irrigate their own fields. This does not allow efficient use of agricultural land. The creation of agrarian joint-stock companies in the territories freed from occupation can serve as a pilot for the creation of such farms in other regions in the future. This is a promising opportunity for the agricultural sector of Azerbaijan. Because the reunification of already formed individual entrepreneurs in agrarian joint-stock companies requires serious calculations, agreements, distribution and so on. Because such individual entrepreneurs have already invested a certain amount of money in their plots of land, and in this case, revaluation of plots of land and reintegration within a joint-stock society is technically, financially and psychologically difficult. However, such problems do not exist for territories free from occupation, and the possibilities of creating agrarian joint-stock companies are still wide. However, as the settlement expands, these opportunities related to the development of the agricultural sector may be lost.

3.2. Agrarian Potential Of Territories Freed From Occupation

3.2.1. Agrarian Potential Of Aghdam District

Aghdam district, which has been under occupation for twenty-seven years, has a multifaceted agricultural potential. As a result of the occupation, the wealth of Aghdam was looted by the enemy, the population engaged in farming in rural areas was forced to settle in other and urban regions of the country in the state of forced displacement, and residential buildings, general infrastructure, including infrastructure facilities necessary for agricultural production were destroyed (Qarabağ Dirçəliş Fondu, 2021).

Among the occupied regions, Agdam is the largest region in terms of population. The relief of the district, which covers 1.3 percent of the country's territory and has an area of 1150 square kilometers, mainly consists of plains and partly mountainous areas. Aghdam region is located in the center of Karabakh, which is an ancient and fascinating land of Azerbaijan - in the northeastern foothills of the Karabakh mountain range, in the west of the Kura-Araz plain. In terms of territory, it is part of the Upper Karabakh economic region. Before the occupation, 143 thousand people lived in Agdam district. The population of the region was mainly settled in rural areas and the main occupation was agriculture.

The climate of Aghdam region is dry in winter, the climate type is warm and temperate. This climate type is characterized by moderate humidity, rainy and mild winters, and mild-hot summers. In the existing land cover of the region, grassy mountain-meadow, steppe mountain-meadow, brown mountain-forest, brown mountain-forest, mountain-black, gray-brown, mountain-chestnut, gray, chestnut, meadow-forest soil types are spread. The most irrigated lands in the Upper Karabakh economic region are in Agdam region. The territory of the district is mainly irrigated by the rivers Gargar, Gulyatag, Khachin, Gabarti. The agricultural lands of this region are also irrigated due to the Darband reservoir located on the Khachin river and the Sarsang reservoir located on the Tartarchay river. However, at the same time, a new potential for irrigating the freed areas involved in crop rotation has also emerged. Thus, the use of water resources such as Sugovushan, Khudafarin and Sarsang reservoirs, Agdam village, Valvalachay for irrigation of agricultural lands of Agdam will contribute to the development of agriculture in the region.

In Aghdam district, where the summer is hot and the winter is dry, there are large pastures and mowing fields (18.4 thousand ha) and the farming traditions of the population have been preserved. Due to the region's plain area and the presence of favorable natural and climatic conditions, although the crop sector has heavy agriculture, the agrarian potential related to the livestock sector was also not small. It should be noted that the grazing and mowing areas available here make up approximately 0.8 percent of the corresponding areas of the republic. Due to the opportunities provided by the prevailing climate and abundant water rivers, the residents of the region could comfortably cultivate both 1-year crops and perennial crops.

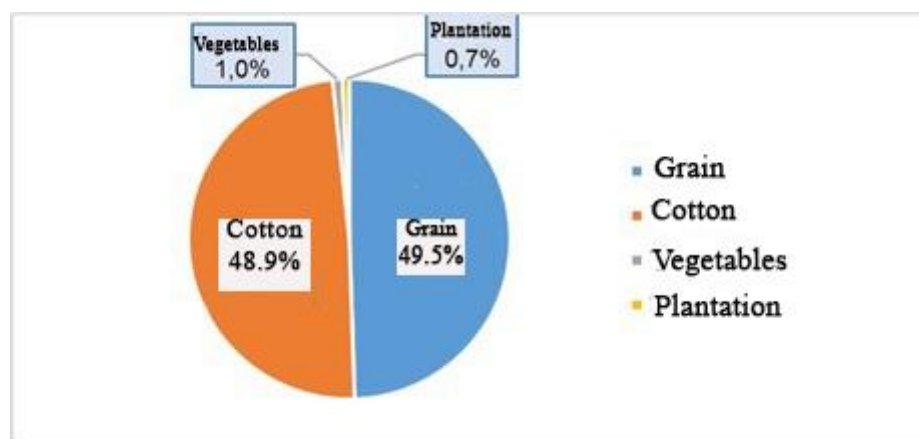
In Agdam, which was under occupation and was freed from occupation, during the Soviet era, cotton growing, grain growing, viticulture and vegetable growing were developed as the main fields of agriculture. Grain fields, cotton fields, vineyards, orchards, and fodder crops occupied a large area in the territory of the region.

3.2.2. Assessment Of Agricultural Potential In The Field Of Crop Production

If we look at the structure of cultivated areas in Agdam region in 1988, it is observed that grain fields (49.5%) and cotton fields (48.9%) cover larger areas. In addition to these plants, in 1985, there were 21.3 thousand hectares of vineyards under perennial plantings in Agdam region, i.e., the maximum area of vineyards, and the fact that these vineyards made up 8.0 percent of the country's share shows that viticulture is a priority area in this region. In addition to viticulture, the presence of 306 hectares of fruit and berry orchards in the 80s showed that the region has a long tradition of crop cultivation. From the structure shown in the diagram below, it is noticeable which agricultural products the region specializes in, and in which areas the historical tradition of agriculture is concentrated (<https://www.stat.gov.az/>).

In general, in 1988, the grain fields in Agdam region made up 1.4 percent of the corresponding cultivated area in the country, and the cotton fields in the region made up 2.5 percent of the country's area.

Chart 1. Planting structure of crop production in Agdam region in 1988, %

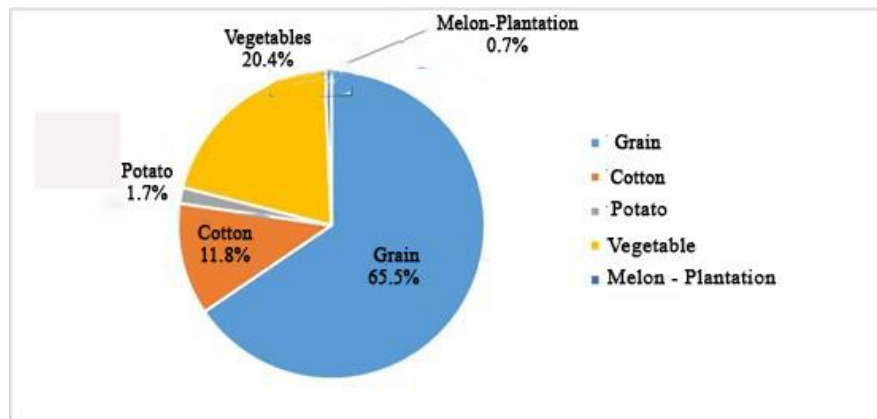


Source: Compiled by the author based on <https://www.stat.gov.az/> materials.

In the part of Agdam that was not subjected to occupation, if we look at the structure of cultivated areas in 2019, it seems that grain (65.5%) and cotton areas (11.8%) have decreased, but they cover larger areas. However, the specific weights of vegetables (20.4%), including potatoes (1.7%) and onions (3.7 thousand ha) are noticeably different. There are almost no vineyards in the unoccupied part of Agdam. However, the area of fruits and berries was 764.8 hectares. Over the years, it is observed that cotton fields are replaced by perennial crops and vegetable fields in the cropping structure (<https://www.stat.gov.az/>).

In 2019, the grain fields in the region made up 1.6 percent of the corresponding cultivated area in the country, and the cotton fields made up 2.9 percent of the country's area.

Chart 2. Plantation structure of agricultural crops in the non-occupied part of Aghdam in 2019,
%



Source: Compiled by the author based on <https://www.stat.gov.az/> materials

3.2.2.1. Grain Production Potential

According to the obtained official statistics, in 1980, 6.3 thousand hectares of grain were planted and 28.3 thousand tons of harvested grain were obtained, in 1985, respectively, the area was 7.3 thousand hectares and harvested grain was 29.8 thousand tons. In 1988, 30.1 thousand tons of grain were harvested from 7.7 thousand hectares of grain area. As it can be seen, during the pre-occupation period (1980-1988), grain production increased by 6.4 percent. The average grain yield was 39.8 cents/ha, and the maximum yield was 44.6 cents/ha, which is 1.9 times higher than the country's yield indicators in those years. Also, the past productivity indicator of grain was 15.8 percent higher than in 2019. In 1980-1988, grain production in Aghdam region was 2.5 percent of the country's production. In 2019, the specific weight of the relevant production in the territory of Aghdam, which was not occupied, is 1.6 percent (55.7 thousand tons). The fact that productivity was higher than the national level during those years shows that Aghdam region has potential opportunities in grain production.

After the restoration of our independence, as a result of fundamental reforms in the agricultural sector and the application of innovative technologies, in addition to the increase in productivity in the country, promising results can be achieved by carrying out new agrarian reforms and applying innovative technologies in the freed territories of Aghdam region. As a result of the research, it is expected to reach 86.6 thousand tons of grain production in Aghdam district by 2025, which is considered the forecast development period.

3.2.2.2. Cotton Production Potential

According to the official statistical data, we can say that the cotton growing area has historically been the most preferred agricultural area for production by the people of the region. In 1980, 43,774 tons were produced from 9,060 hectares of land, in 1985, 12,254 tons were produced from 4,017 hectares of land, and in 1988, 19,297 tons were produced from 7,565 hectares of land. As can be seen from the conducted analysis, during the pre-occupation period (1980-1988), the maximum productivity of cotton in the country was 35.4 cents/ha, while the productivity of this plant reached 48.3 cents/ha in Aghdam region. In 1980-1988, cotton production in Aghdam region accounted for approximately 3.0 percent of the country's production. During those years, the productivity is 23.8 percent higher than the national level, which means that the Aghdam region has more production opportunities in cotton production. It should be noted that in 2019, 7.3 thousand tons of cotton were cultivated from 2.6 thousand hectares of fields with a yield of 28.1 cents/ha in the unoccupied villages of Aghdam. As a result of the conducted research, it is predicted that by 2025, due to intensive cultivation of cotton in Aghdam region, production will reach 10,000 tons with a yield of 31.4 cents/ha, which means that approximately 2.5 percent of cotton production in the country will be formed at the expense of Aghdam region.

3.2.2.3. Vegetable Production Potential

Another field of agriculture with potential for agricultural production in Aghdam region is vegetable growing. Historically, in 1980, 976 tons of melons were produced from 417 hectares of land, with a maximum harvest of 1,556 tons from 1980-1988. If we look at the current statistical data for Aghdam region, in 2019, 107.5 thousand tons of vegetables were obtained from 4.5 thousand hectares of land. As can be seen from the analysis, during the pre-occupation period (1980-1988), the maximum productivity of vegetables in the country was 223.0 cents/ha, while the productivity of this plant in Aghdam region did not exceed 94.4 cents/ha, but in 2019, this productivity was 235.0 cents/ha. It is 0 cents/ha. During 1980-1988, the production of vegetables in Aghdam region was 0.2 percent of the country's production, but in 2019, it is 6.3 percent. In recent years, interest in vegetable crops, especially onion and garlic production in the unoccupied part of Aghdam is reflected in the economic indicators, which suggests that this trend will be applied to other liberated areas as well. As a result of innovative measures, in addition to other types of plants, vegetable production in the region is predicted to be about 231.5 thousand tons in 2025 with an increase in the volume of production due to the expansion of the planting area of vegetable plants and the achievement of high productivity.

3.2.2.4. Grape Production Potential

As in other regions of Karabakh, grape growing is considered one of the traditional fields of agriculture in Aghdam region. Studies show that in 1985, 104,000 tons of grapes were produced from 21,300 hectares of land, but during the following years, the area of grapes was reduced to 15,500 hectares in 1988. In 1988, 86.1 thousand tons of grapes were harvested. In 2019, Aghdam's grape production was only 402 tons, which means that there are no vineyards left, large areas are under occupation, and vineyards in other areas are used for vegetables, etc. indicates that it is replaced by other fields. As it can be seen, during the past years, the most productive period of grape growing in Aghdam region coincided with 1985. It is clear from the analysis that in the pre-occupation period (1980-1988), the maximum productivity of vineyards in the country was 95.3 cents/ha, while the productivity of this plant in Aghdam region was 68.4 cents/ha. During 1980-1988, grape production in Aghdam region accounted for approximately 7.2 percent of the country's production. The fact that the productivity was 89.6 percent of the national level during those years shows that the agricultural traditions of Aghdam region existed in grape production during those times. The country's demand for grapes is expected to be fully satisfied due to the increase of vineyard areas and higher productivity level, along with other plant types, within the framework of the new measures adopted for the lands freed from occupation, as well as the introduction of new techniques and technologies. Cultivation of viticulture, including technical grape varieties, will be the main factor for the revitalization of the winemaking sector in this region. Thus, it is predicted that in 2025, the share of Aghdam region in grape production in the country will be 1.8 percent, and it will produce around 3.8 thousand tons of grapes.

3.2.2.5. Production Potential Of Other Types Of Plants

It is possible to say that the presence of land, climate, water resources, as well as the historically existing tradition of plant growing in Aghdam region promises the production potential of fruit and vegetable production in this region. It should be noted that taking into account the potential, the establishment of pomegranate and palm groves in this zone as a pilot project will be implemented within the plan. Thus, if the agrarian perspective in the regions is taken into account, the establishment of new intensive fruit and berry orchards and the cultivation of melon plants with the use of agrarian innovations applied in the country will make a great contribution to the growth of the country's food security and export of these products. If the livestock area's demand for feed is taken into account, the establishment of areas for growing fodder grass in this region will be taken into account within the framework of the action plan.

In general, the experience of 1980-1988, the results obtained from the analysis of agrarian innovative development trends and statistical indicators over the last years in the country, the production of 373.2 thousand tons of agricultural products from 35.7 thousand hectares of cultivated and garden areas in Aghdam region by 2025 has opportunities, which covers 3.8 percent of the forecast production indicators for relevant products in the country. As a result of the production of agricultural products, the value of

additional products created by Agdam region is expected to be 214.7 million manats, and its share in the forecast indicators for the country is expected to be 4.9 percent (<https://www.stat.gov.az/>).

Forecast indicators of the production of agricultural products in Aghdam region for 2025 and their contribution to the country-wide production indicators (in percentage) are more clearly described below:

Table 1. Forecast of crop production in Agdam region in 2025

Crop products	Cropland forecast for the region, ar	Productivity forecast for the region, cents/ar	Production forecast by region, tons	Expected benefit of forecast production by region to national production in natural terms, %
Grain	18629	46.5	86627	2.1
Cotton	3137	31.4	9850	2.5
Potato	558	170.0	9482	0.7
Vegetables	9258	250.0	231455	12.6
Watermelon plants	570	220.0	12537	2.2
Fruits and berries	3000	65.1	19530	1.6
Grapes	500	75.2	3760	1.8
Total	35652	+	373242	3.

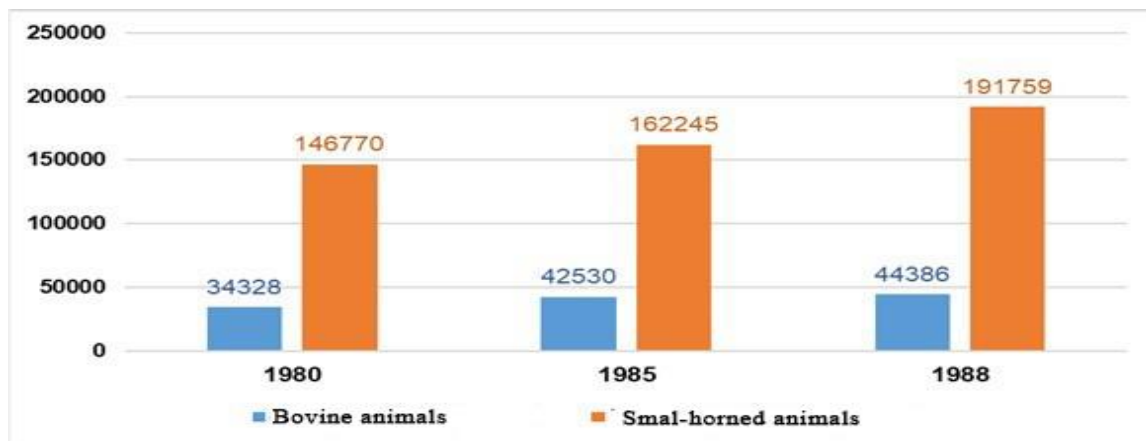
Source: Compiled by the author based on <https://www.stat.gov.az/> materials

With the listed labor, land, climate and water resources, it is possible to produce many times more than this production today. It should be taken into account that in modern times serious development has been achieved with the modern approach applied in all fields of agriculture. It is possible to achieve a significant increase in the volume of production that was before the invasion, both in animal husbandry and with the introduction of more productive seeds. All this will lead to significant progress in the country's agriculture.

3.2.3. Assessment Of Agrarian Potential In The Area Of Animal Husbandry

According to official statistics, there were 34,328 head of cattle in Agdam region in 1980. This number increased to 42,530 in 1985 and 44,386 in 1988. In 1980, there were 146,770 small-horn cattle, 162,245 in 1985, and 191,759 in 1988. In 2019, there were 42,297 cattle and 104,768 small cattle in Agdam. Meat production in live weight for all farm categories was 2741, 3537 and 3817 tons, respectively, in the mentioned years. The total milk production of all farms in the region was 24.4 thousand tons in 1988. Egg production was 12.6 million, 17.4 million and 19.2 million units in accordance with the mentioned 3 years. In 2019, 2563 tons of cut meat, 37.9 thousand tons of milk, 15.0 million eggs and 204 tons of wool were produced in the region. Based on the statistical data, we can say that during the time when we were part of the Soviet Union, the production of products in all areas of animal husbandry in Aghdam region developed with increasing dynamics (<https://www.stat.gov.az/>).

Chart 3. The number of large and small-horned animals in Agdam region before the occupation



Source: Compiled by the author based on <https://www.stat.gov.az/> materials

Forecast indicators of the production of livestock products in Agdam region for 2025 and their contribution to national production indicators (in percentage) are more clearly described below:

Table 2. Forecast of production of livestock products in Agdam region in 2025

Livestock area	Production forecast by country	Production forecast by region, tons	Expected benefit of forecast production by region to national production in natural terms, %
meat (alive)	668224	1270	0.2
Milk	2431880	47159	10.8
Eggs, one thousand pieces	2104081	907702	1.8
Wool	19975	64	2.5
Cocoon, ton	1679	400	23.8
Total	3246324	267962	8.3

Source: Compiled by the author based on <https://www.stat.gov.az/> materials

By 2025, restoration of 64,700 head of cattle (cows and buffaloes) and 30,600 head of small cattle (sheep and goats) in Agdam region will lead to the development of this field in the country and an increase in herd turnover by approximately 5.2 percent. In addition, the number of birds is expected to reach 1.1 million, and the number of bee families is expected to be 4.6 thousand. In these areas, the region's share in the country's production will be 0.2 percent in meat production and approximately 2.5 percent in wool production. Milk and egg production will be 10.8 percent and 1.8 percent, respectively.

Here, the long-standing tradition of cocoon production suggests that a production potential of about 400 tons of cocoons should also be taken into account. As a result of research and research, Agdam's share in the development of the livestock sector until the forecast period is expected to be close to 270 thousand tons or 8.3 percent. Production of livestock products worth 200 million manats is expected in the region, which indicates the potential to create 4.7 percent added value in the corresponding production scale for the country (<https://www.stat.gov.az/>).

In addition to agricultural production potential, great potential for building grain processing, milk processing, and hide processing enterprises in Agdam region should be taken into account. If the

possibilities of production of processing plants and beekeeping products, which are considered a trend for this region, are also calculated, it is observed that the contribution of the concentrated and clustered development of the agro-industry to the economy exceeds the potential of the Soviet era.

In general, as a result of the restoration of agricultural infrastructure in Agdam region, the establishment of new fields and gardens, the restoration of necessary infrastructure for the development of pastures and livestock, in 2025, which is considered the beginning of the productive period, the direct additional contribution to the agricultural production in the country is 641 million manats, other it is predicted to be 4.5 percent. Of course, these forecasts only covered the agricultural potential. If the agro-industrial potential of the processing and value chain is also calculated in the next period, the positive effect will be felt indirectly in the gross domestic product on a larger scale and in terms of the creation of new jobs with a geometric chain.

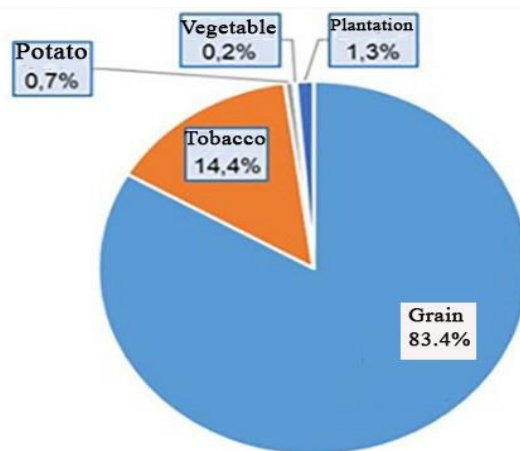
3.3. Agrarian Potential Of Gubadli Freed From Occupation

3.3.1. Assessment Of Agricultural Potential In The Field Of Crop Production

When looking at the structure of the cultivated areas in Gubadli district in 1988, it is observed that grain fields (83.4 percent) and tobacco fields (14.4 percent) cover larger areas. In addition to these plants, there were vineyards on 997 hectares of perennial plantings in Gubadli district. The share of vineyards in the region was 1.1 percent in the country. From the structure shown in the diagram below, it is noticeable which agricultural products the region specializes in, and in which areas the historical tradition of agriculture is concentrated (<https://www.stat.gov.az/>).

In general, grain fields in Gubadli region in 1988 were 0.6 percent of the corresponding cultivated area in the country, and tobacco fields in the region were 3.6 percent of the country's area.

Chart 4. Planting structure of crop production in Gubadli district in 1988



Source: Compiled by the author based on <https://www.stat.gov.az/> materials

3.3.2. Tobacco Production Potential

According to official statistics, we can say that tobacco farming is the most preferred agricultural sector by the population of the region. In 1980, 1,366 tons were produced from 504 hectares of land, in 1985, 2,070 tons were produced from 519 hectares, and in 1988, 2,101 tons were produced from 589 hectares. As can be seen from the analysis, during the pre-occupation period (1980-1988), the maximum productivity of tobacco in the country was 39.0 cents/ha, while the productivity of this plant in Gubadli district was close to 40.0 cents/ha. In 1980-1988, tobacco production in the region made up 3.6 percent of the country's production. During those years, the productivity was 7.8 percent higher than the national level, indicating that Gubadli region has more production opportunities in tobacco production.

As a result of the conducted research, it is predicted that by 2025, the production of tobacco with a yield of 4 tons/ha will reach 2000 tons due to intensive cultivation of tobacco in Gubadli district. This means

that approximately 25-27 percent of tobacco production in the country will be formed at the expense of Gubadli region.

3.3.3. Grain Production Potential

According to official statistics, in 1980, 5.0 thousand hectares of grain were planted and 5.2 thousand tons of grain were harvested. In 1985, the area was 3.6 thousand hectares and harvested grain was 8.0 thousand tons, and in 1988, 6.7 thousand tons of grain were taken from the 3.4 thousand hectares of grain area. As it can be seen, during the pre-occupation period (1980-1988), there was an increase in grain yield by almost 2 times. The average grain yield was 17.5 cents/ha, and the maximum yield was 22.4 cents/ha, which is only 15.5 percent lower than the national yield indicators in those years. During 1980-1988, grain production in Gubadli district made up 0.6 percent of the country's production. During those years, the fact that the productivity was almost equal to the national level shows that Gubadli region has potential opportunities in grain production.

3.3.4. Grape Production Potential

As in other regions of Karabakh, viticulture is considered one of the main fields of agriculture in Gubadli. Studies show that in 1985, 6.2 thousand tons of grapes were produced from 2.4 thousand hectares of land, but during the following years, the area of grapes was reduced to 997 hectares in 1988. In general, in 1988, 2.9 thousand tons of products were obtained from these vineyards. Thus, during these years, the most productive period of grape growing in Gubadli region was in 1985. As can be seen from the analysis, during the pre-occupation period (1980-1988), the maximum productivity of vineyards in the country was 95.3 cents/ha, while the productivity of this plant in Gubadli district was 48.9 cents/ha. During 1980-1988, tobacco production in Gubadli district was equal to 0.3 percent of the country's production. The fact that the productivity in these years is 59.2 percent of the country's level shows that there are agricultural traditions of Gubadli region in grape production (Vəliyev A.H, 2019: 63).

The country's demand for grapes is expected to be fully satisfied due to the increase of vineyard areas and higher productivity along with other plant types within the framework of the new Action Plan adopted for the lands freed from occupation, as well as the introduction of new techniques and technologies. Cultivation of viticulture, including technical grape varieties, will stimulate the development of the winemaking sector in this region. Thus, in 2025, Gubadli region's share of grape production in the country is 1.5 percent, and grape production is predicted to be around 2.7 thousand tons.

In general, by 2025, Gubadli district has the potential to produce 48,000-50,000 tons of agricultural products from 17,000 hectares of cultivated and garden areas. This includes 0.5 percent of the forecast production indicators for relevant products in the country. As a result of the production of crop products, the value of additional products created by Gubadli region is expected to be 27.6 million manats, and its share in the forecast indicators for the country is expected to be 0.6 percent (<https://www.stat.gov.az/>).

The forecast indicators for the production of crop products in Gubadli district for 2025 and their contribution to national production indicators are more clearly described below:

Table 3. Forecast of crop production in Gubadli region in 2025

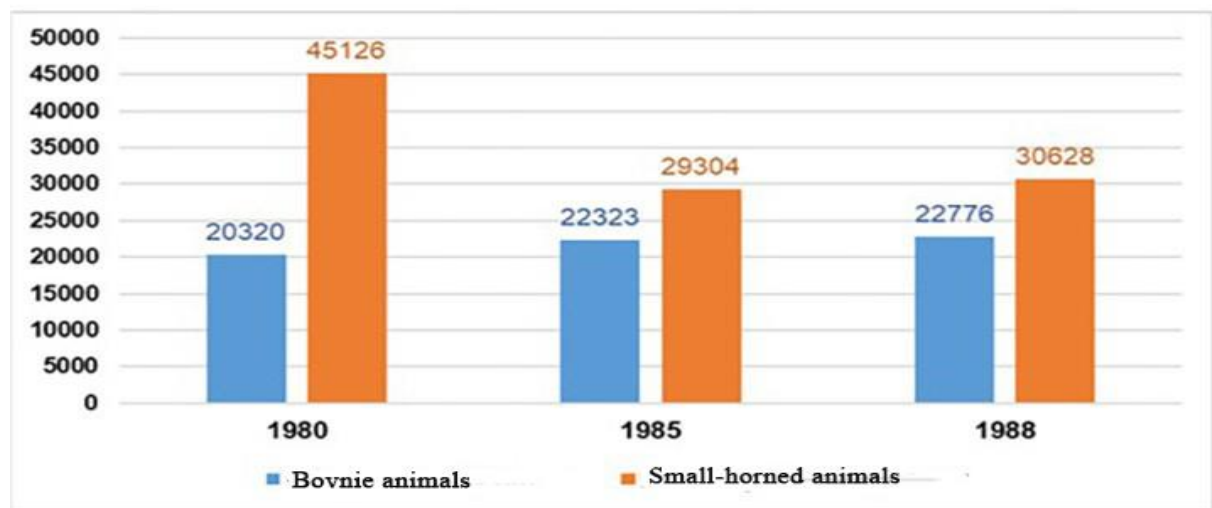
Names of crop products	Forecast of arable land in the region, ha	Productivity forecast for the region	Production forecast by region	Forecast by region, expected benefit of production to national production, %
Grain	11866.5	27.3	32441	0.8

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Tobacco	500.0	40.0	2000	27.0
Potato	396.4	39.4	1561	0.1
Vegetables	246.4	20.5	505.0	0.01
Watermelon plants	242.0	117.8	2852	0.5
Fruits and berries	3000.0	19.7	5917	0.5
Grapes	500.0	53.7	2687	1.3
Total	16751.3		47962	0.5

Source: Compiled by the author based on <https://www.stat.gov.az/> materials

Chart 5. The number of large and small animals in Gubadli district before the occupation



Source: Compiled by the author based on <https://www.stat.gov.az/> materials

3.3.5. Assessment Of Agrarian Potential In The Area Of Animal Husbandry

According to official statistics, the number of cattle in Gubadli in 1980 reached 20,320. In 1985 it increased to 22,323 and in 1988 it was 22,776 heads. As for small-horned animals, in 1980 there were 45,126 heads, including 32,724 sheep, 12,402 goats, in 1985, 29,304 heads, including 17,752 sheep, 290,304 goats, and in 1988, 30,668 heads, including 18,294 goats. sheep, 12,374 goats. Meat production in live weight for all farm categories was 18,499, 22,117, 22,803 tons and cut weight was 1,093, 1,296, 1,320 tons, respectively. The total milk production of all farms in the region was 7,084, 9,642 and 12,055 tons in years, wool production was 682 tons in 1980 and 378 tons in 1985, and egg production was 3,721 in 1980, 4,519 in 1985, 1988 and 4,394 thousand units in the year. Based on the statistical data, we can say that during the time when we were part of the Soviet Union, the production of products in all areas of animal husbandry in Gubadli developed with increasing dynamics.

3.4. Agrarian Potential Of Jabrayil Liberated From Occupation

Jabrayil district is located in the south-east of Karabakh, the Lesser Caucasus Mountains, on the border with Iran. In the district with an area of 1,050 square kilometers, mainly mountain chestnut, chestnut

and brown mountain-forest lands are spread. The lands of the region are irrigated by the main Araz, Incechay and Chailagchay rivers, which are known for their abundance. It is possible to irrigate an area of 7,500 hectares through the Khudafar reservoir built in Jabrayil region.

According to official statistics, the number of cattle increased from 19,314 in 1980 to 22,905 in 1985 and 26,364 in 1988. As for small-horned animals, in 1980 there were 89,831 heads, including 81,825 sheep and 8,006 goats, and in 1988, there were 114,202 heads, including 104,958 sheep and 9,244 goats. Meat production in live weight for all farm categories was 2766, 3309, 4024 tons and cut weight was 1631, 1904, 2271 tons, respectively. The total milk production of all farms in the region was 8708, 10615 and 14025 tons. Wool production was 156 tons in 1980 and 173 tons in 1985. Egg production was 7,866, 10,997 and 11,415 thousand in accordance with the mentioned three years. Based on the statistical data, we can say that production in all areas of animal husbandry has developed with increasing dynamics.

According to the official statistics on crop production, in 1980, autumn and spring wheat were planted on 6468 hectares of grain production and 5543 tons of crops were obtained. In 1985, the area was 5424 hectares, and the harvested product was 9635 tons. In 1988, 12,176 tons of wheat were produced from 5,699 hectares of land. In 1980, 2,041 tons of autumn and spring barley were harvested from 2,601 hectares, in 1985, 6,185 tons from 2,659 hectares, and 7,907 tons from 3,184 hectares in 1988. In 1980, cereals and pulses were planted on 9383 hectares and 9403 tons of crops were collected. In 1985, 15,837 tons were produced from 8,176 hectares, and in 1988, 20,143 tons were produced from 8,995 hectares.

Viticulture is one of the developed fields in the region. In 1980, 6,334 tons were harvested from 6,419 hectares of land, in 1985, 45,982 tons were harvested from 8,438 hectares of land, and in 1988, 41,995 tons were harvested from 6,570 hectares of land.

According to the statistics of 1988, 77,639 tons of different products were produced in the district with a total cultivated area of 24,877 hectares. With the listed labor, land, climate and water resources, it is possible to produce many times more than this production today. If we take into account that in modern times, serious development has been achieved with the modern approach applied in all fields of agriculture in our country, it is possible to achieve a significant increase in the volume of production that was before the occupation by introducing new types of breeds in animal husbandry and more productive seeds in crop cultivation. All this will lead to significant progress in the agriculture of the country, including Karabakh and Jabrayil.

Table 4. Agrarian analysis of Jabrail region

№	Name	Country Total (2019)	By Jabrayil district (1985)	After the restoration of agricultural activity in Jabrayil region, the increase in indicators across the country, in %
1	Cultivated area (ha)	1717054	24877	1.45
2	Number of cattle (head)	2646629	22905	0.87
3	Number of small horned animals	8189223	99321	1.21
4	Liveweight meat production (tons)	573300	3309	0.58
5	Meat production in cut weight (tons)	335719	1904	0.57
6	Milk production (tons)	2150817	10615	0.49
7	Egg production (number)	1827072	10997	0.60

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8	Wool production (tons)	16095	173	1.07
9	Wheat (tons)	2171490	9635	0.44
10	Barley (tons)	1015539	6185	0.61
11	Cereals and pulses (tons)	3538489	15837	0.45
12	Grapes (tons)	201842.4	45982	22.8

Source: Compiled by the author based on <https://www.stat.gov.az/> materials

The above table shows the production in 2019 in various fields of agriculture across the country and the potential production capabilities of Jabrayil region for those products and the share (in percentage) in increasing that production across the country. The table reflects the benefits that will be given to our country in this field after the restoration of agricultural activities in Jabrayil region.

It is clear from the table above that the region, which has only 1.45 percent of the cultivated land in the country, is using its manpower and climate resources very productively. The region, which mainly specializes in grape production, will see an increase of approximately 23 percent after the restoration of grape production. Among other crops, barley, wheat, and cereals, and from the planting of cereal legumes, only approximately 1.5 percent increase will be observed. An increase of approximately 1 percent will be achieved in cattle breeding, and 1.2 percent in small cattle breeding. According to these areas, live and slaughtered meat production will increase by 0.6 percent, and wool production will increase by approximately 1 percent. Milk and egg production will increase by 0.5 and 0.6 percent, respectively.

It is clear from the presentation of agricultural production indicators of Jabrayil, which has a large land area, that the occupation of Karabakh in the past 30 years has caused great damage to the country.

3.5. Agrarian Potential Of Zangila Freed From Occupation

Zangilan district is located in the south of Karabakh, on the border with Iran. The population of the district with an area of 707 square kilometers is 45 thousand (39 thousand in 1993). The territory of the district is located in the southern part of the Little Caucasus mountains in the Arazboyu part. The area has unique beauty, steep rocks, tulip plains, eye-catching forests and bushes.

According to official statistics, the number of cattle increased from 17,704 in 1980 to 20,317 in 1985 and 19,131 in 1988. As for small-horned animals, in 1980 there were 51,210, including 41,338 sheep and 9,872 goats, and in 1985, there were 33,441, including 25,299 sheep and 8,142 goats, and in 1988, there were 34,550, including 25,539 sheep and 9,011 goats. Meat production in live weight for all farm categories was 1724, 1880, 1980 tons and cut weight was 1001, 1084, 1139 tons, respectively. The total milk production of all farms in the region was 9973, 7943 and 9165 tons. Wool production was 71, 47 and 54 tons, and egg production was 2554, 3292 and 3617 thousand units, respectively. Based on the statistical data, we can say that production in all areas of animal husbandry has developed with increasing dynamics (<https://www.stat.gov.az/>).

Table 4. Agrarian analysis of Zangilan region

No	Name	Country Total (2019)	Zangilan region (1985)	After the restoration of agricultural activity in Zangilan district, the increase in indicators across the country, in %
1	Cultivated area (ha)	1717054	6726	0.39
2	Number of cattle	2646629	20317	0.77

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3	Number of small horned animals	8189223	33441	0.41
4	Liveweight meat production (tons)	573300	1880	0.33
5	Meat production in cut weight (tons)	335719	1084	0.32
6	Milk production (tons)	2150817	7943	0.37
7	Egg production (number)	1827072	3292	0.18
8	Wool production (tons)	16095	471	2.93
9	Wheat (tons)	2171490	3111	0.14
10	Barley (tons)	1015539	600	0.06
11	Cereals and pulses (tons)	3538489	3722	0.11
12	Tobacco (tons)	6038.6	1313	21.7
13	Grapes (tons)	201842.4	26165	13.0

Source: Compiled by the author based on <https://www.stat.gov.az/> materials

According to the official statistics on crop production, in 1980, winter and spring wheat were planted on 1,526 hectares of grain production and 1,857 tons of crops were obtained. In 1985, the area was 1488 hectares, and the harvest was 3111 tons. In 1988, 3793 tons of wheat were produced from 1583 hectares of land. In 1980, 329 tons of fall and spring barley were harvested from an area of 214 hectares, in 1985, 600 tons were harvested from an area of 225 hectares, and in 1988, 829 tons were harvested from an area of 346 hectares. In 1980, cereals and pulses were planted on 1813 hectares and 2186 tons of crops were collected. In 1985, 3,722 tons were produced from 1,747 hectares of land, and in 1988, 4,622 tons were produced from 1,929 hectares of land. In 1980, 1,232 tons of tobacco were collected from 381 hectares of land, in 1985, 1,313 tons were collected from 369 hectares of land, and in 1988, 1,272 tons were collected from 359 hectares of land. Grapes are the most preferred production in the region. In 1980, 15,429 tons were produced from 4,573 hectares of land, in 1985, 26,165 tons were produced from 3,841 hectares of land, and in 1988, 16,322 tons were produced from 2,391 hectares of land.

The table above shows the production in 2019 in various fields of agriculture across the country and the potential production opportunities of Zangilan region for those products and its share in increasing that production across the country. The table reflects the benefits that will be given to our country in this area after the restoration of agricultural activities in Zangilan region.

CONCLUSION

Soil suitable for agriculture, which has been under occupation for a long time, has become completely unusable as a result of being left unused, polluted by the invaders, and the destruction of its structure, and its direct use in agricultural production has become impossible.

It was determined that the occupied agricultural lands have a high specific gravity compared to other regions of the republic due to their quality characteristics and productivity. The soil-climate characteristics of the area allow high and efficient development of the crop and animal husbandry areas of agriculture here.

In order to correctly determine the efficient direction of farm activity and the structure of production, the head of the farm (entrepreneur) should first of all investigate which of the agricultural products

grown in the region will bring more income. For this purpose, by drawing up technological maps for the main products, he should calculate the costs required for the production of products from 1 hectare of land, and specify the market prices of the main products grown in the region (taking into account the tendency of price changes).

In my opinion, first of all, it is necessary to use the territories freed from occupation for agricultural production, so that the current condition of those lands, relief features, irrigation possibilities, and water conditions are relatively favorable for the development of agriculture or animal husbandry.

The arable land freed from occupation is equal to 100,000 hectares. Efficient use of these lands as a component of agro potential will greatly affect the minimization of the dependence of the grain and grain products market of our country on international markets. Of course, this will depend on the level of involvement of the land in the economic cycle, and for this, first of all, it is necessary to clear those lands from mines.

It is important to note here that the amount of grain produced in the occupied lands of Azerbaijan and transported to the occupying country was around 150-200 thousand tons every year, as the minister of agriculture of the occupying country admitted. The transportation of the specified amount of grain to Armenia played an important role in ensuring the food security of this country. The liberation of our lands from occupation means an increase of grain in our country at least by that amount. This is more than 10% reduction of grain imported by Azerbaijan every year, 32 mln. spent on buying grain at current import price. will lead to the saving of foreign currency more than dollars and the improvement of the level of ensuring the food security of our country.

The efficient use of lands freed from occupation will enable the development of livestock breeding in addition to grain growing. At present, the capacity of the livestock products segment of the food market of our country is greater, and there are certain difficulties related to the full satisfaction of the population's demand for these products. The development of animal husbandry in Karabakh will allow the increase of the offer of livestock products to the market by local producers, the reduction of the market prices of the said products and the better nutrition of different layers of the population.

As it can be seen, the potential of the liberated territories in terms of agricultural development is very wide. In order to achieve effective use of this potential, it is important that the relevant structures start working now.

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Abstract

Due to the high rates of migrations worldwide, healthcare providers are affected by the increased patients' ethnicity and cultural diversity. "Cultural Competencies in Healthcare" can be defined as factors that healthcare providers and organizations should comprehend and integrate to enhance the delivery and structure of healthcare systems and facilities. Cultural competencies mainly depend on how a person's beliefs, values, and behaviors concerning health and well-being are built upon certain factors such as nationality, race, ethnicity, gender, language, sexual orientation, physical and mental ability, occupation, and socioeconomic status. The main aim of a healthcare system that is culturally competent is to supply excellent care for every single patient despite race, ethnicity, and cultural background. Various programs teach facts regarding cultural competence to be ready before transitioning into their jobs. But to know every detail about every culture is considered impossible; hence, training techniques that concentrate only on facts are limited, so they are combined with approaches that yield universal skills. When it comes to encouraging cultural competence, several organizations have actively participated by developing guidelines that focus on improving the perspectives of specific areas, such as respect and tolerance for cultural differences, physicians accept responsibility to understand health and illness's cultural aspects, recognizing personal biases against people of different cultures, and being aware of sociocultural factors' impact on patients. Nonetheless, cultural competence is still considered a new concept and is an ongoing learning process that develops through stages based on experiences and previous knowledge.

Keywords: Cultural competence, cultural diversity, migrants' integration, healthcare providers skills.

INTRODUCTION

Cultural competence can be considered a necessity recently due to the increased rates of migrations worldwide. It is defined as a set of harmonious policies, behaviors, and attitudes that align together in a system or amongst experts to ensure practical work in inter-cultural conditions and increase the service quality, therefore, inducing better results. Culture is related to a combination of human behavior that consists of language, communications, actions, beliefs, thoughts, values, and organizations of racial, religious, ethnic groups. On the other hand, competence refers to an individual's or an organization's ability to function effectively in the context of the cultural beliefs, habits, and needs that customer and their communities offer (Cross, 1989). Cultural competence highlights the concept of being able to operate effectively in various cultural situations and adapting strategies to reach out to different cultural groups. They do not entail action or structural change, even though they suggest an understanding of cultural similarities and differences. There are eight principles of cultural competence. "Racial and ethnic minorities tend to receive a lower quality of health care than no minorities, even when access-related factors such as patient's insurance status and income are taken into account," according to the recent National Academy of Medicine report Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care. Many cultural competence models have been established, and these models are used to inform various cultural competence interventions such as provider training and practical tools. While cultural competency has typically been associated with the culture and language of racial and ethnic minorities, it is increasingly being applied to other groups, such as individuals with disabilities. These populations have been the main subjects of cultural competence interventions'

studies. Cultural competence and health literacy are now linked, indicating that mutual understanding between patients and providers requires integrating culturally and linguistically competent, and health literate approaches. Thus, the rise of national attention to chronic racial and ethnic inequality in healthcare has driven the cultural competence movement. Health and healthcare imbalances between minority and majority populations have been documented in numerous studies. The demand for cultural competence in healthcare has been strengthened by demographic changes that have resulted in several minority-majority states and variety in previously homogeneous areas. When it comes to cultural competence and patient safety, distinctions in healthcare also exist. For example, there has been a study where hospitals across the country showed that patients with poor English proficiency were more likely to be harmed than those with high-level English proficiency when exposed to adverse effects. These findings also apply to children, as evidenced by a study that indicated Latino children in hospitals are more likely than non-Latino white children to encounter an unfavorable event. Diagnostic errors, missed screenings, unexpected negative reactions to medication, harmful treatment interactions from concurrent use of traditional medicines, healthcare-associated infections, adverse birth outcomes, inappropriate care transitions, and inadequate patient adherence to provider recommendations and follow-up visits are all examples of patient safety events that can occur when culture, language, and health literacy are not addressed. Cultural competence can have a significant impact on patient commitment and directly affect medical error and harm. It is crucial to improve cultural competence and do so; five approaches can be followed and applied (Brach et al., 2019).

CULTURAL COMPETENCE

Cultural competence is a set of attitudes, behaviours, values, and practices that come either among individuals or together in a system, program, or organization to permit them to perform work more efficiently in various cultures (Gopalkrishnan, 2019).

Furthermore, it attributes to the ability to praise and respect the language, beliefs, and behaviours of those receiving assistance and those administering the aid (US, 2014).

In the context of healthcare, cultural competence refers to the ability to recognize, understand, and respect clients' values, choices, and precise needs (Lin et al., 2019). To develop culturally competent healthcare, the environment should be aware of one's cultural background and experiences and the need to restrict their effect when interacting with people from other cultures with distinct life situations. Furthermore, cultural competence necessitates knowledge of and respect for different cultures. It also necessitates responding to patients in culturally appropriate ways (Echeverri et al., 2021).

Themes	Definitions	Authors
Culture	[Culture] refers to integrated patterns of human behaviour that include the language, thoughts, communications, actions, customs, beliefs, values, and institutions of racial, ethnic, religious, or social groups.	Cross, T., Bazron, B., Dennis, K. (1989). Towards a culturally competent system of care (Vol. 1). Washington: Georgetown University Child Development Center, CASSP Technical Assistance Center.
Culture	A process; not fixed, not predetermined: constructed by individuals, expressive of interplay between individual subjectivities and collective objectiveness	Airini (1997). Dreams of woken souls: the relationship between culture and curriculum. PhD thesis, University of British Columbia.
Cultural Competency	Competency is having the capacity to function effectively as an individual and an organization within the context of the cultural beliefs, behaviours and needs presented by consumers and their communities	Cross, T., Bazron, B., Dennis, K. (1989). Towards a culturally competent system of care (Vol. 1). Washington: Georgetown University Child Development Center, CASSP Technical Assistance Center.
Pacific cultural competency	[Is] the ability to understand and appropriately apply cultural values and practices that underpin Pacific people's worldview and perspectives on health	Tiatia, J., Foliaki, L. (2005) Pacific Cultural Competency Framework for DHBs (Draft 4). Unpublished report.

Table 1. Definitions of culture; cultural competency and Pacific cultural competency (KS & T, 2009)

IMPORTANCE OF CULTURAL COMPETENCE IN HEALTHCARE

Cultural competence is crucial since it helps healthcare providers display the most outstanding services to every patient; therefore, the patients will be delighted. Professionals having a solid background and understanding of cultural competence will lead to no chance of being biased. In addition, it helps them to provide the best services despite their social status and beliefs (The Chicago School, 2020). In other words, cultural competence assists healthcare organizations and patients that are similar, leading to higher interaction and involvement and respect and understanding; hence, promoting increased patient safety, reduced inefficiencies, reduced care disparities, and decreased costs (Aid et al., 2021). Communication can be affected when there are differences between the healthcare providers and the patients. This can have an impact on both parties' decisions regarding treatment. For instance, the healthcare provider might interpret the patient's silence as a sign of not wanting to get the treatment when the patient's response was due to their way of showing respect. So, when healthcare providers are unsuccessful in realizing the differences between them and their patients, that will naturally lead to lower quality of care. Cross-cultural communication can be improved by constructing teams with healthcare providers that consider the patients' diversity. Therefore, wider spectrum of cultural knowledge would be accomplished (Aid et al., 2021).

EXAMPLES OF CULTURAL COMPETENCE IN HEALTHCARE

There are countless examples of cultural competence in healthcare that can highlight the ways that healthcare systems deal with cultural differences when administering care, even when hardships and distinctions occur. These examples are set to provide a better understanding of the situations that healthcare providers constantly encounter (Aid et al., 2021).

Respecting the Patient's Choices

An 80-year patient that is severely ill gets informed that one of his heart valves has stopped working, and for him to survive, a surgery needs to take place (Aid et al., 2021). Since the patient has a history of excessive bleeding, he will require blood transfusions during the surgery. The patient is a devout Jehovah's Witness, and according to his religious beliefs, blood transfusions are not permitted; hence, the patient refused to perform the surgery. In such case, the patient's medical team speaks to the patient and his family and discusses the risks that the patient will have, and he might even not survive without the surgery. After the patient gains all the information and is aware of the risks, the medical team starts to prepare him for surgery.

Another hypothetical case of a 47-year-old patient who has a history of alcohol abuse and refuses analgesics following surgery because he believes God wants to punish him for his sins (Smith, 2019). There are five approaches to convincing the patient. First, assess whether the patient's rejection jeopardizes your commitment to his care. What is acceptable is limited by concerns for the patient's health. If evidence reveals that withholding treatment might put the patient's health in jeopardy, you should decline to do so, regardless of the religious basis for the request. In contrast, if refusing the treatment will not jeopardize the patient's health, you may consent to the demand, even if you disagree with it. Second, learn more about how the patient's decision making is connected to his religious beliefs. Question the patient if he fully understands the decisions he must make. "This approach conveys respect, builds trust and opens up the possibility of finding an accommodation that both patient and physician can pursue with integrity" (Smith, 2019). Third, challenge the patient's views and refusals of receiving the needed care in a respectful manner. Healthcare providers, as a part of their job, have a responsibility to respectfully debate patients' refusals to receive the medical treatment that healthcare providers think is necessary. Fifth, encourage the patient to bring some of the religious members into the debate. It may be beneficial to expand the discussion beyond the healthcare providers and the hospital. However, such an approach could be dangerous since the members of the same religion and beliefs could boost the patient's opposition to treatment (Smith, 2019).

HOW TO IMPROVE CULTURAL COMPETENCE IN HEALTHCARE

To enhance and give the best care to patients, healthcare professionals and organizations must learn how to elevate cultural competence (Aid et al., 2021). To do so, there are a few strategies and steps that can be followed:

1. Develop awareness and education.
2. Approachability can induce improved cultural competence.
3. Hiring diverse staff.
4. Implementing CFI strategy.

Develop Awareness and Education

This approach is considered the foundation for improving cultural competence in healthcare (Aid et al., 2021). Healthcare professionals must recognize their beliefs and create awareness of their culture to conduct cultural competence. This would provide the general knowledge and hence improve their cross-cultural awareness. Healthcare providers with cross-cultural knowledge are more receptive to unusual attitudes, behaviours, or actions. It also enhances the connection and communication with the patients and allows the healthcare providers to respond more confidently and quickly. Cross-cultural awareness has improved harmony, customized treatment plans, and better patient participation and compliance. To put these benefits into use, healthcare organizations develop cultural competence training. This training teaches healthcare providers how to build intercultural communication skills and helps them learn how to respond to cultural differences better.

Furthermore, cultural competence training can assist the organization in identifying rules or procedures that are obstacles to other communities. They can then alter them to make sure that they match the needs of various patients (Aid et al., 2021).

Approachability Can Induce Improved Cultural Competence

Approachability is required for cultural competence in healthcare (Aid et al., 2021). Approachability is a factor that makes sure language, race, culture, and similar variables do not become obstacles to patients receiving appropriate care. A few ways can ensure that healthcare organizations make healthcare more approachable. First, developing knowledge about the local community where the healthcare providers learn about the group of people they are assisting. It is necessary to evaluate demographic data by distributing surveys to specific populations to collect information (Aid et al., 2021). In this way, the healthcare providers will have a better way of meeting the patients' needs. For instance, recruiting interpreters for a specific language or cooperating with traditional healers (Bhattacharya, Kumar, Sharma and Thiyagarajan, 2019). The second way to increase approachability is by recruiting and training diverse team members. In doing so, the patients will come across team workers that might look like them, speak their language and share their language; hence, they feel more comfortable and welcomed. Communicating with the patients would be easier since the healthcare providers can understand their point of view and needs. Having diverse healthcare providers can also help with teaching everyone else by sharing their insights with their colleagues.

CFI Strategy

Pharmacists are considered the most approachable healthcare providers in healthcare as they see the patients between 1.5 to 10 times more often than they see physicians. Hence, they play an essential role in educating patients (Tsuyuki, Beahm, Okada and Al Hamarneh, 2018). CFI strategy is used to improve cultural competence in pharmacy practice (Rice and Harris, 2020). It is a specific set of questions that aid in decreasing biases. It is used to apply dependent cultural factors to diagnose and treat mental illness and improve diagnostic assessment efficacy even though this set of questions can be viewed negatively by the patients, and they may find them unclear. CFI can induce enhanced cultural competence as healthcare professionals learn and understand different cultures. This strategy is mainly used to improve communication as it is the pharmacist's job to communicate and educate patients. For instance, a pharmacist can correct a common misconception among minor communities' patients that taking antidepressants can make you addictive and are not effective. So, the pharmacist's job here is to communicate with the patient and inform them about the treatment and potential adverse effects. In this way, the patient will somehow normalize mental illness and seek to get treatment. Pharmacists can customize patient education with the newly learned communication strategies of CFI. CFI is crucial, especially during the COVID-19 pandemic, as pharmacists need to maintain the same levels of care and flexibility in services (Rice and Harris, 2020).

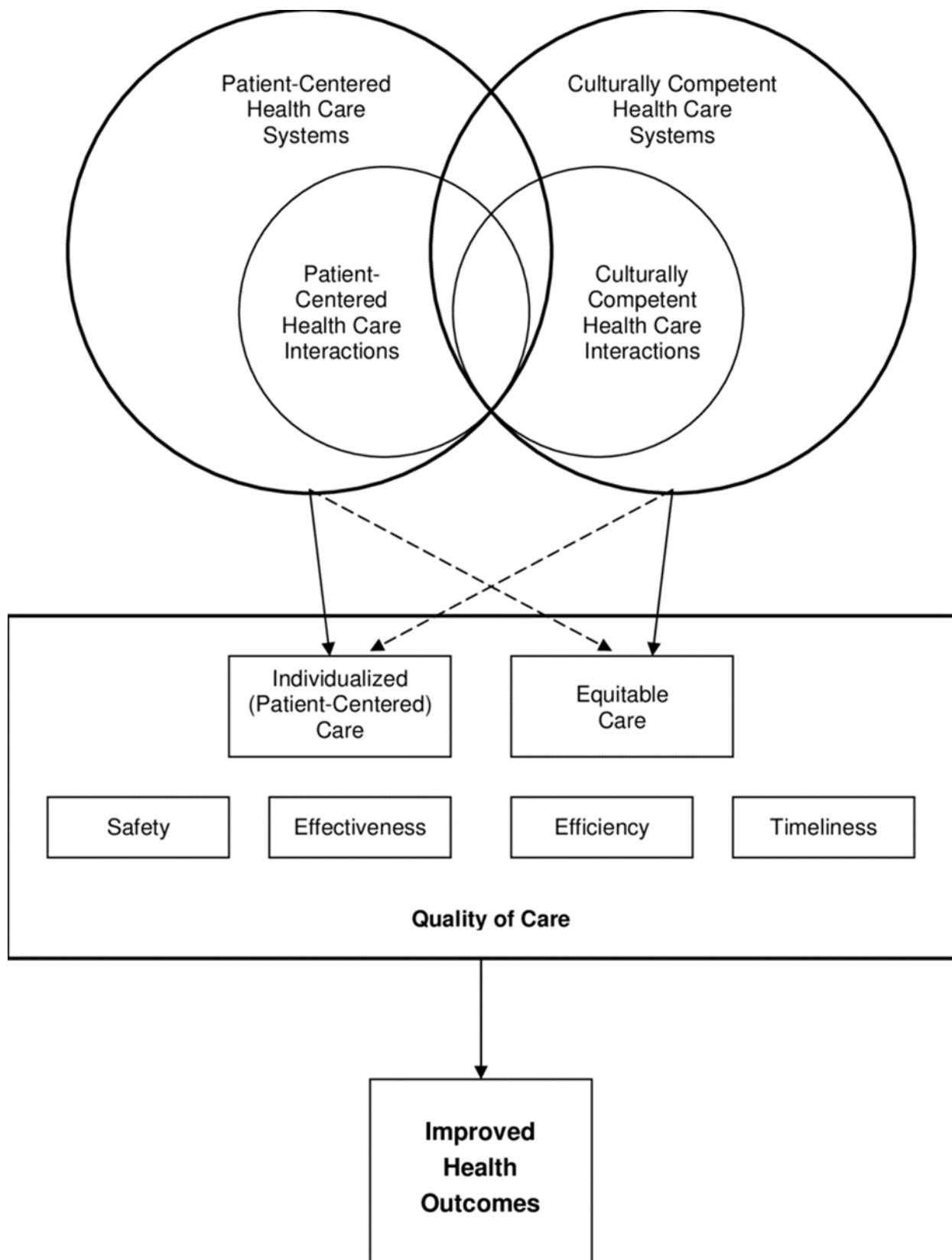


Figure 1. Patient-centeredness and Cultural Competence Integral to Health Care Quality (Beach, Saha & Cooper, 2006)

OBSTACLES OF CULTURAL COMPETENCE IN HEALTHCARE

There are a few barriers that are encountered when dealing with cultural competence in healthcare (Rice and Harris, 2020). There are three main barriers in any healthcare organization. They are first having sufficient knowledge of the organization's cultural competence. It is essential to acknowledge the organization's need to focus on cultural competence. That is done by asking what factors the organization lacks and how gaps exist. To achieve leadership, after recognizing these points. If cultural competence is valuable in the healthcare system, then data must be collected regarding the patient's race, language preferences, ethnicities, etc. (Rice and Harris, 2020). Surveys can be beneficial to track the missing pieces that the organization requires. Second, committing to cultural competence. Healthcare systems must design an institutional framework that shows culturally competent practices, encourages cross-cultural knowledge and understanding and promotes a diverse workforce. To maintain cultural competence, commitment must be established, and that is fulfilled by building a stable base that bears regulations and protocols that make sure practices are culturally competent.

Furthermore, systems must deal with resistant employees and limit cultural competence to racial and ethnic diversity and believe that they are already culturally competent. Healthcare institutions could develop educational procedures that widen cultural competency's meanings in these situations. Third and last, having limited resources that back up cultural competence. To construct the base needed to view cultural competence as more than just a value, the healthcare systems must supply money, time, and leadership. Other than budgeting, there are diverse materials, interpreters, training, and programs for recruiting diverse staff members (Rice and Harris, 2020).

THE FIVE BUILDING BLOCKS OF CULTURAL COMPETENCE

For cultural competence to take place and be effective, five specific factors need to be followed and applied (Campinha-Bacote, 2019). These factors are put and designed to promote leadership skills. There is a synergistic process between cultural humility and cultural competence called cultural competemility, where cultural humility spreads through the five building blocks of cultural competence, which are the following:

1. Open attitude
2. Self-awareness
3. Cultural awareness
4. Cultural knowledge
5. Cultural skills

Therefore, cultural competemility demands healthcare providers to sustain both an attitude and a wide angle of cultural humility and competence since they're involved in cultural encounters, acquire cultural knowledge, establish cultural skills, and be culturally aware (Campinha-Bacote, 2019). Therefore, cultural competemility can be recognized as a process combining both becoming and being. To explain further, people need to become culturally competent and commit to the operation of cultural humility.

OPEN ATTITUDE

In cultural competence, you must know what to learn and try to go on with a sense of wonder about yourself and others so that you would have an open mindset (Campinha-Bacote, 2019). You have to consider that there is only little that you know so that your mind automatically wants to gain new information. One must prepare to be exposed to various ideas and perspectives through clinical

interactions. There are a few key points one must consider if they want to have an open attitude, such as being completely open and welcoming diverse ideas and concepts, searching for different views and conflicting arguments, and observing all the pros and cons when dealing with a problem. Healthcare providers should be devastated that social injustice still takes place, and that's why there is ingrowth in cultural diversity in healthcare as well as inequalities. This shall encourage the healthcare providers to improve and provide more for cross-cultural patients. In addition, it will make them acknowledge that their views about patients and their daily interactions can either influence cultural competence positively or contribute to worsening social injustices (Campinha-Bacote, 2019).

SELF – AWARENESS

The second most important element in cultural competence is self-awareness. (Campinha-Bacote, 2019). Health care providers must give up their biased views towards patients of diverse cultures to become fully culturally competent. This type of sacrifice associates the vow of serving all patients the same way despite their cultural beliefs and values. Increasing awareness of one's cultural background would be helpful when interacting with cross-cultural patients (Kaihlanen, Hietapakka and Heponiemi, 2019). To fully understand cultural competence, one must learn about their own culture, values, beliefs, and background. In simpler words, before giving your judgment about someone, you must understand all their experiences, ideas, challenges, etc. Therefore, you will automatically become more unbiased and objectively interact with patients. There are six elements in self-awareness:

1. Acknowledging your own cultural background.
2. Being aware of your own presumptions, objectives, and beliefs.
3. Being aware of how people may view you and your character.
4. Understanding one's own strengths and weaknesses.
5. Recognizing your own personal favoritism, behavior, and cultural incompetence.
6. Knowing your self-reflection and intervention efficiency.

CULTURAL AWARENESS

This involves recognizing that each individual in this world is unique and therefore has a fantastic set of beliefs, values, views, and background, and even if they don't match your own, they should be equally priceless and worthy (Campinha-Bacote, 2019). Cultural awareness in healthcare refers to acknowledging and accepting one's cultural background, the concept of cultural indifferences in others, and an understanding of how one's personal opinions influence one's values, prejudices, and cultural perspectives (Lin, Lee and Huang, 2015). Healthcare professionals who respect and accept cultural diversity are culturally sensitive.

CULTURAL KNOWLEDGE

Cultural knowledge refers to the knowledge obtained by healthcare professionals who understand the ideas, beliefs, and evaluation methods of cultural competence in healthcare (Lin, Lee and Huang, 2015). According to scholars, high scores on self-reported cultural knowledge assessments do not always imply a high level of genuine cultural understanding. Individuals may choose to give socially acceptable responses rather than those that genuinely reflect their actual perspective, increasing the instrument's unreliability. Researchers should carefully analyze the efficacy of utilizing self-rated ratings to assess healthcare workers' cultural understanding in the future. Accordingly, there is a suggestion to combine different evaluation methodologies into a single cultural knowledge measurement that incorporates objective data collected through interviews, assessments, and oral or written reports. This suggestion parallels Kumaş-Tan et al. (2007), who suggested that measurements should not rely solely on qualitative methods. We anticipate that results acquired with instruments that work with various

objective modes will be more accurate and dependable than results obtained with solely quantitative or qualitative methods. In addition, cultural knowledge encompasses three main areas:

1. Any health-related practices, values, beliefs of culturally diverse population.
2. Illness rates in culturally diverse population.
3. Treatment response in culturally diverse population.

Cultural competemility involves an awareness of one's knowledge limitations and sympathy for situations in which one's natural narcissism is likely to deceive and restrict one's perspective (Campinha-Bacote, 2019). The most crucial impediment to cultural competemility is the ability to stereotype people, rather than the low level of awareness regarding the specifics of any particular cultural adjustment (Campinha-Bacote, 2019). To avoid misunderstanding patients from contrasting cultural groups, it is crucial to recall the principle of intra-cultural variation when learning about the culture. Intra-cultural variations encompass the observed variation within cultural groups and the expected variation across cultural units. Every person is special and unique in diversity within each culture, the experiences of life, and the adjustment to other cultures. Incorporating cultural humility into cultural knowledge enables purposeful and significant cultural contact with the patients as exceptional individuals rather than a stereotype. As cultural humility becomes a part of cultural knowledge, the attribute of teachability becomes essential. Teachability is an educational attribute characterized by the ability to receive instruction and a desire or ability to be taught and instructed. A teachable spirit encourages HCPs to see that they can gain knowledge from their colleagues and their patients and other individuals (cultural informants), regardless of the person's status or accomplishment.

CULTURAL SKILLS

With experience and practice, the cultural knowledge you gained will develop into cultural skills that involve asking more in-depth inquiries about your patients' healthcare views and habits. As a result, cultural skills entail the capacity to (a) conduct culturally-based physical examinations, (b) effectively manage resources, recognize and respect others' cultural ideas and values, and develop and carry out culturally appropriate plans. Some valuable cultural skills include: Ability to change your communication style to fit the needs of diverse people, organizations, and cultures.

1. Applying active listening skills.
2. Developing mutually trusting partnerships.
3. Detecting the sources of dilemmas or issue as well as their influence.
4. Building procedures that facilitate cultural competence.
5. Generating valid requests of others.

Cultural skill is the ability to perform a thorough cultural examination to gather purposeful cultural data about the patients being treated (Campinha-Bacote, 2019). Cultural humility consists of managing a cultural assessment that needs more than choosing a tool and asking the patient some listed questions. The step taken by the healthcare practitioner must be culturally appropriate. HCPs must listen with attention and stay nonjudgmental about what they hear to instil cultural humility in cultural skills. To develop a non-changeable cultural humility, a guide was created by Boesen (2012). This guide is known as 'ASSESS', which stands for the following:

A: Ask questions in a delicate manner.

S: Seek self-awareness

S: Suspend judgment

E: Express kindness and gratitude

S: Support a safe and welcoming environment

S: Start where the patient is at.

Going over and coming back is another way to obtain insight and appreciate diverse cultures. 'Going over' applies to taking on the perspective of a different culture, a different way of life, or a different perspective on a problem. It is succeeded by a counter-intuitive process of 'returning' with new knowledge. Permitting the patients to share their cultural customs will enter the 'passing over' into their emotions. Then returning to one's cultural values with a fresh understanding of the patient's perspective, allowing the development of common ground and a culturally appropriate treatment plan. According to Dunne (1972), passing over is based on the understanding that no matter what one already has, it is not enough. Our concern about the efficacy of just using self-evaluated findings to assess cultural talent is similar to our concern about the usefulness of using these findings to determine cultural knowledge. Are self-evaluated results adequate for determining cultural competence? Is it possible that these measurements are too subjective? Is the confidence of responders a factor in the answers? The practical reality is the most general and objective approach for assessing skills and abilities nowadays. When objective observations are not possible due to time or space constraints, a self-rating depending on the frequency of behaviour (using cultural skills) can be utilized as an objective technique. With questions like "I include cultural assessment while completing individual or organizational evaluations" and "If I provide direct client services, I record the adjustments I make with customers." We advocate expanding the variety of measuring methodologies utilized in future research to include behaviour observations, expertise, tests, case studies, and oral reports to improve the dependability of results. You'll notice that this is a cyclical and continuous process. It is not always linear, though. We alter our strategy and ideas as we learn more about ourselves and others. As we participate in new observations and influences, our cultural lenses transform. When all the elements of this model are successfully implemented, it opens a way for the formation of cultural competence and respectful meeting of the requirements of patients from all walks of life (Campinha-Bacote, 2019).

CULTURAL COMPETENCE AND ITS LINKS

Cultural competence has several factors that directly or indirectly affect it. These links must be recognized to have a better idea about cultural competence and be aware of what enhances cultural competence and what needs to be worked on more. There's a link between cultural competence and the following:

- Cultural competence and health literacy
- Cultural competence and language.
- Cultural competence and ethnic diversity
- Cultural competence and patient safety
- Cultural competence and medication adherence.
- Cultural competence and communication skills.
- Cultural competence and leadership.

CULTURAL COMPETENCE AND HEALTH LITERACY

Limited health literacy is directly linked to cultural competence through processes of insufficient understanding as well as a restricted approach to healthcare (Lie, Carter-Pokras, Braun and Coleman, 2012). Patients who barely speak English or don't speak it are often judged and considered to have low literacy. This is not a factor determining their intelligence, but it just means that teaching them about their medical status and treatment plan can be difficult. Recent research has focused on treatments to overcome the literacy barrier between patients and healthcare practitioners by emphasizing communication approaches and clarifying who is responsible for ceasing the gap. With a growing, more diverse, and ageing population, the combinations of poor health literacy and cultural disparities are projected to worsen. If the cultural differences remain unresolved, this would lead to poor fallouts in

health due to miscommunication, conflicts regarding the value, and contracting views of health and illness. Once training providers begin to address both problems, reduction in medical errors, enhancement in adherence as well as patient engagement will be induced. This will affect both the patient and the population positively. In addition, trainees and healthcare professionals will benefit.

The Patient

A strong groundwork and health literacy are needed to develop the best patient-centred healthcare (Lie, Carter-Pokras, Braun and Coleman, 2012). Trainers in health literacy and cultural competence are instructed to create more efficient training strategies for their students to improve future practice and improve accuracy in assessing patient-centred outcomes. Patient comfort, quality of life, compliance to medications, and clinical parameters are examples of patient-centred outcomes far removed from training. Considering effective training that enhances patient-centred outcomes is an expensive undertaking that necessitates a broad, multi-institutional, cross-disciplinary, and long-term follow up of practice by trainees from training. Crossing the gap between advocates of health literacy and cultural competence training will help us move nearer to achieving a fair society by improving the abilities of every healthcare professional, with patients and their families and populations as the significant contributors that benefit.

The Population

As the populations worldwide are becoming more diverse, healthcare professionals face more significant challenges in understanding health literacy levels and cultural beliefs and customs (Lie, Carter-Pokras, Braun and Coleman, 2012). Evidence-based concepts are now viewed as the bedrock of primary care. Attention toward health literacy and cultural diversity is required when discussing the importance of these services. Nowadays, these services differ due to two reasons, one being the cost and two being the uneven perceptions of their worth. To increase the chances of patients comprehending the advantages and acting on that knowledge, healthcare professionals must explain value using health literacy and cultural perspective. The population benefits from lower healthcare costs and better population health when many people adopt preventative services.

The Trainees

Due to the fast development of the internet and the discovery of modern tools (e.g., distant learning, simulation innovations, as well as rapidly growing guidelines, the amount of knowledge and number of skills and competencies that health professions trainees must integrate, endlessly repeat, and illustrate has erupted (Lie, Carter-Pokras, Braun and Coleman, 2012). Incorporating curricula and time for brand-new matters is no longer a possibility. Trainees must be persuaded to adopt suggested practices through training tactics. Longitudinal integration has been recognized as representing the real-world clinical setting, where patients present as whole people in their families, communities, and societies. As healthcare providers identify, diagnose, and handle common illnesses, they must acknowledge and show sensitivity towards health literacy and cultural competence problems. Over 40% of poor clinical outcomes, whether too poor adherence, medical errors, or follow-up failures, are most likely to be avoided, and that's due to acknowledging limited health literacy and cultural competence. The cooperation between health literacy and cultural competence for trainees is critical, not only for saving time and work but also for having a better approach to the patient. In addition, assessment methodologies can be combined to represent possibilities for better clinical outcomes and to eliminate health disparities.

The Healthcare Professionals

Well-designed and adaptable groups positively impacting care processes and results have been viewed as part of healthcare achievements (Lie, Carter-Pokras, Braun and Coleman, 2012). These groups will be evaluated according to their performance; therefore, every healthcare professional is required to be familiar with their own culture, beliefs, attitudes, language, and procedures. This type of connection incorporates health literacy and cultural competence for cross-disciplinary interaction. Increasing the effectiveness of education can occur when different health professions come together and learn. Advocates for health disparities would seek this chance to teach health literacy and cultural competence.

CULTURAL COMPETENCE AND LANGUAGE

The language barrier is a chief obstacle seen in cross-cultural populations. It is crucial to overcome the language barrier, especially in healthcare. Otherwise, it will lead to unsatisfied patients, poor compliance, and low quality of care (García-Izquierdo and Montalt, 2022). If language is a barrier, it is tough for the healthcare professionals to communicate, ask/ answer questions, and gain the patients' trust, especially if cultural differences are present concerning the patients' sickness and well-being. The most challenging fact regarding the language barrier in healthcare and a diverse culture is that consent becomes a problem both ethically and legally due to the patient's inability to understand their condition or agree to any treatment plans. Using any of the patients' relatives or family to translate something is not advised because they have low health literacy; thus, mistakes can affect clinical outcomes. In this case, hiring an interpreter would be ideal for everyone.

CULTURAL COMPETENCE AND ETHNIC DIVERSITY

Striving for ethnically diverse healthcare in a cross-culturally population is necessary. It's been suggested that ethnic minorities have poor SDH, which correlates to their absence of healthcare availability (Nair and Adetayo, 2019). Furthermore, compared to Caucasian women, African, Hispanic, American, and Asian women are less likely to have breast repair surgery after a mastectomy. There are certain things neglected in training and leadership in the healthcare field, such as cultural, gender, and ethnic diversity. Therefore, the healthcare organization must increase cc and racial and ethnic diversity to meet the requirements of a diverse population. Steps to increase cc and ethnic diversity aid in reducing healthcare disparities and improving healthcare results (Seeleman, 2014). Efforts to teach trainees through national conferences and their organizations will assist in developing culturally proper health education and cultural competence. When it comes to people from ethnically and racially disadvantaged minorities rising to the highest standard possible, they tend to earn lower pay, and they're mainly found in managerial jobs that serve low-income people. This will negatively impact ethnic minority groups' access to patient-centred treatment (Harrison et al., 2019). Being from an ethnic minority increases your risk of poor-quality care, especially the likelihood of safety occurrences. Again, it is crucial to fill out these gaps to reduce healthcare disparities. Limited access to diversity and inadequate education are some of the issues highlighted. Sadly, cultural competency is often seen as a minor concern in healthcare.

CULTURAL COMPETENCE AND PATIENT SAFETY

Patient safety is one area where disparities in healthcare exist the most (Brach, Kendall and Fitall, 2019). For instance, patients with poor English proficiency were at a higher rate of being damaged than those with good English proficiency when side effects took place and when the injury was severe, according to research. One explanation for it is that patient safety programs tend to overlook and undervalue the essential link between culture and patient safety and quality in patients from minor cultural and linguistic backgrounds. Providing safety for the patients is a critical responsibility of every healthcare provider. Noticeable improvement has been seen regarding the acknowledgement of the versatile procedures taken that contribute to preventing the occurrence of adverse effects in healthcare and the

implementation of necessary transformations in systems, training, and cultural organizations to enhance patient safety. Despite these achievements, there is still a severe patient safety problem that needs to be identified and addressed.

Moreover, the link between language and cultural competence is related indirectly to patient safety outcomes in cross-cultural minorities. Hence, it is essential to emphasize the importance of the healthcare providers to conduct a thorough examination when taking care of cross-cultural patients and ensure that their own beliefs and values are not accidentally forced on the patients. The complications and effects of the mediating factors of culture and language in the therapeutic interaction must be explicitly and substantively mentioned in patient safety policy and curriculum texts. The solid link between culture, language, and patient safety may be neglected or diminished unless such clear and direct mention is made as long as doubtful assumptions are made about the potential of mainstream patient safety programs to improve overall patient safety and quality care despite their cultural backgrounds (Johnstone and Kanitsaki, 2006). Therefore, it is necessary that the potential negative consequences of this omission must be foreseen and their risks minimized, if not eliminated.

CULTURAL COMPETENCE AND MEDICATION ADHERENCE

Medication adherence can be defined as patients using the medications prescribed for them as instructed (Shahin, Kennedy and Stupans, 2019). Patients may be subjective when it comes to their health condition regarding medication adherence and medication use. Hence, it is critical to consider cultural beliefs when delivering medical advice and/or administering medical treatment. Medication adherence is complex. Methods of treating, health literacy, self-efficacy, cognitive skills such as remembering, tolerance, problem-solving skills, and psychosocial factors such as personal and cultural beliefs about medicine administration all have a role in adherence to treatment. Personal views include both cognitive as well as emotional perceptions. Cognitive perceptions include five main divisions:

1. Identity: addresses people's attitude towards sickness labels and symptoms and the goals for treatment.
2. Timeline: refers to how people perceive the length of time they will be sick, including the symptoms and recovery period.
3. Consequences: related to people's view of the disease's severity and its effects on their daily activities.
4. Control: related to beliefs regarding the illness's possibility to be healed, avoided or controlled.
5. Causes: corresponds to people's opinions about the causes of their illness.

On the other hand, feelings that occur due to sickness, such as worry and/or despair, are referred to as emotional perception. What can also influence medication adherence is cultural beliefs. As we have mentioned before, cultural beliefs refer to behaviours that are affected by thoughts, attitudes, and actions that society members have shared and handed on to the next generations. That may also influence patients with chronic diseases to take their medications. Other beliefs, such as spiritual and religious, can also significantly affect medication adherence in patients. However, non-compliance should not be seen as solely the patients' responsibility. On the contrary, social, healthcare, and therapy-related factors all play a crucial role in medication adherence. So, to apply suitable and appropriate adherence tactics, health care practitioners must first evaluate the influence of patients' illness views, cultural beliefs, and other beliefs on their adherence levels.

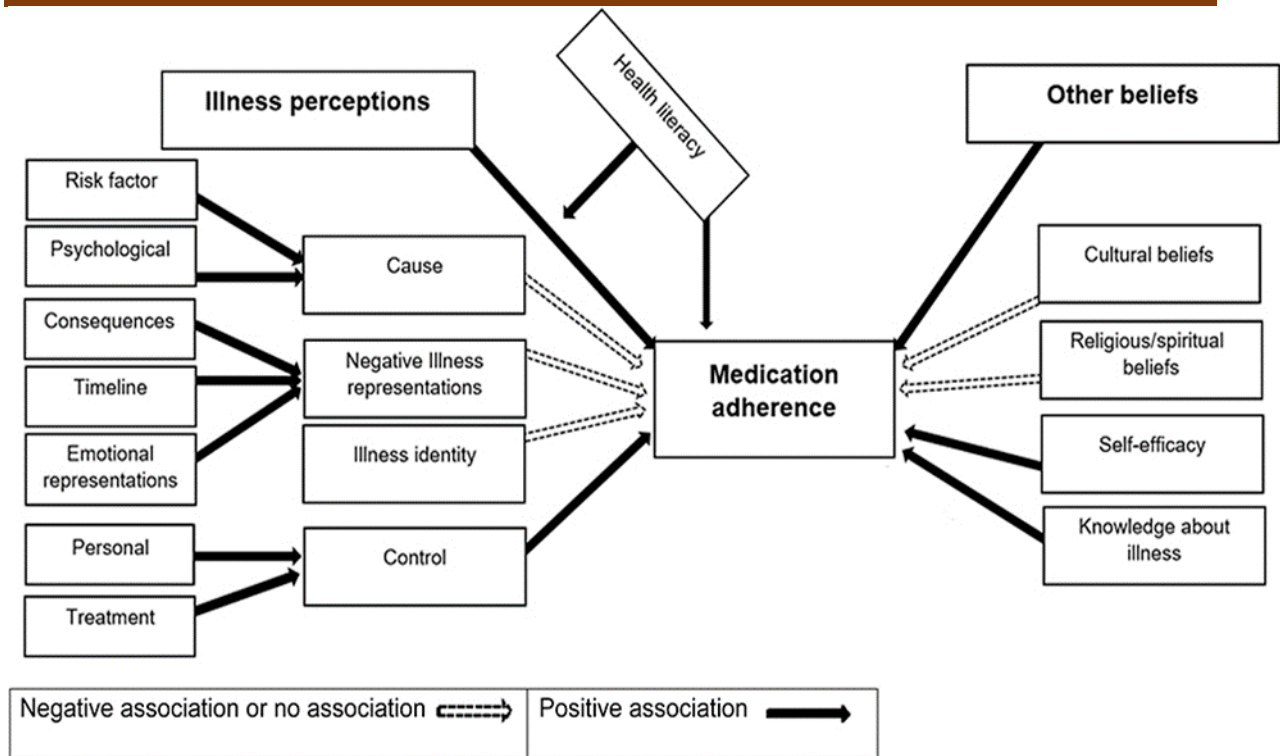


Figure 2. Conceptual model to illustrate the effect of illness perceptions and other beliefs on medication adherences (Sharon, Kennedy & Stupans, 2019)

CULTURAL COMPETENCE AND COMMUNICATION SKILLS

Developing culturally competent communication at the practitioner, care facility, healthcare plan, and national levels will help reduce racial and ethnic gaps in high-quality care (Stephanie L. Taylor, 2004). Even though some health plans have newly expressed interest in reducing racial and ethnic inequities in healthcare, only a few have highlighted how these health plans may increase their cultural competency to do so. It is widely recognized that effective patient-provider communication is critical to providing high-quality care. Patient contentment, compliance with treatment plans, and clinical outcomes are linked to good communication between patients and providers. It is believed that communication elements that identify and truly reflect variations between providers and patients (especially in terms of culture, values, and race) play a crucial role in eliminating ethnic and racial gaps in healthcare quality. Culturally competent communication refers to speaking with a level of knowledge about healthcare disparities and a recognition that cultural influences have a significant impact on health behavior patterns and the capacity to handle these aspects correctly. It is more than just a feature of the patient and provider interaction in healthcare; it's also a feature of the healthcare facility and the larger organization responsible for funding and delivering the treatment. Culturally competent communication is vital because patients have diverse cultural origins, beliefs, traditions, and languages in their provider's face, necessitating culturally competent communication to boost the quality of care. For instance, questioning healthcare providers is considered impolite in certain cultures. This leads to poor maintenance or even medical errors because they are less likely to seek further clarification regarding their condition or follow up on a treatment plan. In addition, many patients use traditional remedies. They may become hesitant to tell their healthcare provider, resulting in a potential drug interaction between the traditional therapy and the medication given. There's a higher chance of patients giving positive feedback regarding their physical and mental health results when their providers speak the same native language as them. On the other hand, patients; incapability to communicate in their mother language with their healthcare provider can result in care delays, fewer or missing appointments, noncompliance to treatment, and medical errors. As we have mentioned earlier, hiring a diverse staff can reduce so many issues and train and educate healthcare providers about cultural competence.



Figure 3. Cultural competence interventions by targeted healthcare level (Jongen, McCalman & Bainbridge, 2018)

CULTURAL COMPETENCE AND LEADERSHIP

Cultural Competence requires various skills in different fields. Healthcare leaders understand cultural competence and its importance even though it is considered a new concept that is still being taught and trained (Nikitara et al., 2022). Culturally competent leaders can be found at all levels of an organization or community. While leaders need to run their business toward good change, it is also crucial for them to know that they are learning. Cultural competence is a process, not a terminal and no person can fully understand something, anything it might be. The most effective leaders make a clear and noticeable effort to improve their cultural competency by practicing with others and learning from their failures. For a leader to become culturally competent, they need to acquire and develop ten distinct qualities:

1. Learners
2. Courageous
3. Data driven
4. Transparent
5. Inclusive
6. Sensitive
7. Connected
8. Strategic
9. Enthusiastic
10. Realistic

PURNELL MODEL FOR CULTURAL COMPETENCE

The Purnell model for cultural competence was created in 1995 by Larry Purnell and is appropriate to be used by all healthcare providers (Purnell, 2000). PMCC is built up of domains with twelve multiple parts that target different cultures. They're all considered a key role in improving quality care in healthcare systems. Considering all the domains by the hcp is essential when caring for patients of various ethnic backgrounds (Purnell 2005).

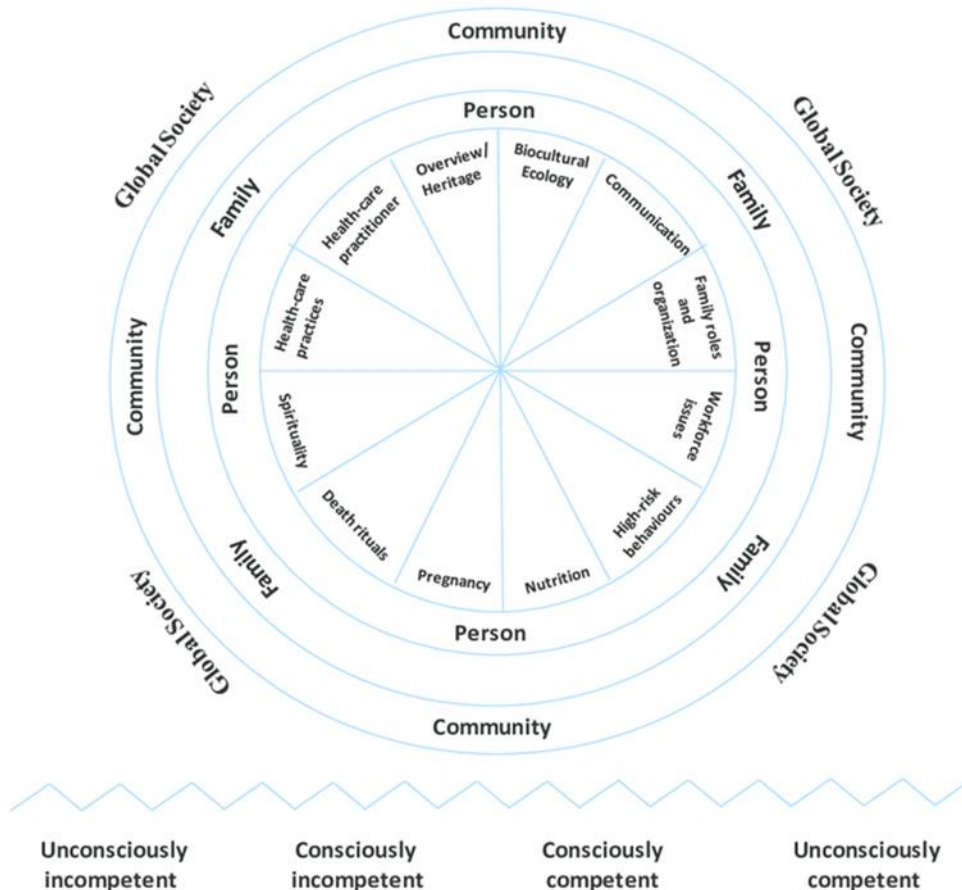


Figure 4. The Purnell Model for Cultural Competence (Roy, 2016)

The first domain consists of culture and heritage, which refer to how the country's origin geographically can influence the current homes, governmental interventions, economics, socioeconomic levels, and occupation (Purnell 2005). The second category includes important communication concepts such as primary language and dialects, language's contextual performance and accessibility, non - linguistic distinctions, and body language. The third category is family roles and organization, which is concerned with who is in charge of things in terms of age and gender. Priorities and ambitions, developmental stages, socioeconomic status, and forms of culture influence how a family is organized. Employment difficulties, such as socialization, independence, and the presence of language obstacles, are within the fourth domain. The fifth domain comprises bio-cultural ecological elements, including evident disparities in ethnic and racial origins, such as skin colour and other physical differences. High-risk behaviors, such as smoking, drinking, or taking illegal substances, are the sixth domain. Physical exercise and degrees of protection or precautions taken are also included in this realm. Nutrition is the seventh domain. Individuals or communities are used to specific kinds of food and derive significance from the food they eat, depending on their location of origin. Food consumed in conjunction with certain traditions may harm one's health.

Specific racial and ethnic groupings have nutritional limits and impairments. Pregnancy is the eighth domain where it is looked at uniquely since various beliefs accompany it. When encountering a particular racial group, the act of childbirth and the postpartum period include specific traditions that must be considered. Death rituals fall in the ninth domain. Death is viewed differently in different cultures regarding how it is handled, what rituals are conducted, and how one should act after a death. Spirituality is the tenth domain, which covers religious practice, prayer, personal strength, life's purpose, and how spirituality connects to health. The eleventh domain is concerned with healthcare practices. This area encompasses the responsibility for one's health and the obstacles that must be overcome to obtain positive health outcomes. Traditional practices, religious routines, chronic treatment and rehabilitation programs, mental-health policies, and the positions of the sick are all examples of healthcare practices. The attitudes and functions of ancient and folk healthcare practices are addressed in the twelfth and last domain, healthcare professionals. The Purnell model has several purposes:

- Create a platform for all healthcare providers to study culture's concepts and features.
- Identify situations where a personal culture is affected worldwide in terms of historical viewpoints
- Build a model that connects the most important cultural relationships.
- Connect cultural features to improve consistency and conscientiously attentive and competent health care delivery.
- Form a basis that captures human attributes like motivation, desire, and purpose.
- Establish a framework for cultural data analysis; and consider the individual, family, or community in the context of their racial surroundings.
- Eliminate stereotypes or biases if the hcp are culturally competent.

As a result, the Purnell Model can be used as a guide for analyzing, developing, executing, and evaluating interventions by diverse healthcare professionals. Improved prospects for health education, sickness and disease blockage, and health repair are achieved through a comprehensive assessment of each client and individualized therapy.

CONCLUSION

Cultural competence is one of the most under presented yet most important attributes to healthcare. It can generally refer to a set of values, behaviors, and beliefs that are put into action in order to understand and interact with people in a better way, especially those who come from different cultures and have different belief systems from one's own. Since immigration has been increasing drastically, people from different cultures settle in a place that is unfamiliar to them in terms of language, views, traditions, beliefs and so on. This leads to having cross-cultural population and increases the needs to have a clear understanding of the term "cultural competence". Cultural competence is an extremely important aspect that is under viewed, especially in healthcare. It plays a huge role in the relationship between the patient and the healthcare provider as the healthcare provider should provide an environment where the patient feels the most comfortable, respected, and listened to as well as welcomed. Hence, all the healthcare providers should be trained and educated about cultural competence since it is a huge part of their jobs and responsibilities, it also reflects on the patients. This way, the patient's quality care will be increased, and healthcare disparities would be decreased.

Cultural competence can be summed up into 5 domains where each requires a specific quality that is learned from the healthcare provider. In order for the healthcare provider to become culturally competent, she/he needs to have an open attitude where they have an open mind and are welcoming of

diversity when it comes to patients. The second thing that they need is self-awareness where they acknowledge and have adequate information about their own culture. Once that is accomplished, being culturally aware becomes easier. To recognize other cultures and respect them as well as understand their point of views is important. This will build up and develop cultural knowledge where the healthcare provider becomes more familiar with cross-cultural patients. Last attribute is developing cultural skills where the healthcare provider gets more involved by asking more detailed and in-depth questions to understand the patients' views and habits more.

Cultural competence has several factors that are linked to it and affected by it. For instance, limited health literacy is a major issue when it comes to cross-cultural patients. Patients that don't understand the instructions given from the healthcare providers are incidences that occur often. Not understanding the language is a normal thing for a patient that speaks their own mother language. It does not mean that they're not smart, but this will affect them regarding their medication adherence, understanding their medical status, and deciding their treatment plan. Another major issue that is somehow related to health literacy is language barrier. It is a very common and expected factor that contributes to decreased quality of care, patient compliance, and medical errors. This will affect the communication between the healthcare provider and the patient, and if neither of the two can understand each other how will either benefit? That's why having a diverse staff is useful and crucial, or even interpreters. Patient safety is another factor where healthcare disparities take place. Having poor cultural competence can affect the adverse effects and therefore, affect the patient's safety and well-being. Cultural competence is connected to medication adherence where the patient may be biased by their own culture when it comes to their medical status, medication use, and compliance to drugs. Therefore, hcp should acknowledge their beliefs and culture when giving their medical opinions and suggesting treatment plans. It is so important for the hcp to have good communication skills in a diverse population. Chances of having positive feedback from patients are higher when the hcp can communicate and speak the same language.

Cultural competence continuum model is built to for the hcp to help them know when they have reached being culturally competent. It consists of 6 steps. As you go to the next step you slowly but surely become more culturally competent. The model's steps consist of cultural incapacity where it's not intended to be culturally destructive but due to the lack of capacity to help the minorities. Next is cultural blindness where there is no place for discrimination and to believe that color or culture make no difference and that we are all the same. The upcoming step is cultural pre-compliance where it consists of acceptance and respect for other cultures. Last step is advanced cultural competence, here the person becomes culturally competent and holds culture in high esteem.

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ÖZET

Evlilik en basit anlamıyla iki kişinin dolayısıyla da iki ailenin birleşmesidir. Siyasi evlilikler ise devletler arasındaki politik süreci etkileyen en önemli faktörlerden biridir. Bu evliliklerle zayıf olan devlet, belli bir güce sahip olan diğer bir devlet ile akrabalık yoluyla sosyo-politik ilişkiler kurmak, olası saldırıları engellemek ve barış ortamını sürdürmeyi amaçlamaktadır.

Devletlerin siyasi ve ekonomik güçleri bu evliliklerin içeriğini belirlemektedir. Evliliği talep eden devletin gücü, gönderilen gelinin siyasi statüsü ile doğru orantılıdır. Örneğin güçlü bir devletin evlilik talebi karşılığında gönderilen gelin, hükümdarın birinci dereceden akrabaları arasından seçilirken, daha güçsüz bir devletin talebi hükümdarın diğer yakınları arasından karşılık bulmaktaydı. Gelinin kendi ülkesindeki politik gücü, geldiği ülkenin siyasetinde ne denli söz sahibi olacağını belirlemektedir. Aynı şekilde damadın statüsü de gelinin kendi ülkesindeki politik gücüyle doğru orantılı olarak dış politikadaki saygınlığını belirleyen faktörler arasındaydı.

Uygurlar dönemindeki Çin ile yapılan siyasi evlilikler incelendiğinde, bu evliliklerin devletlerin politik ve ekonomik durumlarının yansıması olduğu görülmektedir. Uygurların güçlü olduğu dönemlerde evlilik taleplerinin hızla değerlendirildiği ve gelinin imparatorun ailesinden seçildiği görülmektedir. Bu duruma en güzel örneklerden birisi Çin İmparatorunun öz kızını, Uygur Kağanı Moyen Çor'a vermesidir. Uygurların iç çekişmelerinin yoğun olduğu veya dış politikada sıkıntılı oldukları zamanlarda Çin ile yapılan siyasi evliliklerde sürecin daha yavaş ve isteksiz işlediği görülmektedir. Tun Baga Tarkan'ın evlilik talebinin değerlendirilmesindeki süreç bu duruma örnek olarak gösterilebilir.

Bu evlilikler sonucunda gönderilen prensesler için kapsamlı bir karşılama ve görkemli evlilik merasimleri yapılmaktaydı. Gelen prensesler kendi ülkelerinin adetlerine uygun şekilde karşılanmaktaydı. Daha sonra Uygur geleneklerine göre belirli ritüellerle Uygur olarak kabul edilen prenseslere, Hatun ünvanı verilmekteydi. Hatun ünvanı alan prensesler törenlerle Kağanın yanına oturtulurdu. Bu çalışmada Çin prenseslerinin, Uygur Hatunu ünvanı alışı sırasındaki törenler ayrıntılı ele alınacaktır.

Anahtar Kelimeler: Uygur, Çin, Evlilik, Tören, Dış Politika.

ABSTRACT

Marriage, in its simplest sense, is the union of two people and therefore two families. Political marriages are one of the most important factors affecting the political process between states. The weak state with these marriages aims to establish socio-political relations with another powerful state through kinship, to prevent possible attacks, and to maintain a peaceful environment.

The political and economic powers of the states determine the content of these marriages. The power of the state requesting marriage is directly proportional to the political status of the bride sent. For example, the bride, who was sent in return for the marriage request of a powerful state, was chosen among the first-degree relatives of the monarch, while the request of a weaker state was met among the other relatives of the monarch. The political power of the bride in her home country determined how much she would have a say in the politics of the country she came from. Likewise, the status of the

groom was among the factors that determined the prestige of the bride in foreign policy in direct proportion to her political power in her own country.

When the political marriages with China in the Uygurs period are examined, it is seen that these marriages reflect the state's political and economic conditions. It is seen that during the times when the Uygurs were strong, the marriage demands were quickly evaluated and the bride was chosen from the emperor's family. One of the best examples of this situation is that the Emperor of China gave his daughter to the Uygur Kagan Moyen Çor. It is seen that the process is slower and more reluctant in the political marriages made with China when the internal conflicts of the Uygurs are intense or when they are troubled with foreign policy. The process of evaluating Tun Baga Tarkan's marriage request can be given as an example of this situation.

A comprehensive welcome and magnificent marriage ceremonies were held for the princesses sent as a result of these marriages. The princesses who came were welcomed by the customs of their own countries. Afterward, the princesses who were accepted as Uygurs with certain rituals according to Uygur traditions were given the title of Hatun. Princesses who took the title of Hatun were seated next to the Kagan with ceremonies. This study will be discussed in detail the ceremonies during the Chinese princesses' taking the title of Uygur Hatun.

Keywords: Uygur, China, Marriage, Ceremony, Foreign Policy.

GİRİŞ

Hukuki açıdan kadın ve erkeğin aile kurmak için bir araya geldiği evlilik; aile, boy, bodun hatta devletlerin birleşmesini sağlayan özel bir yapıdır. Eskiçağlardan beri varlığını bildiğimiz siyasi evlilikler ise iki ülkeyi evlilik yoluyla birleştiren ve dış politikalarının bir parçası olarak karşımıza çıkmaktadır.

Törenler bu evlilikler sırasında uygulanan düzenli toplantılardır. Eski Türkler’de “ordu karargâhı” anlamına gelen *Toy* kelimesi, “ziyafet, düğün” anlamında da kullanılır. Toy, Türk beylerinin iktidarı ve hakimiyeti tek elden yürütebilmek için icat edip uyguladıkları bir faaliyet olmasının yanında hükümdarlığın da göstergesi olarak sayılırdı. Genellikle çocuk isteme, bey çocuklarının doğumu, veliaht tayini, tahta çıkış, bey çocuklarının avdan dönüşü, akınların ve seferlerin zafer ile sonuçlanması, ad verme, esirlikten kurtulma, evlenme ve bayram gibi nedenlerle toy törenleri düzenlenirdi (Koca, 2012). Türkler düğün kelimesinin karşılığı olarak toy sözcüğünü kullanırdı. Kitabelerde düğün ve tören anlamında *törün* kelimesinin kullanıldığı görülmektedir (Berber, 2009). Bilge Kağan Abidesi kuzey yönü 9-10. satırlarında bu kelime; “...*Türgiş Kağanka kızımın ertingü ulug törün alı birtim. Türgiş Kagan kızın ertingü ulug törün oğluma alı birtim...*” (Türgiş Kağanına kızımı ... fevkalade büyük törenle alı verdim. Türgiş Kağanının kızını fevkalade büyük törenle oğluma alı verdim...) cümlesi ile geçmektedir (Ergin, 2011).

Türklerde devlet törenleri toplumun bütünüyle ilgiliydi. Toylar; devlet ve aile toyları olarak ikiye ayrılırdı. Dede Korkut’ta büyük Han’ın yaptığı toya “Ulu Toy”, beylerin yaptığına ise “Küçük Toy” denirdi. Ulu toylarda *orun ülüşe*³ yani oturma ve yemek yeme düzenine çok dikkat edilirdi (Ögel, 1988).

Uygurlar ve Çin arasında gerçekleşen siyasi evliliklerden biri Moyen Çor Kağan döneminde, Kağanın Çin’den gelen elçi ile kızını evlendirmesidir. Çin, kuzey sınırında yer alan Uygurlar ile askeri yönden baş edemeyeceğini anlayınca evlilik yolu ile akrabalık bağı kurmuş, Uygurlar ile aralarını iyi tutmuştur (Uygur, 2015). Uygur Devleti ile T’ang Hanedanlığı arasındaki bu evlilikler; “*Kudiliş Siyaseti (evlilik siyaseti)*”⁴ adı altında uygulanan önemli bir diplomasi türü olmuştur. Bu diplomasi, ticari ve kültürel

³ Türk boy teşkilatında en önemli düzenlemelerden biri de orun ülüş meselesidir. Büyük törenlerde ya da herhangi bir toyda, boyların oturma ve yeme düzenleri kesin şekilde belirlenmiştir. Geniş bilgi için bkz., Abdülkadir İnan, “*Orun ve Ülüş Meselesi*”, **Makaleler ve İncelemeler I**, Ankara 2020, s.241-254.

⁴ Kudiliş Siyaseti (evlilik siyaseti) çatısı altında yapılan evlilikler Tang Hanedanı ve başka kavimler arasında yapılan barış anlamına gelmektedir. Siyasi bir amaca hizmet eden bu evlilikler Çince Hı Çing Cing Sı diye isimlendirilmiştir. Bkz., Abdullah Cinkara, **İpek Yolu ve Uygurlar İsimli Uygurca Eserin Transkripsiyon, Aktarma ve Değerlendirmesi**, Ankara 2019, s.352 vd. (Yayımlanmamış Yüksek Lisans Tezi)

ilişkileri geliştirmenin yanında siyasi bir amaca da hizmet etmiştir. Evlilik, bir bakıma devletler ve hanlıklar arasında barış anlamına gelmiş her iki ülkenin ortak çıkarlarına hizmet etmiştir (Kutluk, 2020).

Çin ülkesinden, Uygur ülkesine elçilik heyeti gönderilmiş, Moyen Çor Kağan bu heyeti memnuniyetle karşılamıştır. Hatta öz kızını elçi olarak gelen, Tun-huang Askeri valisi Li Ch'en-ts'ai ile evlendirmiştir. Bu sayede Çin Devleti'nin ülkeye getireceği siyasi ve ekonomik yararları gözetken Kağan, bazı boy beylerini, Çin başkentine göndererek böylelikle siyasi evlilikleri de başlatmıştır. Moyen Çor Kağan, 4000 eğitilmiş savaş atını kızına çeyiz olarak vermiştir. Çin'deki isyanın bastırılmasında kullanılacak olan bu atlar imparatoru oldukça memnun etmiştir. Ülkeye gelen Uygur elçileri imparator tarafından çok iyi ağırlanmış, elçiye gelin edilen Kağanın kızına “*Bilge Prenses*” unvanı verilerek karşılıklı hoşluklar yapılmıştır. Bir ay geçmeden Moyen Çor Kağan, Çin'i ziyarete gelmiş ikili ilişkileri kuvvetlendirmiştir (Baykuzu, 2013). Siyasi evlilik politikasını devam ettiren Kağan, iki ülke arasında sınır ticaretini düzenleyerek, siyasi, iktisadi ve kültürel ilişkileri geliştirmiştir (Kutluk, 2020).

Moyen Çor Kağan'ın ilk dönemlerinde Çin, 751'de Talas Meydan Savaşı'nın⁵ kaybedilmesi sonucunda iç karışıklıklar ile uğraşmaktaydı. 755 senesine gelindiğinde ise An Lu-shan⁶ isyanı T'ang Hanedanı'nı derinden sarsmış, hanedanın itibar kaybına sebep olmuştu (Çandarlıoğlu, 2019). Çin hem ülkesinde devam eden iç karışıklıklar hem de An Lu-shan isyanını sebebiyle güçsüz durumdaydı. Bu sebeple T'ang Hanedanı, Uygurların yardımına muhtaç olmuştur (Tokuda, 2010).

757'de Çin İmparatoru General Pu-ku Huai-en'i Uygurlara elçi olarak göndermiş ve kendilerine yardım etmeleri için evlilik anlaşması yapmayı teklif etmiştir (Baykuzu, 2014). Çin'in siyasi evlilik talebi karşılığında Moyen Çor Kağan Çin'deki isyanın bastırılması için askeri yardım göndermiştir (Gömeç, 2015; Baykuzu, 2013). Kudilişis siyaseti, iki ülke arasındaki bağları güçlendirdiği gibi Uygur Kağanının, Çin üzerinde siyasi üstünlük kurmasını sağlamıştır. Aynı zamanda Çin de Uygur Devleti'ne gelin olarak gönderdiği Çin'li prensesler ile meşhur *Çin entrikalarını* kolaylıkla uygulamıştır. Çin İmparatoru çıkarttığı fermanında gerçekleştirilecek olan evliliğin detayları hakkında bilgi vermiştir. Fermana;

“Öğrendiğime göre, eskiden aziz İmparatorun idare ettiği bütün ülkede, değerli hizmet yapan kişilere mutlaka mükâfatları verilir. İtimat verilen sözün baştan sona kadar tutulması ile olur. Fazilet bütün dünya için faydalıdır. İyi ahlaklı olmayanlar değiştirilir. Chou sülalesi zamanında barbarlara çok iyi davranılıyordu barbarlar çok memnun oluyor ve yavaş yavaş Çin ile olan münasebetleri düzeliyordu. Han sülalesi zamanında evlilik vasıtası ile akrabalıklar kuruldu. İki devlet arasındaki münasebetleri iyileştirmek için ben de eski İmparatorun bulduğu çareye başvuracağım.

İsyanlar çıktığı zaman ülkemiz sarsılmıştı, Uygurlar Çin İmparatoruna samimiyet göstererek asker gönderdiler. İsyanları bastırdılar. Daha önceleri Çin İmparatorluğu ile Uygur Kağanlığı arasında akrabalık bağı vardı. Onların sayesinde Çin hudutları emniyete alındı. Şimdi de iki başkentimizi isyancıların elinden kurtardılar.

Uygur Kağanı Çin'e yaptığı yardımlara karşılık bir Çinli prenses ile evlenmek istiyor. Kızım başka bir ülkeye gideceği için üzgünüm. Fakat ülkemiz ve halkımız için kızımın oraya gitmesi lazım. Ona merhamet etmediğimi zannediyorlar. Çin milleti için ülkemizin dışında saray kurulmasını ve en sevdiğim kızımın oraya tayin edilmesini istiyorum. Kızım on binlerce mil uzakta evlensin uluslararası sulh olsun.

Uygurlar ile aramızda samimiyet ve itimat kurulduktan sonra, ailemiz ve ülkemiz içinde tam bir sulh ve asayiş olacak. En küçük kızım prenses Ning-kuo unvanıyla Uygur Kağanı'yla evlensin. Evlilik merasimi

⁵ Talas Savaşı Çin ordusu ve Arap Ordusu arasında cereyan eden savaştır. Geniş bilgi için bkz. Ahmet Taşağıl, “*Talas Savaşı*”, **TDV İslam Ansiklopedisi XXXIX**, İstanbul 2010, s.501.; Hakkı Dursun Yıldız, **İslamiyet ve Türkler**, İstanbul 2015, s.69 vd; Bahattin Keleş, “*Talas Savaşı'nın Türklerin İslamiyet'i Kabul Etmelerinde Yeri ve Önemi*”, **Türk Dünyası Araştırmaları Dergisi S.225**, İstanbul 2016, s.83-96, http://isamveri.org/pdfdrg/D00130/2016_225/2016_225_KELESB.pdf, 16.12.2021, 14:02.

⁶ An Lu-shan, 703 senesinde Çin'in kuzeydoğusunda, Kore yakınlarında bükünkü Liao-ning eyaletinin Ch'ao-yang şehrinde dünyaya gelmiştir. Babası K'ang soyadlı Semerkand'lı bir Soğd, annesi Göktürk'lerin A-shih-te soyundan bir kamdır. Geniş bilgi için bakınız; Tilla Deniz Baykuzu, **An Lu-Shan İsyanı ve Büyük Yen Devleti**, Konya 2013, s.57 vd.

bakanlığı, O'nun, Uygur ülkesine gitmesi için yol hazırlığı yapsın. Hon-chung valisi Yü elçi olarak gitsin. Kağan'a Ying-wu Wei-yüan Pi-chia Kağan unvanını verdim. Yeğenim Hu-lu Shao-ch'ing unvanıyla prenses Ning-kuo'nun evlilik işleri idarecisi olsun.” sözleri yer almaktadır (Çandarlıoğlu, 1974).

Uygurların Çin hükümetini zor durumdan kurtarması her türlü hediye ve övgüye değer olduğundan imparator kızını Uygur ülkesine yollamakta çekinmemiş böylece ikili ilişkilerini kuvvetlendirmişti. Çin İmparatorunun sınıra kadar uğurladığı Çin prensesine, yüksek rütbeli aristokratlar ve vezirlerden oluşan bir heyet eşlik etmiştir. Ning-kuo Prenses çeyizinde, ipekli kumaşlar, altın-gümüştan kaplar ve beraberinde hediyeler getirmiştir. Prenses ve beraberindeki elçilik heyeti Orhun'a ulaştığında, Moyen Çor onları tahtında oturarak karşılamıştır. Çin heyetinin hoşuna gitmese de Uygur Devleti'nin Çin'den üstün durumda olduğunu gösteren bir siyasi davranıştır. Uygurların, Çin heyetine; “-Çin İmparatorunun yakını olduğunuz için Kağanımızın huzuruna çıkıyorsunuz, yoksa Kağanımızın yüzünü göremeyecektiniz.” demişlerdir.

Uygur Kağanı Moyen Çor görkemli bir düğün ile Çin imparatorunun kızı Ning-kuo Prenses (Mackerras, 2021) ile evlenmiş, prenses unvanı Hatunluğa yükselmiştir. Uygurlarda Katun (Hatun) ünvanı özel bir tören ile verilmekte ve bu ünvanı taşıyan kadın saraydaki tüm kadınlardan üstün durumdadır (Donuk, 1988). Hatun ünvanı alan Prenses Ning-kuo, Moyun Çor Kağan'ın ölümü ile birlikte Çin'e geri gönderilmiştir (Çandarlıoğlu, 1974; Gömeç, 2015).

Uygur-Çin siyasi evliliklerinden bir diğeri Tun Baga Tarkan döneminde gerçekleştirilen, Prenses Hsien-An'ın evliliğidir. Böğü Kağanı öldürdükten sonra tahta çıkan, Tun Baga Tarkan (Ho ku-tu-lu Kağan) birkaç kez Çin imparatorluğu ile iyi ilişkileri devam ettirmek amacıyla evlilik talebinde bulunmuştur. Ancak reddedilen bu istek Çinli bakan Li-Pi'nin gayretleri sonucunda imparatora kabul ettirilmiştir (Çandarlıoğlu, 1974).

Tun Baga Tarkan (Ho Ku-tu-lu Kağan) kardeşi tengriken Kutlug Bilge, bakan eşleri ve devlet bakanı Chia-tieh Tu-tun'un başını çektiği bin kişiden oluşan heyeti Çin'li prensesi karşılamak üzere Çin ülkesine göndermiştir. Çin'de üst düzey bir devlet töreni ile karşılanmıştır (Çandarlıoğlu, 1974). Çin ülkesine gelen Uygur heyetinin Çin İmparatoru tarafından nasıl karşılandığı kaynaklarda detaylıca anlatılmıştır.

“İmparator Uygur prensesinin şerefine bayram yapılmasını istedi. Tören sırasında Uygur prensesini Yin-t'ai kapısından geçirdiler. Üç yaşlı prenses onu bekledi. O, onlarla tercüman vasıtası ile konuştu. Diğerleri eğilerek selamlayınca O da reveransla cevap verdi. Onlar, Onunla içeri girdiler. İmparator sarayın iç salonlarından birinde idi. Yaşlı prensesler önce girdiler ve İmparatoru beklediler. Uygur Prensesi gelip reveransla Ona hürmetlerini bildirdi. Sonra harem misafirlerinin teşrifatçısı Ona yaşlı prenseslerin yanında yer gösterdi. Tekrar tercüman vasıtasıyla suallere geçildi. Sonra hep beraber ziyafet salonuna gittiler. Hsien-fei merdivenleri indi onları bekledi. Uygur Prensesi eğilerek onu selamladı. Hsien -fei onu eğilerek cevaplandırdı. Tekrar O selam verdi ve O kabul etti. Onlar batı merdivenlerine çıkıp oturdular. İmparator Uygur Prensesine hediyeler verdiği zaman O, yerinden inip reveransla hediyeleri kabul etti. Cariyeler ve prensesler reveransla karşılık verdiler.”

Çin sarayında Uygur Prensesleri dönmeden, böyle iki kez daha ziyafet verilmiştir. Çin İmparatoru memurlarının rütbe sırasını tekrar düzenleyerek T'eng Beyi Chang-jan'ı evlilik merasiminin yöneticisi yaptı. Prensese Uygur ülkesine gidişlerinde refakat etsin diye devlet işleri bakanlığının sağ başkan vekili olan Kuan Po'yu ve yanında Kağan'a “K'u-tu-lu Ch'ang-shou T'en-ch'in P'i-Chia Kağan ve prensese Chih-hui Tuan-cheng Ch'ang-shou Hsiou Shun Hatun” ünvanlarını veren ferman vererek uğurlamıştır (Çandarlıoğlu, 1974).

Uygur-Çin siyasi evliliklerinden biri de prenses T'ai-ho'nun evliliğidir. Bu prensesin evliliği ve yapılan törenler Türk kültür tarihi açısından bir hazine niteliğindedir. Evlilik öncesi ve sonrasında yapılan törenler ile ilgili ayrıntılı bilgiler o dönem elçi raporlarına yansımıştır.

Tengride Kut Bulmuş Alp Bilge Kağan döneminde, Uygur elçilik heyeti Çin devletine kız istemeye gitmiş lakin bu istek olumlu yanıtlanmamıştır. Bu sebeple Kağan, 3 bin atlı ile beraber Piti Bulak'a gelmiş, Çin yönetimi de Tiande şehrine konumlanarak Uygurlara karşı önlem almışlardır. Çin hükümetinin protokol dairesi imparatorluk sekreteri Li Jiang imparatora sunduğu önergede;

“Uygurlar güçlenip kuvvetlendiler, kuzey sınırları boşaltıldı, bir bela meydana gelirse, zayıf askerlerimiz onlara karşı koyamaz, birbirinden kopmuş haldeyken şehirler korunamaz. Eğer efendimiz bunu göz önünde bulundurursa, silahı ve orduyu arttırsın, şehirleri ve kaleleri tamir ettirsin. Bu, Çin'in uzun vadeli planıdır, halkın da yararına olur. Sınırlardaki bela beştir, bunları sıralamama izin verin. Elbette istekleri rüzgâr yükselince, atlar semirince derhal taarruz edilecek. Bu yüzden dışarıda tazyik olacak, içeride önlem alınacak. Bunlar mutlaka Çin sarayına müşküller doğuracaktır. Bu ilk endişemizdir. Ordunun gücü henüz yerine gelmedi. Keşif ve gözetleme kabiliyetimiz yeterli değil. Mızraklarımız ve zırhlarımız hazır değil. Surlarımız ve göletlerimiz sağlam değil. Bu ikinci endişemizdir. Stratejik yerleri elde tutup korumak, hayati yerleri saldırıdan uzak tutmak için sınır generalleri ile plan yapalım. Bugün sadece Sarı Irmak'ın sınırının dışını gözetliyoruz, sarayın üstünde hüküm veriyoruz, düşman aniden sınıra saldırınca, elimizdeki kaybetmemiz söz konusu olur. Bu üçüncü endişemiz. Uygurlarla iyi ilişkiler kurduğumuzdan beri, dağların ve ırmakların şekillerini öğrendiler. Ordunun sınır muhafızları dolu ya da boş olsun, düşmanların hepsi ayrıntılara vakıflar. Bu dördüncü endişemizdir. Kuzey Dilleri (Uygurlar) ve Batı Rongları (Tibetliler) birbirleriyle savaşırlar, bu yüzden sınırlarda onlara karşı hazırlığımız yok. Bugün Uygurlar bize at satmıyorlar, eğer Tibetlilerle anlaşp düşmanlıklarına son verirlerse generallerimiz ve emri altındakiler surları kapatıp savaştan kaçınırlar, sınır halkı felakete bürünür. Bu beşinci endişemiz. Kulunuz bu evliliğin onaylanması kanaatindedir, yabancıların ülkesinde protokol kuralları korunsun, bunun üç faydası olacak. Evlilik yoluyla barış anlaşması olursa gözetleme ve ateş kuleleri teyakkuz halinde olmayacak, şehir duvarları ve kaleler düzene girebilecek, ordular güçlerini büyüterek gelişecek, güce kavuşmuş orduyla tarlalardaki tahıllar toplanabilecek, bu birincisi. Kuzeyi gözetlemenin endişesi olmazsa, güneyde Huixi'yle ilgilenebiliriz, bu ikincisi. Kuzeydeki düşmanlar (Uygurlar) bize akrabalıkla bağlanırsa, batıdaki yabancıların (Tibetlilerin) düşmanlığı daha da derinleşecek, ülkelerinde huzur kalmayacaktır. Ülkemiz oturup sükûnete erişecektir, yağma ve talan uzun vakit duracaktır, bu üçüncüsü.” diyerek endişelerini ve önerilerini yazıya dökmüş imparatora bildirmiştir. Ancak imparator, Li Jiang'ın bu önerisini göz ardı edip onaylamamıştır (Yıldırım, 2021).

Çin ülkesine gönderilen elçilik heyetleri bu Kağan döneminde de devam etmiştir. Pek çok kez Çin ülkesine giden Uygur elçileri Kağanın evlilik isteğini tekrarlamıştır. 820 senesinde Çin İmparatoru evlilik teklifini kabul etmiş ancak Uygur Kağanı Tengride Kut Bulmuş Alp Bilge Kağan, bu evlilik gerçekleşmeden vefat etmiştir (Gömeç, 2015).

Uygur Kağanı, Kün Tengride Ülüg Bulmuş Alp Küçlüg Bilge, Çin ile akrabalık bağı kurma politikasını devam ettirmiştir. Bu sebeple Çin imparatoru Mu-tsung, küçük kız kardeşi T'ai-ho Konçuy'u Uygur Kağanı'na gelin olarak göndermiştir. Kağan, Uygur başbakanının (İl Ögesinin) başkanlığında, 500 kişiyi aşkın heyeti gelin almak için Çin'e göndermiştir. Bir başka belgede Uygur heyetinde T'ai-ho Konçuy'u karşılamak için, İnanç Külüg, Tudun Sekel ile Yabgu, prenses gibi devlet adamlarının yanı sıra 2 bin kişi ile 20 bin at ve binden fazla deveyi Çin'e gönderdiği, o zamana dek bu kadar büyük bir elçilik heyetinin gelmediği anlatılmaktadır. Hatta Çin İmparatoru'nun şehre sadece 500 kişinin girmesine izin verdiği, diğerlerinin başkent dışında T'ai-yüan şehrinde kalmalarını emrettiği söylenmektedir. İmparator, T'ai-ho Konçuy (eski imparator Hsien-tsung'un kızı) için yeni bir Fu teşkilatı kurdu muştur (Wen-Shen, 1967).

821 senesinin temmuz ayında T'ai-ho Konçuy, Uygurlara gitmek üzere beraberindeki heyet ile Çin ülkesinden ayrılmıştır. İmparator Mu-tsung, konçuyu T'ung-hua-men kapısına kadar uğurlamıştır. Yapılan büyük uğurlama töreninin sarayın ileri gelen memurları, aristokratlar ve kadın-erkek tüm halk tarafından ilgi ile izlendiği kayıtlara geçmiştir (Wen-Shen, 1967).

Çin elçileri 822 senesi ekim ayında T'ai-ho Konçuy'u, Uygurlara teslim ederek Çin topraklarına geri döndüler. Elçilerin notlarında;

“T'ai-ho Konçuy, Uygurların memleketine gittiği ilk günlerde birkaç gece iyi uyuyabildi. Kağan, yüzlerce süvariye bize göndererek Konçuy'un daha önce onlarla başka bir yoldan gitmesini rica etti. Fakat Hu Cheng bu isteği kabul etmedi. Barbarların elçileri şöyle dedi:

-Eskiden Hsien-an Konçuy bize geldiği zaman, Hua-men'e yüzlerce mil mesafe kala bizzat bizimle beraber gitmişti. Şimdi, bizi niçin kabul etmiyorsunuz?

(Hu) Cheng de şöyle cevap verdi:

-İmparatorumuz, (T'ai-ho) Konçuy'u Kağanınıza götürmemizi emretti. Kağanınızın henüz daha kendisini görmedik. Konçuy daha önce sizinle nasıl gidebilir?

Barbarların elçisi bir daha ısrar etmedi ve isteğinden vazgeçti.

Ondan sonra biz Uygurların başkentine geldik. İyi seçilmiş bir günde, Konçuy'a Uygurların Hatunu unvanı verildi. Merasimde Kağan evvela kulenin yukarısına çıktı ve kendi yüzünü doğuya doğru çevirerek oturdu. Bu kulenin aşağısında Konçuy'u oturtmak için keçe ile süslenmiş hususi bir oda (çadır) kurulmuştu. Barbarların şefleri Konçuy'a barbar adetlerini öğrettiler. Bundan sonra Konçuy, kendi T'ang yani Çin elbiselerini çıkardı ve Hatun'un resmi elbiselerini giydi. Bu elbisenin üstüne yukarıdan aşağıya doğru uzanan kıpkırmızı bir kaftan ve bunun üzerinde de kızıl renkli bir ceket vardı. Altından yapılmış bir taç, saçın önüne kadar yüzünü kapadı. Konçuy bunları giyinerek binanın dışına çıktı ve evvelki merasimde olduğu gibi Kağanın önüne kapanarak selam verdi. Barbarlar evvelce, önde küçük bir oturma yeri bulunan büyük bir tahtirevan hazırladılar ve onu ipekle süslediler. Bu sırada bir baş vezir, Konçuy'u tahtirevana davet etti. Ondan sonra, Dokuz Kabile Uygurlarının baş vezirleri beraberce bu tahtirevanı taşıdılar. Güneşin dönüş yönüne uyararak avlunun sağ tarafından başlayıp dokuz defa döndüler. Ondan sonra Konçuy tahtirevandandan indi ve kuleye çıktı. Kağan ile yüzünü doğuya doğru çevirip oturdu. Az sonra bütün memurlar ve saray mensupları gelip onları ziyaret ettiler ve Hatun'a selam verdiler.

Hatun'un kendine mahsus hususi bir otağı vardı. Kağan, iki vezirin onun hizmetinde olarak otağa girip çıkmalarını emretti. Hu Cheng'in Çin'e dönmesinden önce, Hatun kendi otağında bizi yemeğe davet etti. Bütün gün bizden ayrılmadı ve gözyaşı döktü. Kağan da bunun için bize çok hediye verdi.” (Wen-Shen, 1967).

Evlilik töreni sırasında gerçekleştirilen uygulamalar Türk kültürü açısından değerlendirildiğinde bazı imgeler dikkat çekicidir. Bunlardan birisi Hatun kıyafetlerini de oluşturan kırmızı renktir. Tören rengi olarak karşımıza çıkan kırmızı renk, güneşin ve tüm savaş tanrılarının rengidir. Kırmızı, eril hareket ilkesini, ateşi, hükümdarlığı, aşkı, hazzı, gelin ve evlilikle alakalı birden fazla özelliği temsil eder. Aynı zamanda Türklerde yön belirten kızıl renk güneyi işaret etmekte ve Türk mitlerinde hem gök hem de yer unsuru ile ilişkili olarak gösterilmektedir (Çoruhlu, 2013).

Törenlerde al/kızıl/kırmızı rengin kullanılması; T'ai-ho Konçuy'un giydiği kaftanda olduğu gibi, Türk toplumunda kızıl renk hem yön tarif etmede hem de inançlar ile ilgili konularda pek çok anlam ifade etmektedir. İnançlar ile ilgili “*Al ruhu*”⁷ ya da “*al ateş*” ismi verilen bir koruyucu ruhun olduğu bilinmektedir. Al bayrak kullanımı, evliliklerde gelinin giydiği al renkli gelinlik, doğum yapan kadınlarda al renkli aksesuar ve giysilerin kullanımı, törenlerde kullanılan al renk bu koruyucu ruhtan faydalanma ile ilgilidir. Aynı zamanda al ile ilgili olarak “*alaslama*” merasimleri Türkler arasında sıkça uygulanan merasimler arasındadır. Ateş kültü ile alakalı olarak yapılan uygulama ateşle temizlenme ve arınma merasimi olarak uygulanır. Al renkli giysiler giyen gelin yine temizlenme arınma ateşin ifade edildiği al renk ile güçlenerek yeni bir hayata geçişi temsil eder. Ayrıca “*Al Kaftan*” ve “*Al Damga*” hükümdarlık sembolü olarak görülmektedir. Ergenlik kaftanı olarak da ifade edilen bu giysi Türklerde güveylik elbisesi olarak ve gelinliğin sembolü olan *Al duvak* şeklinde kullanılmıştır (Genç, 1997).

Törenlerde dikkat çeken bir diğer imge selamlama ritüelidir. Konçuy'un Kağan'ı selamlaması, Türklerin güneşe ve güneşin doğduğu, doğuya saygı göstermesi ile ilişkilidir. Hun İmparatorluğu'ndan, Göktürklerle intikal ettiğini düşündüğümüz tahta çıkma töreni Çin kaynaklarında dikkat çekici biçimde

⁷ Türk mitolojisinde kötü ruhu temsil eden “*Al ruhu*” ile ilgili geniş bilgi için bkz., Abdülkadir İnan, “*Al Ruhu Hakkında*”, **Makaleler ve İncelemeler I**, Ankara 2020, s. 259-267.

tasvir edilmiştir. Göktürklerde taht değişikliği sırasında yeni Kağanı en yüksek rütbeli kişiler tarafından bir keçe üzerinde güneş yönünde dokuz kez döndürülürdü. Her dönüşte bütün tebaa onun önünde eğilir, döndürmeler ve eğlenmeler sona erince hükümdarlarını ata bindirerek dolaştırırlardı (Koçak, 2011).

Güneşin doğduğu yöne saygı ve selamlama Türkler arasında en eski zamanlardan beri vardı. Hunlar doğuya ve batıya devletçe saygı gösterirlerdi. Doğu *güneşin*, batı ise *ay*'ın sembolü olarak kabul edilmekteydi. Türklerde güneş aydan daha önemliyken, Uygurların farklı dinlerle tanışmaları, dini ve kültürel hayatlarında ayın önemini artırmıştır. Türk tarihinde güneş doğarken diz çökerek güneşi selamlama ve güneşten yardım dileme gibi güneşe saygı hareketleri sıklıkla karşımıza çıkmaktadır. Türklerin yön tayin ederken yüzlerini doğuya döndükleri, ölülerinin başlarını ve evlerinin kapılarını doğuya doğru çevirdikleri bilinmektedir. Güney ise, Türkler için doğudan sonra gelen ikinci ve önemli bir yöndü. Güneş gökte yarım bir daire çizdikten sonra batmaktadır. Türklere göre güney, güneşin gökte çizdiği bu çemberin tam ortasıdır. Bu sebeple Türkler güneye gün ortası adını vermişlerdir. Güneşe yüzlerini dönen Türklerin güney sağ yanlarına geliyordu bu sebeple Türkler güneye beri yani sağ derlerdi (Ögel, 1988). Hatunun Kağana yüzünü dönmesi ve dönüş yönünün sağ taraftan olması Türklerin güney yönüne duydukları saygıdan dolayı olabileceğini düşündürmektedir.

Hükümdarı temsil eden güneş, kozmik bilgide bilgeliğin, bütünlüğün ve gizemin simgesidir. Güneş, Uygur Kağanlarının da simgesi idi. Orhun Yenisey Yazıtları'nda "*Tengriden kut almış*" ifadesi zamanla Uygur Kağanlığı döneminde özellikle Uygurların beşinci kanundan sonra güneşten ve aydan kut almış olarak tanımlanmaktadır. Bu durum güneşin hükümdarlık simgesi olması ile birlikte kut verici olduğunu da kanıtlar durumdadır. Ayrıca Uygurların kabul ettikleri Mani dini etkisiyle güneşten sonra ay kültürünün ön plana çıkmasını sağladığı anlaşılar. Göktürk ve Uygur Kağanlarının giysilerinin, evlerinin kırmızı veya altın kızılı rengi olması, güneş ve ateş kültürüyle ve bu renklerin kötü ruhları kovması inancıyla alakalıdır. Şamanlar tören yaparlarken ağacın başına beyaz gök renkli parçalarla birlikte güneşin temsili olarak kırmızımsı veya sarı renkli parçalar da takarlardı. Yine güneş resimlerinin şaman davullarında geniş yer alması da zamanla güneş mitlerinin şaman folklorunda ve simgelerinde önemli bir yer işgal ettiğini gösterir (Bayat, 2015). Prensesin hükümdarın etrafında dönmesi ve selamlaması, hükümdarı güneşin, yağız yerdeki temsilcisi olarak görülmesinden ileri gelmektedir.

Toy sırasında dikkat çekici olan bir başka unsur ise dokuz sayısıdır. Prensesin tören sırasında bir tahtırevana bindirilmesi ve dokuz defa döndürüldükten sonra Kağanın yanına Katun ünvanı alarak oturtulması eski Türklerdeki, Kağan ve katun anlayışını göstermesi bakımından önemlidir. Nitekim Göktürkler'in Kağanlarını bir keçe üzerine oturtarak dokuz kez döndürdüğü böylece Kağan ünvanı verildiği bilinmektedir (Keklik, 2019).

Dokuz sayısı ile ilgili , Altay mitolojisine göre gökleri delip çıkan büyük bir çam ağacı vardı. Bu ağacın tepesinde Tanrı Bay-Ülgen oturuyordu. Şaman davullarında da resmedilen bu gök ağaçlarının kökleri dünyada değil; daha ziyade göğün başladığı yerden itibaren başlıyordu. Altay Yaradılış Destanında bu ağaçların dokuz tane dallarının olduğu ve ağacın bir yanında ay ve diğer yanında güneş bulunduğu inanılmaktadır (Ögel, 2010).

Yakut Türkleri arasında bilinen Er-Sogotoh Destanında, gök ve yerin yapılışı hakkında kıymetli bilgiler vardır. Destana göre, "*Göklerin en üst katı Dokuz Felek çırgısıdır ki bunlar durmadan dönerler. Onun altında 7 kat gök vardır. Cennet ise 7 kat göğün en üstünde ve ortasında bulunurdu. Burada ne ay ve ne de güneş batardı. Dünyanın sarı göbeğinden çıkan ağaç, buralara kadar uzanırdı* ((Ögel, 2010).) Ayrıca dokuz sayısının kutsallığıyla ilgili Altay Türeyiş efsanesinde; Adem'in meyve alıp yediği ağacın dokuz dallı olduğu ifade edilmektedir. Kutsal ağaçların dalları için budak kelimesi kullanılmış, İslamiyetten sonra bile Tuba ve Sidre gibi kutsal ağaçların budaklarının varlığı bilinmektedir (Ögel, 2010). Eski Türklerin dünya görüşü ile ilgili olan bu bilgiler Kağanın ya da Hatunun tahta çıkışları esnasında dokuz kez döndürülmesinin bir sebebi olarak gösterilebilir.

SONUÇ

Uygur ve Çin arasında gerçekleştirilen evlilikler genellikle dış siyasetin bir sonucu olarak tezahür etmiştir. Ülkelerin çeşitli sebeplerle akrabalık tesis ettiği bu evlilikler kadar yapılan törenler de diplomatik açıdan bir güç gösterisine dönüşmüştür. Evlilik talebi için elçi olarak görevlendirilen

kişilerin nicelik ve niteliği, seçilen hediyelerin miktarı ve değeri, Çin Prensesinin statüsüne bağlı olarak yapılan törenler de değişkenlik göstermiştir.

Tören sırasında gerçekleştirilen uygulamalar kadim Türk kültürünün bir yansıması olarak karşımıza çıkmıştır. Çinli bir prenses olarak geldiği Uygur ülkesinde, Çin kıyafetlerini değiştirerek Uygur Hatun kıyafetlerini giyen gelin, artık Uygur Hatunu olarak kabul görmektedir. Uygur Hatunu olan prenses, tahtırevan üzerinde Kağan'ın etrafında dokuz kez döndürülerek eşini, hükümdarını ve mitolojik bağlamda da güneşi selamlamaktaydı. Tüm bu törenler sırasında yapılan uygulamalar aynı zamanda Çinli prensesin, Uygur milleti tarafından da katun olarak kabul edildiğini göstermektedir. Türklerin bu törenler sırasındaki uygulamaları günümüze farklı şekillerde devam etmektedir. Kültürel ve mitolojik geçmişe sahip bu uygulamalardan biri olan kına gecelerinde gelinin damadın etrafında dönmesi, eski Türklerdeki Hatunun Kağanı selamlama ritüelinin bir devamı sayılabilir. Uygur-Çin siyasi evlilikleri için yapılan törenlerde görülen kırmızı renkli Hatun kaftanının yine kına gecelerinde giyilen kaftanlarla yaşadığı, aynı zamanda kırmızı rengin Türk mitolojisindeki koruyucu unsuru, gelinlerin belli bir ritüel ile beline bağlanan kuşakta devam ettiği görülmektedir.

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ÖZET

Literatür taramaları ve piyasa analizi yapıldığında, endüstriyel otomasyon sistemlerinin çok açık bir şekilde hız kesmeden yayıldığını görebiliyoruz. Endüstriyel üretimin verimini arttırmak için üretim teknolojilerinin akıllı olacak şekilde tasarlanması ve hatlarda oluşacak arıza durumundan sonra arıza onarımının 3M (Maintenance and Material Management) açısından hızlı yapılabilmesi için modülerlik önemli bir stratejidir. Sanayi devriminin önemli bir konusu olan akıllı fabrikaların oluşumunda akıllı sistemler çok önemli elemanlardır. Akıllı fabrikalar birbirleriyle haberleşme yeteneğine sahip akıllı elemanlardan oluşur ve aynı zamanda kendi kendine veri işleme özelliğine sahiptirler. Geniş yelpazede yayılan akıllı üretim tesislerinin üretim işlemlerinin tek bir CPU (Central Processing Unit) ile yapılması hem veri işleme yükünü arttırır hem de yazılımda karışıklığa neden olur. Akıllı sensörlerin konum, uzunluk, yükseklik gibi fiziksel nicelikleri algılayıp, çeşitli dönüşümleri yapıp, analiz edip merkezi işlemci birimine talep edilen sonucu geri dönüş olarak aktarması daha verimli bir sistem tasarımına olanak sağlayacaktır.

Bu çalışmada geleneksel bir analog sensörü, yukarıdaki amaç doğrultusunda IOT uygulamalara uyum sağlayacak şekilde akıllı sensöre dönüştürülmüştür. Sensör PLC (Programmable Logic Circuit) 'lerle hızlı ve hassas bir şekilde iletişim kurabilmek için ek bir mikro denetleyici ve ethernet iletişim protokolü ile donatılmıştır. Bazı zorunlu uygulama ayarları için OLED ekranı entegre edilmiştir. Bu zorunlu ayarlar dahili ekranın yanında PC GUI ile de yapılabilir. Sensör mesafe ölçtüğünde analog sinyali mikro denetleyiciye aktarır ve analog sinyalinin anlamlı dönüşümleri mikro denetleyicide yapılarak PLC'ye sadece bir dijital sinyal aktarılabilir. Bu dijital sinyalin tekabül ettiği eşik değeri gerçek zamanlı PLC tarafından ethernet haberleşme protokolü üzerinden de değiştirilebilir. Haberleşme protokolü üzerinden gerçek zamanlı ölçülen mesafede alınabilir.

KEYWORDS: Akıllı Fabrikalar, IOT, Otomasyon Teknolojileri, Sensörler, PLC.

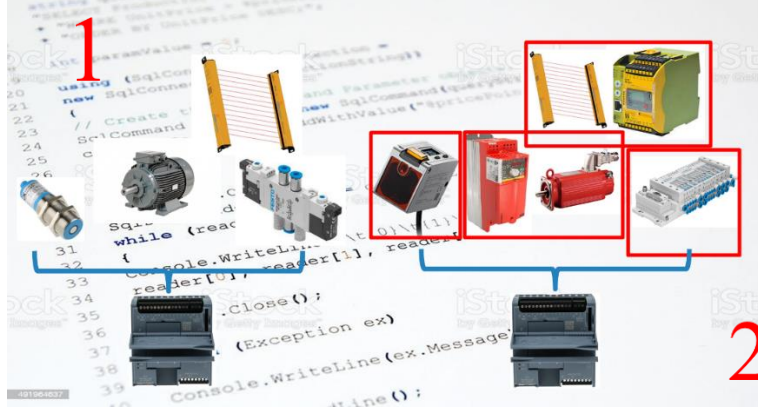
GİRİŞ

Her sanayi devriminin, üretimi daha üretken hale getirebilmesi için bir gelişim stratejisi vardır. Günümüzdeki sanayi devriminin stratejisi ise, Akıllı sistemler ve entegrasyonu olarak karşımıza çıkıyor. Yani Endüstri 4.0., üretim teknolojilerinin dijitalleştirilmesi sonucu, üretimin dijital dönüşümüne yönelik bir girişimdir. [1-2] Günümüzde otomasyon sektörünün sanayi devrimi Endüstri 4.0.'e hızlı bir şekilde uyum sağlanması için otomasyon ekipmanları hız kesmeden geliştirilmekte [1-3] ve bir sürü çeşitlilikle ortaya çıkmaktadır. Bütün bu gelişmeler, Endüstri 4.0. sanayi devriminin çok önemli elemanlar arasında yer alan ve haberleşme ağlarıyla birbirine bağlı akıllı üretim elemanları ile meydana gelen Akıllı Fabrikalar 'ı oluşturmak için yapılmaktadır. [4] Üretim teknolojilerinin akıllı olacak şekilde tasarlanması ve üretim tesislerinin modüler yapıya sahip olmaları, hatlarda oluşacak arıza durumundan sonra, arıza onarımının 3M açısından hızlı yapılabilmesi için, çok önemli bir stratejidir. 3M kısacası, bir yerin malzeme gereksinimlerinin karşılaması için tedarik zincirlerinin planlanmasını ve yürütülmesini içeren bir işlevidir.

Bir örnek ile akıllı cihazların otomasyon üzerindeki etkisinden bahsetmek gerekirse; Geniş yelpazede yayılan bir üretim tesisinin, Şekil 1'deki 1 numaralı kurgu ile kendi alanlarında uzman olmayan elemanlarla yönetilmesi, tesisin bütün yükünü CPU 'ye aktararak, hem veri işleme bakımından kontrolcüyü zorluyor, hem de yazılım karmaşıklığa neden oluyor. Oysa ki 2 numaralı kurgu ile akıllı

fabrikalarının modüler bir biçimde tasarlanması ve üretim işlemlerinin hepsinin, tek bir CPU ile yapılması yerine, kendi çaplarında küçük bir yönetici olarak yapmaları, CPU 'de hem veri işleme yükünü hem de yazılımdaki karmaşıklığı azaltmış olur.

Bu aynı zamanda 3M açısından, bakımın yapılması için bozulan ekipmanın değiştirilmesi, buna CPU da dahil, külfetli olmayacaktır.



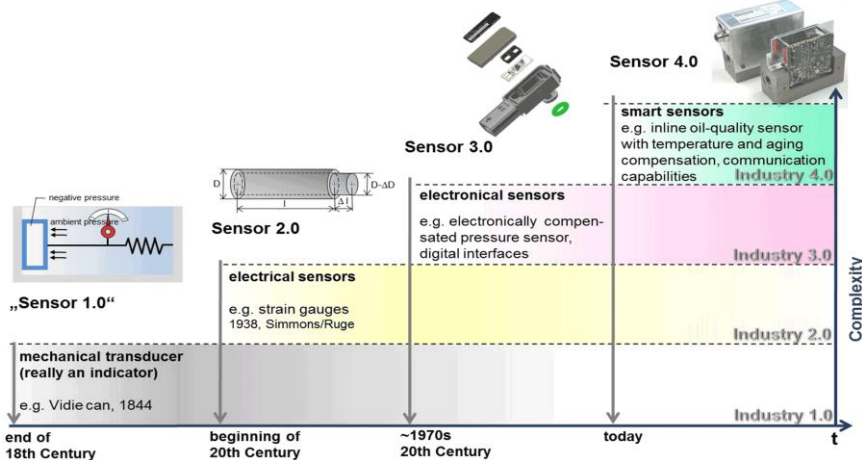
Şekil 7 Otomasyon Sistemlerinde Modülerite'nin Önemi

Bugünlerde dünyanın yeni tip korona virüse karşı büyük bir mücadele içinde olduğunu ve ülkelerin pandemiye kontrol altına almak için mücadele ettiğini bildiğimiz için bu akıllı fabrikaların önemi her geçen gün daha da artıyor. [5] Akıllı fabrikalar çok sayıda insanların tek bir yerde bulunmasını önleyerek sadece insanları kurtarmakla kalmaz, aynı zamanda virüslerin yayılmasını kontrol etmede de yardımcı olabilir. [6]

Bu nedenle akıllı fabrikaların oluşturulabilme düşüncesine katkıda bulunabilmesi için bir otomasyon ürünü olacak modüler yapıllı akıllı sensör tasarlamaya karar verildi.

ARAŞTIRMA KONUSU VE AKIILI SENSÖRLERİN UYGULAMALARI

Şekil 2'de, sensörlerin gelişim aşamaları incelediğimizde [7]; önceden sadece analog sensörler analog çıkış üretirlerdir. Analog veriyi anlamlı veriye dönüşüm işlemlerinin hepsi, PLC gibi denetleyicilerde yapıldı. Sonra analog sensörler, bu işi kendi yapılarında gerçekleştirmeye başladılar. Bir sonraki aşama olarak, ölçümün daha hızlı yapılabilmesi için, analog sensörlerin, belli bir analog değer ölçtüğünde, bir dijital çıkış üretme modelleri gerçekleştirildi. Fakat şimdilik dijital çıkış üretme eşik değeri, sadece sensör ayarlarından manuel olarak ayarlanabilmektedir ve bu eşik değeri, uygulama esnasında çalışıkları denetleyici ile bir haberleşme protokol üzerinden ayarlama çalışmaları yeni yeni artmaktadır ve endüstriyel otomasyonun geliştirme çalışmalarının yeni bir konusudur. [8]



Şekil 8 Sensörlerin Gelişme Evresi

Bu çalışmada geleneksel bir analog sensörü, akıllı sensöre dönüştürmek için; Sensöre ek bir mikrodenetleyici, fabrika içerisindeki PLC ile haberleşmek için bir iletişim protokolü, bazı zorunlu ayarlar için bir LCD ekranı entegre edilmiştir. LCD üzerinden yapılan ayarlar aynı zamanda tasarlanan GUI (Graphical User Interface) üzerinden de yapılabilmektedir.

Akıllı fabrikalarda akıllı elemanlar, sistemin bir çalışanı gibi davranırlar.



Şekil 9 Akıllı cihazların Otomasyon Sistemlerindeki Etkisi (1-2-3)

1. Otomasyonun ilk çağlarında insanların hatlarda çalıştığı gibi, akıllı fabrikalarda da akıllı cihazların da üretim hatlarında kendi görevleri vardır.
2. Bir robot kolu (dijital kol) ürünü belli bir noktada kalite kontrolüne alıyor. Sensör kendi başında kalite yöneticisi gibi gerekli kontrolleri sağlıyor.
3. Plastik levhanın üretim bandında, akıllı sensörler tarafından farklı noktalardan kalınlık ölçüleri alınmıştır.

Bu örnekler çoğaltılabilir.

Tüm bu uygulamalarda, sürece ilişkin tüm veriler ortak veri tabanında saklanmaktadır. Ve tüm üretim tesisi birbirleriyle bağlantılı şekilde takip halindedir.

LİTERATÜR TARAMASI VE PİYASA ANALİZİ

Bu teknolojiye öncü ülkeleri, AB bölgeleri arasında Almanya, İsviçre ve Avusturya'dır (GSA olarak anılır). Performansları, sensörlerin maliyet tasarrufu geliştirmesinde, iş modelleri uygulamalarında ve gelir artışındadır. [9]

LAM- firması, ürettiği LAM-F kodlu analog sensöre ek olarak, programlama ayarlarının yapılabildiği bir elektronik kart tasarımı yaptı. Modül Ethernet TCP/IP haberleşme protokolü üzerinden haberleşmektedir. Analog sensörün ölçme aralığı, hazırladıkları ara yüz üzerinden sadece offline olarak yapılabiliyor. [ALMANYA] [10]

Roder- firmanın ürettiği LDM41PN kodlu profinet haberleşme ile çalışan analog sensörde, sadece profinet üzerinden çıkış sinyali alınabiliyor. Fiziksel bir çıkış alınması gerekiyorsa profinet seçeneğinden vaz geçip RS-232 haberleşme protokolüne geçiş yapılması gerekiyor. [ALMANYA] [11]

Baumer- firmanın ürettiği OM70-L0070.HH0048.EK kodlu analog sensör, MODBUS TCP/IP veya Profinet ile haberleşmektedir. [İSVİÇRE] [12]

Elektronik çip üretiminde öncü firmalarından **Texas Instruments**, bilimsel literatür taramaları yapıldığında, analog sensörlerin diagnostics için bir IO aparat geliştirdiği, fakat analog sensörlere özellik kazandırma ile alakalı bir çalışma rastlanmamıştır. [13]

Dr. Sergey Yurish'in IFSA (International Frequency Sensor Association) derneğinde yazdığı kitapta, analog sinyallerin geleneksel ADC'ler yerine UFDC çevirici ile daha verimli bir dönüşüm ile alakalı çalışmalara rastlanmıştır. [14]

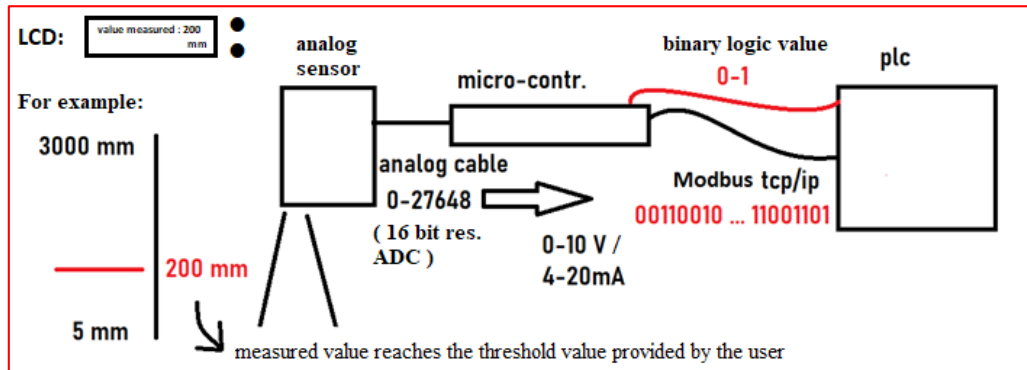
Bu makalede yapılan çalışmada, tasarlanan ürüne Baumer sensörden farklı olarak bir LCD entegrasyonu ve bazı yenilikler yapılmıştır.

Tablo 4 Teknik Olarak Makaledeki Çalışmanın Piyasadaki Ürünlerle Karşılaştırılması

Karşılaştırılacak Özellik	NGMS (UDAFF)	LDM42 (ASTECH)	OM70 (BAUMER)	LAM (WAYCON)	Açıklama
Fieldbus Teknoloji	Modbus TCP/IP	Profinet IO	Modbus TCP/IP Profinet IO	RS-232	PLC'lerle haberleşmek için kullanılan protokol
Ürün Ebatı	55x55x25 mm	187x96x50 mm	74x55x26 mm	100x75x30 mm	Sensörün gerçek ebatı
PC Serial Interface	LCD, Webserver, Micro Usb	RS-232	Ethernet TCP/IP Webserver	Ethernet TCP/IP Webserver	Sensörün temel ayarların yapılması için kullanılan arayüz
Ölçüm Mesafesi	50-5000 mm	200 -30000 mm	30-70 mm	0.5-200 mm	Lazer sensörün ölçebildiği mesafesi
					Sensörlerin gerçek halleri

MATERYALLER VE METODLAR

Sensör herhangi bir mesafe ölçtüğünde analog değerini mikro denetleyiciye aktarır ve analog sinyalinin anlamlı dönüşümleri mikro denetleyicide yapılır. Kuantizasyon ve ölçeklendirilme ile dönüşmüş değer, PLC tarafından daha önceden ayarlanan eşik değerine gelindiğinde, mikro denetleyici PLC'ye bir dijital sinyal aktaracaktır. Eşik değeri LCD üzerinden veya PC GUI ile ayarlanabilir. Ya da gerçek zamanlı olarak PLC ile bir endüstriyel haberleşme protokolü üzerinden uygulama esnasında değiştirilebilir. Dijital sinyal PLC tarafından Ethernet kablosu veya kuru kontak (fiziksel bir kablo) üzerinden alınabilecektir. (Şekil 4)



Şekil 10 Akıllı Sensörün Çalışma Prensipleri

Bu tip Siber-Fiziksel Sistemler (CPS), akıllı fabrikaları yaratmak [15] veya otonom araçları geliştirmek için önemlidirler [16].

Malzemeler

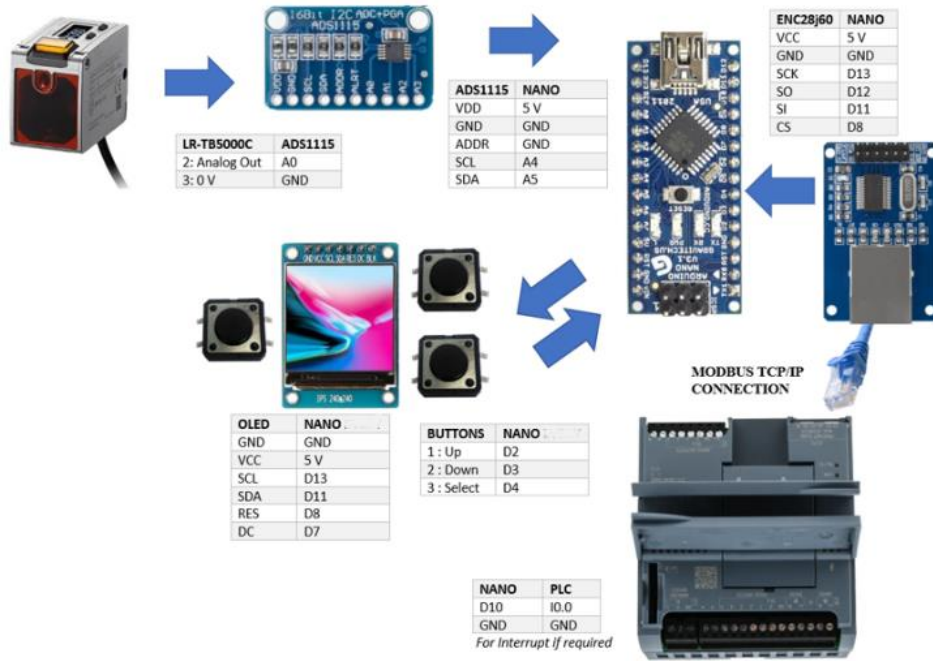
Arduino Nano kullanıcı dostu bir donanım ve yazılım platformuna sahip ve bir kontrolcü olarak proje için tüm gereksinimleri içerir. Arduino Nano, analog değeri okumak, değeri ADC modülü üzerinden işlemek, örneklemek ve değeri anlamlı hale getirmek için kullanıldı.

Texas Instruments 'in geliştirdiği **ADS1115** 16-bit ADC Modülü, analog değeri daha hassas bir şekilde analogtan dijitala çevirmek için kullanıldı.

ENC28J60 Ethernet LAN Modülü, SPI ile Modbus iletişim protokolü arasında veri alışverişi yapmak için kullanıldı. SPI protokolü Arduino nano tarafından desteklenir ve Modbus protokolü **PLC** tarafından desteklenir. Dönüştürme ile ilgili kodlar Arduino Nano kontrolcünde yazıldı.

Keyence LR-TB5000 Mesafe ölçen sensör 0-10V arasında analog değer ölçer.

OLED Arduino TFT LCD bazı zorunlu ayarlar için kullanıldı. Yukarı-aşağı seçim butonları ile ayar modlarına ulaşılabilir. Modlar; **IP Ayarları**, normalizasyon ve ölçekleme için **Sensör ölçüm aralığı**, **Gerçek zamanlı ölçüm** değeri ekran yansıp-yansıması, **ölçüm mesafesi eşik değeri**ni ayarlama menülerden oluşur.



Şekil 11 Uygulamada kullanılan ekipmanlar

Yöntem

Arduino Nano içerisinde 10-bit dahili ADC modülü bulunur. Dönüştürme, kodun istediği anda değil, ayarlanan Prescaler değerinin 13 zorunlu cycle ve kontrolcünün frekans kristalinin periyodu ile çarpımından çıkan zaman sonrası olur. Bu uygulamamız için kabul edilebilir değeri, SPS cinsinden 19,231 olabilir. [17]

Tablo 5 Arduino Nano 'daki ön ölçekleyiciye göre ADC dönüştürme sonuçları

Prescaler		ADC Çevrimi ^[1]		İşlemci Saati		Saniye cinsinden Sonuç	Mikro-Saniye cinsinden Sonuç	Örnekleme Rate ^[2]
2	*	13	*	1 / 16000000	=	0.000001625	1.625	615,385

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4	*	13	*	1 / 16000000	=	0.00000325	3.25	307,692
8	*	13	*	1 / 16000000	=	0.0000065	6.5	153,846
16	*	13	*	1 / 16000000	=	0.000013	13	76,923
32	*	13	*	1 / 16000000	=	0.000026	26	38,462
64	*	13	*	1 / 16000000	=	0.000052	52	19,231
128	*	13	*	1 / 16000000	=	0.000104	104	9,615

[1] Daha doğru sonuç için dönüşüm çevrimleri 13,5 kez alınmalı, 0,5 değeri ortalama yarım saat çevrimi yapmamızı sağlar.

[2] Örnekleme hızı, Saniye cinsinden sonuçların tersidir.

Çözünürlük, $2^{10} = 1024$ olan dahili ADC 'nın 1'lik bir ADC değeri, 4.88 mV 'lik bir Voltaj adımına neden olur- bir LSB için voltaj değeri (5 V Vref için ADC çözünürlüğü).

19,231 SPS (saniyedeki örnekleme sayısı) 'lik değeri için yanıt süresinin hesaplanması:

$$Tepkime Süresi = \frac{1}{19231} = 0.000052 \text{ saniye (1)}$$

$$Tepkime Süresi = 52 \text{ mikro saniye (2)}$$

Bu değer oldukça hızlı bir örnekleme yapmamıza olanak tanıyor olsa da 1 ADC değeri nicelik açısından kaba bir değerdir.

Çözünürlüğü artırmak için projede Texas Instruments tarafından üretilen harici bir 16-bit ADS1115 ADC modülü kullanıldı. Modüldeki osilatör 1 MHz 'dır ve giriş sinyalinin örneklendiği 250 kHz'de örnekleme frekansı veya modüler frekans oluşturmak için ayrıca 4 faktörüne bölünür. [18]

Çözünürlük, $2^{16} = 65536$ olan bu modülün 1'lik bir ADC değeri, 0.1875 mV (187.5 mikro-V) Voltaj adımına neden olur- bir LSB için voltaj değeri (6,144 V Vref için ADC çözünürlüğü).

860 SPS (saniyedeki örnekleme sayısı) 'lik değeriyle ADS1115 için yanıt süresinin hesaplanması:

$$Tepkime Süresi = \frac{1}{860} = 0.001163 \text{ saniye (3)}$$

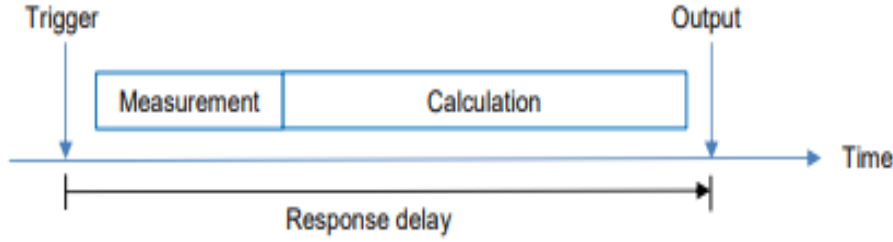
$$Tepkime Süresi = 1.163 \text{ milli saniye (4)}$$

Bu değer önceki dahili ADC 'nın sağladığı değerden düşük fakat 1 ADC değeri nicelik açısından daha hassas bir değerdir.

Şimdi bu elde edilen değerleri, piyasadaki rakip ürünlerimizin ile karşılaştıracacağız.

Tepki Süresi

Tepki Süresi, ölçümün tetiklenmesi ile çıktıdaki ölçülen değerin değişmesi arasında geçen süreyi tanımlar. (Şekil 6) Tepki süresi, ışık miktarını en iyi şekilde almak ve yeterli bir maruz kalma rezervi elde etmek için sensör tarafından nesneye göre ayarlanan maruz kalma süresine bağlıdır. Bu yüzey özelliklerine (yapı, renk vb.) ve ölçülen nesneye göre sensörün konumuna bağlıdır. Karanlık nesneler ışığı daha az yansıtır ve bu nedenle açık nesnelerden daha uzun maruz kalma süresi gerekir, bu da tepki süresini artırır. [19]



Şekil 12 Sensörlerin tepkime süresi açıklaması

Otomasyon alanında sık karşılaştığım ürünlerin tepki verme süreleri şöyledir.

Leuze ODS10 Optik Lazer Yer Değiştirme Sensörü = 3.4 ms* [20]

Baumer OM70 Optik Lazer Yer Değiştirme Sensörü = 1,2 ms* [12]

Keyence LRTB serisi Optik Lazer Yer Değiştirme Sensörü = 1 ms* [19]

**Bir ölçüm için laboratuvarında ölçülen sonuçlar. Genellikle ölçümler birden fazla kez alınır ve dolayısıyla yanıt süresi aşağıdaki gibi hesaplanır:*

$$\text{Tepki Süresi} = \text{ölçüm süresi} * \text{alınan ölçümler (5)}$$

Örneğin, Keyence LR- TB için kullanıcı ölçüm sayısını 10'a ayarlarsa,

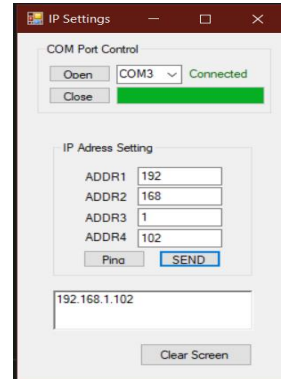
$$\text{Tepki Süresi} = 1 * 10 = 10 \text{ ms (6)}$$

Leuze ve Keyence sensörlerin çalışmada tasarlamak istendiği özelliklerine sahip olunmadığı ve Baumer bu çalışmada tasarlanan ürüne en yakın akıllı ürün olduğu için ADS1115 'den elde edilen örnekleme değeri 1.16 ms kabul edilebilir bir değer olarak ele alıyoruz.

Ölçülen değerin anlamlı veri haline gelebilmesi için, ADC 'den gelen çıkış değerleri normaliz ve ölçeklendirilmesi için aşağıdaki formül kullanılmıştır:

$$\text{Scale}_x = \left(\frac{\text{measured value} - N_{Min}}{N_{Max} - N_{Min}} \right) * (S_{Max} - S_{Min}) + S_{Min} \quad (7)$$

UYGULAMA VE ÜRÜN AVANTAJLARI



Şekil 13 Akıllı Sensörün Tasarım Uygulaması

Analog sensör yer değiştirmeyi ölçer ve bu analog değeri (0-10 V arasında) ADS1115 'ye iletilir. Dijitale dönüştürülen değer Arduino denetleyicisine iletilir. Arduino daha sonra, kullanıcı tarafından OLED ekrandan sağlanan değer aralığında değeri normalleştirir-ölçeklendirir. Bu değer gerçek dünyadaki analog sensör tarafından ölçülen değerdir. Ölçüm, kullanıcının OLED Ayarlarında yaptığı tercihe göre Modbus kayıtlarına veya OLED ekrana gösterilebilir. (Şekil 7)

OLED 'den IP Ayarlarının yapılabilmesi, bu kategorideki diğer ürünler arasında benzersiz bir teknolojidir. Bununla birlikte, tüm bu zorunlu ayarların PC'den yapılması için bir kullanıcı kontrol GUI de tasarlanmıştır. Bu arayüzden ayrıca diagnostics doyası da alınabilir.

3M açısından bozulan ekipmanın değiştirilmesi, böyle bir tasarımdan dolayı bir avantaj olacaktır.

SONUÇ VE ÖNERİLER

Bu çalışmada akıllı sensörlerin, geleneksel otomasyon sistemleri daha üretken ve 3M açısından daha verimli hale getirdiği örnekler üzerinden incelenmiştir.

Endüstri 4.0 ile uyumlu tasarlanan modüler akıllı sensörün piyasadaki rakipleri arasında 2 yönden rekabetçi bir ürün olduğu gösterilmiştir.

- Dijital ekran veya usb GUI gibi kullanıcı dostu arayüz seçeneği sayesinde akıllı sensörün devreye alınması ve zorunlu ayarlarının yapılması kolay hale getirilmiştir.
- Tepki verme süresi olarak; 1.16 ms saniye ile 1.2 ms olan rakip bir ürününkinden daha hızlı bir tepki verme süresi hesaplanmıştır.

Arduino Nano 'nun dahili ADC ile Texas Instruments 'in geliştirdiği harici ADC modülü arasındaki çevrim süresi ve hassasiyet farkı hesaplanmıştır.

Üretim fabrikaların IOT uygulamaları için değerler MODBUS TCP/IP protokolünden geçirilebilir ve bu alanda bir şeyler yapmayı planlayan mühendisler için iyi bir referans niteliğindedir.

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**DEVELOPMENT OF SMART PACKAGING WITH CURCUMIN TO DETERMINE
THE CHANGES IN FOOD QUALITY**

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Abstract

Smart packaging is based on the one-to-one interaction of food with its packaging or its environment to monitor food quality and safety. The smart packages are designed to provide consumers with information about food quality throughout the food chain, from the moment of storage to the moment of purchase from the shelves. Especially, colorimetric pH indicators (synthetic, natural) working within the system of smart food packaging are remarkable when used with fresh food materials such as fish and meat, which are perishable and require real-time freshness monitoring. Among polyethylene (PE) types, low-density polyethylene (LDPE) is a polymer widely used in food packaging due to their good sealing, stiffness and moisture barrier, and transparency properties. Thermoplastic starch (TPS) is of great interest because it is biodegradable and provides high flexibility. LDPE/TPS blends can be considered semisynthetic polymers for smart food packaging film applications. Synthetic pH-sensitive dyes perform well, but the development of safe colorimetric films is preferred in the development of meat quality indicators. In recent years, pH-sensitive films have been developed to monitor meat quality with edible natural pigments such as anthocyanins, betalains, and curcumin. Curcumin is a hydrophobic phenolic substance derived from *Curcumin longa* and is known as turmeric. Curcumin, a natural bioactive compound, is notable for being non-toxic and showing numerous benefits. It is widely used as a food colouring agent due to its intense yellow colour. In this study, it was tried to develop a hydrophobic colorimetric film by adding natural pigment curcumin to LDPE/TPS (70/30 and 50/50 by weight) blends by melt extrusion method. The thermal and mechanical properties, an affinity for water, and colour change properties in pH solutions of LDPE/TPS/Curcumin films were investigated. These films exhibited a distinct colour change from yellow to brown at pH: 10 at the end of the seventh day, especially in the pH buffer solutions at a 50/50 mixture. When the same mixture was used to monitor chicken meat spoilage at 25°C, the meat samples has shown colour changes from light yellow to light brown due to the increased content of total volatile basic amines (TVBN).

Keywords: LDPE, Smart Packing, Curcumin, pH indicator, Meat Spoilage

INTRODUCTION

Smart food packaging has attracted great interest in the food industry in the modern world, as it allows the monitoring of food quality. It aims to evaluate the food quality and monitor the food quality in packaged foods on-site and in real time. Along with various pH sensitive colorimetric sensors and indicators in the literature, wireless electronic sensors have generally been developed for smart packaging with their features such as good portability, low-cost advantages, and easy fabrication (Lin., 2016, Long., 2019, Zhai., 2019, Ma., 2018). Among them, the most notable and widely studied colorimetric sensors have been. These pH sensitive sensors can respond quickly, so colour changes are evaluated directly with the naked eye. Total volatile basic amines (TVBN), such as ammonia, are generally considered to be indicators of meat spoilage. Meat spoilage can easily occur during distribution and storage due to microbial contamination (Zhang., 2013). There is a series of studies in the literature that try to use synthetic pH-sensitive dyes in smart packaging systems for real-time monitoring and evaluation of meat spoilage. (Chun., 2014, Mo., 2017, Pacquit., 2006).

Recently, chemical melt extrusion methods have been proposed to embed pH-sensitive dyes into solid films and simultaneously prevent dyes from leaching. (Wells., 2019). This has provided new approaches to designing pH-sensitive colorimetric films for smart food packaging. Synthetic pH sensitive dyes perform very well in improving food quality indicators such as meat, poultry, and fish. However, they are not completely safe colorimetric films in terms of food health and quality (Lee., 2014). In the last decade, anthocyanins, betalains and curcumin from plant extracts have been used as natural indicators to develop pH-sensitive films to monitor meat quality. (Ma., 2016, Zhai., 2018, Zhang., 2019, Kuswandi., 2011, Liu., 2018). The package containing fresh meat has high relative humidity (RH). Therefore, if the polymer film is hydrophilic, it can absorb water from the interior of the packaging, resulting in the leaching of pigments from the film (Liu., 2018, Ma et al., 2018). The leaching of natural pigments does not cause food safety issues. However, this situation has a great impact on the indicator feature of the film (Ma., 2016, Zhai 2018).

In this study, it was tried to develop a natural hydrophobic colorimetric film by adding natural pigment curcumin (CUR) to low density polyethylene/ thermoplastic starch (LDPE/TPS) blends by melt extrusion method. LDPE is a commonly used polymer, is in high demand, and is easy to mass produce. Especially in the manufacture of plastic boxes, tubes, toy coatings and food packaging films. On the other hand, LDPE is a nontoxic polymer and LDPE films have been widely used in food packaging due to its good mechanical and water barrier properties. (Zia., 2019). TPS is the form of starch, a naturally sourced biopolymer, made processable with the help of plasticizers. TPS has a structure that allows the use of films, and packaging in terms of mechanical and other performance properties. It gives biodegradable features to the products produced from TPS (Özdemir., 2021). The blending is helpful in combining the biodegradable property of TPS and the mechanical properties of PE. When blending PE and TPS, incompatible blends obtain, and the tensile properties of the blends decrease. PEGMAH reinforcement as compatibilizer is a generally used method to increase the tensile properties (Sabetzadeh., 2015). Curcumin is a hydrophobic polyphenolic compound and is yellow orange in colour. It also shows strong antioxidant, antitumor, anticancer, and antibacterial properties (Reddy., 2018, Luo., 2012). Curcumin, which is frequently used as a natural indicator, is stable in pH 4 and 7. When they go out of this range, they degrade and change colour (Etxabide., 2020). To study the effects of curcumin reinforcement on LDPE/TPS blend, 70/30 and 50/50 LDPE/TPS blends were used as control specimens. Loading levels of CUR were changed between 3-5-7 wt%. PE-g-MAH was used for the compatibilization of LDPE/TPS blends.

MATERIALS AND METHODS

Materials

LDPE used as matrix materials was supplied from Dow Chemical Company (Density: 0.918 g/cm³, Melting temperature: 106 °C) and commercial TPS (28% Glycerine ratio) from Sunar Company. Maleic anhydride grafted polyethylene (PE-g-MAH) used as a compatibilizer was supplied by Tisan Engineering. The natural indicator curcumin was purchased in high purity from Biobasic Canada.

Methods

Before the mixtures were prepared, each was dried at 80°C for 24 hours. The composites were prepared by using a co-rotating twin-screw lab-scale extruder (Xplore 15 ml Micro-compounder). The extrusion parameters were barrel temperature of 130 °C, screw speed of 100 rpm, and 4 min residence time. The compounds were taken from the extruder in paste form and then pelleted using a pelletizing machine. Pellets were moulded into films with the help of a laboratory-scale hot press (60 Bar, 130 °C, 1.40 min cooking time). Two types of matrices were chosen 70PE/30TPS and 50PE/50TPS. 3-5-7 wt% of curcumin was added to these matrices with a constant 15 wt% PEGMAH ratio.

Characterization

The prepared composites were characterized by tensile test (ASTM D 882), pH solution test, contact angle test, differential scanning calorimeter (DSC) and thermogravimetric analysis (TGA).

RESULTS AND DISCUSSION

Tensile test

The tensile tests of the films were carried out in a universal test device at a tensile speed of 10 mm/min and at room temperature according to ASTM D 882 standard. Film samples were prepared in 2x8 dimensions and at least 5 samples were tested for each value. The tensile strength and elongation at break values of the film samples are given by taking the average value. The 70PE/30TPS blend showed the highest tensile strength (12.2Mpa) of all curcumin-containing films. When added curcumin to the films, especially with the addition of 70PE/30TPS/3KUR, the tensile strength decreased to 6.07 Mpa. As the curcumin content increased, the tensile strength decreased to around 5.29 Mpa. Agglomeration of curcumin in the 70/30 matrix is thought to be the cause of this condition (Reddy.,2018). In contrast to the 70PE/30TPS matrix, the 50PE/50TPS blend showed lower tensile strength than the curcumin-containing films. As the curcumin content increased in this matrix, the tensile strength increased to 8 Mpa, especially at 7 wt% curcumin content. In this case, it is thought that curcumin exhibits a more uniform distribution in the 50/50 matrix than in the 70/30 matrix.

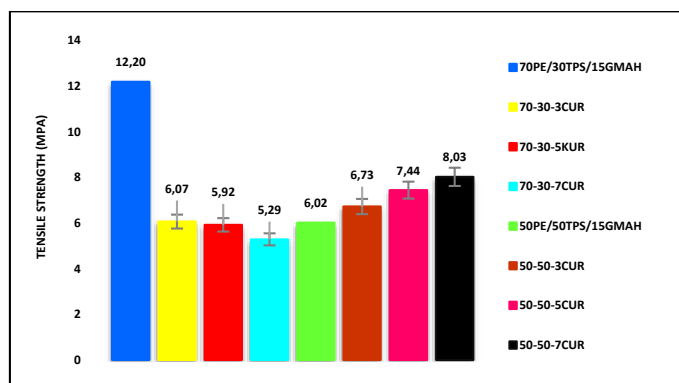


Figure 1. Tensile strength of the samples

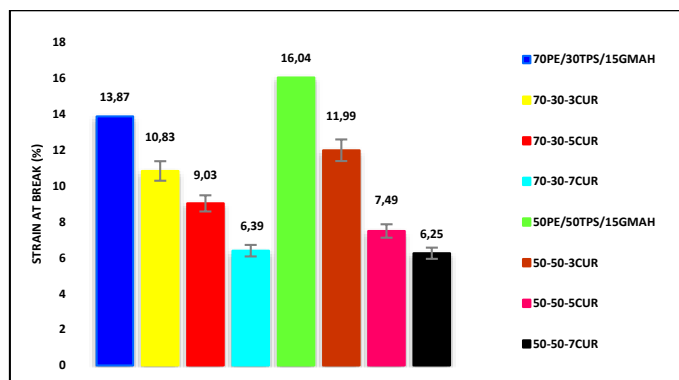


Figure 2. Strain at break of the samples

The elongation of the 70PE/30TPS matrix was high at first (13.87 %), as expected, but this value decreased with the addition of the natural indicator curcumin. The elongation of the 50PE/50TPS matrix between the two matrices was higher than the 70PE/30TPS matrix.

Differential Scanning Calorimeter (DSC)

DSC measurements were carried out to determine the thermal properties of the produced samples. Glass transition temperature (T_g), cold crystallization temperature (T_{cc}), melting temperature (T_m), crystallization temperature (T_c), and % crystallinity value (X_c) were obtained from DSC analysis was given in Table 1. With the addition of curcumin into the 70PE/30TPS matrix, T_m values did not change much, but the crystallinity values of the material decreased with increasing curcumin content. With the addition of curcumin into the 50PE/50TPS matrix, one unit decrease occurred in T_m values. Crystallinity values increased with increasing curcumin content. The highest crystallinity value of 28.78% was observed in 50PE/50TPS/7CUR film.

Table 1. DSC data of all samples

Sample	T_m	$\Delta H_m(J/g)$	W_f	H_m^0	% X_c
PE	110,62	62,8	1	293	21,4
TPS	121,05	10,71	1		
PE-g-MAH	123,29	83,53	1		
70PE/30TPS/15GMAH	107,07	39,91	0,7	293	19,45
70PE/30TPS/3CUR	107,36	46,23	0,7	293	22,54
70PE/30TPS/5CUR	107,91	44,36	0,7	293	21,62
70PE/30TPS/7CUR	107,17	34,53	0,7	293	16,83
50PE/50TPS/15GMAH	106,31	28,92	0,5	293	19,74
50PE/50TPS/3CUR	107,42	39,13	0,5	293	26,70
50PE/50TPS/5CUR	106,1	41,12	0,5	293	28,06
50PE/50TPS/7CUR	106,71	42,17	0,5	293	28,78

Thermogravimetric Analysis (TGA)

Thermal stability was evaluated using a Mettler Toledo TGA Star trademark machine. Specimens of approximately 10 mg of sample were loaded onto a platinum pan. The specimens were heated from ambient temperature to 25°C at a rate of 800°C with a heating rate of 10°C.min⁻¹ under the nitrogen atmosphere. The results of the thermo-gravimetric analysis test are summarized in Table 2. As the curcumin content increased, the decomposition temperatures decreased. At the same time as was expected the percentage of char residue increased with the increasing curcumin ratio for both matrices.

Table 2. TGA data of all samples

Samples	Onset Temp. (°C)	50% Mass Loss Temp. (°C)	Char Residue (600 °C) (%)
PE	454,14	474,60	0,90
CURCUMIN	308,52	388,62	36,67
70PE/30TPS/15GMAH	489,54	472,50	2,58
70PE/30TPS/3CUR	435,09	474,60	4,15
70PE/30TPS/5CUR	437,47	473,76	4,42
70PE/30TPS/7CUR	439,30	474,18	5,19
50PE/50TPS/15GMAH	486,60	475,44	3,85
50PE/50TPS/3CUR	438,17	474,60	5,07
50PE/50TPS/5CUR	436,86	473,76	5,50
50PE/50TPS/7CUR	428,27	474,18	6,84

pH Buffer Solution Test

pH tests were performed in 2,4,7 and 10 pH buffer solutions. These results are 3-5-7 wt% repeated for all curcumin films for 7 days. For the 70PE/30TPS matrix, colour change began to be observed as the curcumin content increased. The transition from yellow to slightly orange was not clearly observed. Figure 3 shows 3-5-7 shows the change in curcumin content in pH buffer solutions over 7 days. For the 50/50 matrix, colour changes appeared visibly as curcumin was selective to the TPS phase (Fig.4). A definite colour change from yellow to orange was observed, especially at pH:10.

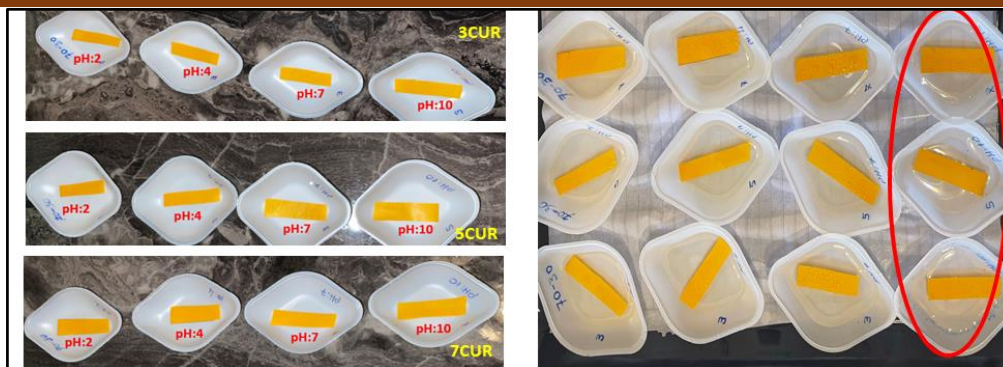


Figure 3. Color changes in increased curcumin content for 70PE/30TPS blends

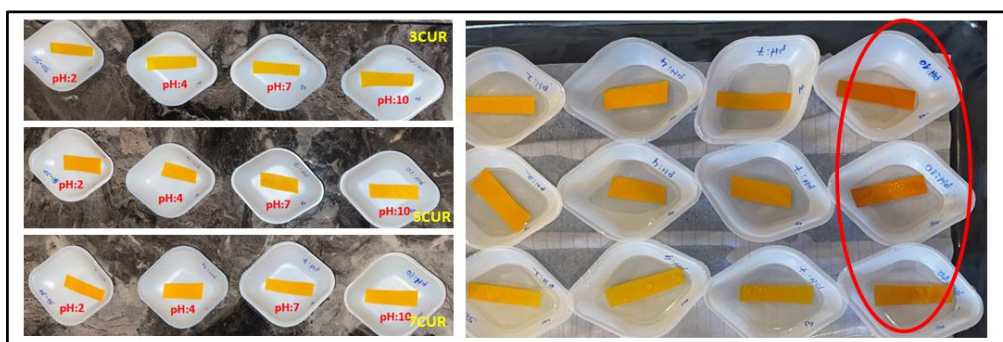


Figure 4. Color changes in increased curcumin content for 50PE/50TPS blends

As a result of experiments on chicken meat for the 50/50 matrix, a slight colour change was observed, especially at pH:10 at 7% curcumin content. However, the TVBN level released when chicken meat is spoiled is not high enough to make the pH value 10. Experiments with other foods should be continued.



Figure 5. Colour changes in increased curcumin content for chicken meat

Contact Angle

Contact angle measurements provide information on the degree of hydrophobicity/hydrophilicity of the film surfaces. If the contact angle of the water drop on the surface of a film sample is high, it means that the film surface has a more hydrophobic character and is more resistant to water. This value is significantly affected by the chemical composition of the film surface (Anderson.,2016, Yamak.,2013).

The contact angle values of the produced packaging films were measured using the Attention Theta Lite device with the suspended droplet method at room temperature. For each film sample, measurements were taken from at least 5 different parts of the film surface. The mean of the values is reported in Table 3.

Table 3. Contact angle result for 70PE/30TPS and 50PE/50TPS films

Samples	Contact Angle (°)
PE	100,38
TPS	41,18
70PE/30TPS	93,39
70PE/30TPS/15GMAH	95,44
70PE/30TPS/3CUR	97,04
70PE/30TPS/5CUR	97,46
70PE/30TPS/7CUR	97,98
50PE/50TPS	92,66
50PE/50TPS/15GMAH	96,01
50PE/50TPS/3CUR	96,54
50PE/50TPS/5CUR	96,76
50PE/50TPS/7CUR	98,12

PE is hydrophobic, TPS is hydrophilic and Curcumin is hydrophobic. As the curcumin content in the 70PE/30TPS mixture increased, the contact angles increased. As the PE content increases in the 50PE/50TPS mixture, and the curcumin content also increases the contact angles increase.

CONCLUSION

The CUR reinforced PE/TPS films were produced by using extrusion, and hot press processes. The mechanical, pH test, contact angle and thermal properties of samples were determined. The curcumin

content increased, and the tensile strength increased, especially at 7 wt.% curcumin content, down to 8 Mpa. In this case, it is thought that curcumin exhibits a more uniform distribution in the 50PE/50TPS matrix than in the 70PE/30TPS matrix. With the addition of curcumin into the 50PE/50TPS matrix, one unit decrease occurred in T_m values. Crystallinity values increased with increasing curcumin content. As the curcumin content increased, the decomposition temperatures decreased. As a result of the pH tests, the film with 7% curcumin showed the best colour change for the 50PE/50TPS mixture. The higher the curcumin content, the greater the contact angles.

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**THE EVALUATION OF THE LAND REGULATIONS MADE BY THE DIRECTORATES
OF THE CADASTRE IN CONSEQUENCE OF PUBLIC PROPERTIES**
**KADASTRO MÜDÜRLÜKLERİNCE YAPILAN YÜZÖLÇÜMÜ DÜZELTMELERİNİN HAZİNE
TAŞINMAZLARI YÖNÜNDEN DEĞERLENDİRİLMESİ**

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Özet

Arazi, taşınmaz ve yok edilemez özellikte olmasının yanı sıra toplumların ve bireylerin akla gelebilecek olan bütün taşınabilir değer ve aktivitelerine mekân oluşturması bakımından vazgeçilemeyecek bir olgudur. Bu olgunun değerlendirilmesinde ortaya çıkan kullanım ve mülkiyet çeşitliliği, dünyamız üzerinde uçsuz bucaksız şekilde yer kaplayan arazileri sınırlandırarak belirli parçalara bölmeyi gerekli kılmıştır. Böylelikle her biri belirli bir geometri ve yüzölçümüne sahip olan parsel kavramı ortaya çıkmıştır. Neredeyse bütün literatürde “arazi” ismiyle tanımlanan taşınmaz varlıkların, sınırlandırılarak belirli bir yüzölçümüne kavuşturulması, geometrik bilgilerinin paftalara, metinsel bilgilerinin ise tapu kütüklerine kaydedilmesi suretiyle parsel halini alması süreci ülkemizde 3402 sayılı Kadastro Kanunu kapsamında gerçekleştirilmektedir. Kadastro Kanunu gereğince oluşturulan parseller, bir yerin kadastro çalışmasının yapıldığı tarihte tedavülde olan; alet-edevat, teknolojik yöntem ve teknik hesaplamalarıyla yapıldığı için günümüz teknolojisi ve hesaplama yöntemleriyle kontrol edilip karşılaştırıldığında, bu kanun kapsamında kadastro yapılarak kayıt altına alınmış olan parsellerin yüzölçümlerinde hataların çıkması kaçınılmaz olmaktadır. Bazen parsellerin sınırlarında ve yüzölçümlerinde, bazen de sadece yüzölçümlerinde var olan bu hatalara sıklıkla rastlanılması ve gerek teknik gerekse hukuki sebeplerce bu hataların düzeltilmesinin zorunluluk arz etmesi, “yüzölçümü düzeltmesi” denilen iş kalemını doğurmuştur. Öyle ki; 3402 sayılı Kadastro Kanunu’nun 41. maddesinde anılan yüzölçümü düzeltmesi işlemi, “Kadastro Sırasında veya Sonrasında Yapılan İşlemlerle Geometrik Durumları Kesinleşmiş Olan Taşınmazlarda Ölçü, Sınırlandırma, Tersimat ve Hesaplamalardan Doğan Hataların Düzeltilmesi Yönetmeliği” ve “Tapulama ve Kadastro Paftalarını Yenileme Yönetmeliği” gibi mevzuat çalışmalarının yürürlüğe konulmasını gerekli kılmıştır. Yüzölçümü düzeltmesi işlemi, yüzölçümü hatalı olan tüm parsellerde uygulanacağından dolayı bu kapsama mülkiyeti şahıslara ait olan parsellerle birlikte aynı zamanda mülkiyeti Devlete ait olan Hazine parselleri de dâhil olmaktadır. Tasarrufu Milli Emlak Genel Müdürlüğüne ait olan Hazine parsellerinin tabii tutulacağı yüzölçümü düzeltmesi iş ve işlemleri çeşitlilik ve yoğunluk arz etmekte olduğundan dolayı ilgili idare olan Milli Emlak Genel Müdürlüğünce bu konuda mevzuat hükümleri ihdas edilerek bu iş ve işlemlerde istikamet belirlenmiştir. Bunların ilk akla geleni ise “327 sayılı Milli Emlak Genel Tebliği”dir”. Çalışmada Hazine parselleri üzerinde gerçekleştirilen yüzölçümü düzeltmesi işlemleri irdelenerek bunlar hakkında izlenen yol ve belirsizlik olduğu düşünülen hususlarla ilgili gerçekleştirilecek süreç ortaya konulmaya çalışılmıştır.

Anahtar kelimeler: Yüzölçümü düzeltmesi, Hazine parseli, Kadastro Kanunu, Mülkiyet

Abstract

In addition to being immovable and indestructible, land is an indispensable phenomenon in terms of creating a place for all movable values and activities of societies and individuals. The diversity of use and ownership that emerged in the evaluation of this phenomenon necessitated dividing the vast lands on our world into certain parts by limiting them. Thus, the concept of parcels, each of which has a certain geometry and surface area, has emerged. The process of limiting immovable assets, defined as "land" in almost all the literature, to a certain area, recording their geometric information on maps and textual information on land registry, is carried out within the scope of the Cadastre Law No. 3402 in our country. The parcels created in accordance with the Cadastre Law, which were in circulation at the date of the cadastral survey of a place; Since the tools and equipment are made with technological methods and technical calculations, it is inevitable that errors will occur in the surface areas of the parcels that have been recorded by cadastre within the scope of this law, when they are checked and compared with today's technology and calculation methods. The fact that these errors, which sometimes exist in the borders and areas of the parcels, and sometimes only in the area, and the necessity of correcting these errors due to both technical and legal reasons, named to the work item called "area correction". So that; Area correction process referred to in Article 41 of the Cadastre Law No. 3402, "Regulation for Correction of Errors in Measurement, Limitation, Reversal and Calculations in Real Estates whose Geometric Conditions Have Been Determined During or After the Cadastre" and "Regulation for Renewal of Land Registry and Cadastre Sheets". required to be put into effect. Since the surface area correction process will be applied to all parcels with an incorrect surface area, this coverage includes the parcels owned by individuals and the Public properties owned by the State at the same time. Due to the diversity and intensity of works and operations for the correction of the surface area to which the Public properties, which are owned by the General Directorate of National Real Estate, will be subject to, the relevant administration, the General Directorate of National Real Estate, has established the provisions of the legislation and the direction in these works and transactions has been determined. The first thing that comes to mind is the "National Real Estate General Communiqué No. 327". In the study, the surface area correction operations carried out on the Public properties were examined, and the process to be carried out regarding the issues thought to be uncertain and the path followed about them was tried to be revealed.

Keywords: Area correction, Public property, Cadastre Law, Property

GİRİŞ

İnsanların ekonomik, sosyal, politik ve demografik yapılanmalarından etkilenerek tarihsel gelişmelere göre sürekli bir değişim süreci içinde günümüze ulaşan mülkiyet kavramının tanımını yapmak son derece zordur. Bu özelliklerinden dolayı göreceli ve değişime açık bir kavram olduğundan aslında mülkiyetin net bir tanımının bulunamaması isabetlidir (Basedow, 2016).

Bununla birlikte, mülkiyet en temel tanımlamayla, hukuk düzeninin belirlemiş olduğu sınırlar ve kurallar içerisinde bireyle eşya arasındaki hâkimiyet bağının diğer bireylere karşı korunmasını sağlayan, sahibi olan bireye eşyayı hâkimiyeti altında tutarak onun üzerinde dilediği gibi tasarruf etme yetkisini veren haktır (Özlük, 2019).

Mülkiyet hakkı kavramının kanuni bir tanımına yer vermeyen Türk Medenî Kanunu'nun 683. maddesinde bu yetkiler tanzim edilerek, "Bir şeye malik olan kimse, hukuk düzeninin sınırları içinde, o şey üzerinde dilediği gibi kullanma, yararlanma ve tasarrufta bulunma yetkisine sahiptir. Malik, malını haksız olarak elinde bulunduran kimseye karşı istihkak davası açabileceği gibi, her türlü haksız el atmanın önlenmesini de dava edebilir." ifadeleriyle mülkiyet hakkının içeriği belirlenmiştir (Resmi Gazete, 2001).

Bununla birlikte, gerek kanun maddesinde gerekse literatürde sıklıkla geçen malik olan kişinin "kullanma ve yararlanma hakkı" özel hukuk ve kamu hukukundan doğan birtakım sınırlama ve

kısıtlamalara tabidir. Özellikle taşınmaz mülkiyeti konusunda mülkiyet hakkından doğan hak ve sorumlulukların yerine getirilebilmesi, mülkiyetin kayıt altına alınmasına bağlı olmuştur.

Tarihin ilk dönemlerinden günümüze kadar toplumların taşınmazlara bakışı üzerinde önemli değişiklikler olsa da, sahip olduğu öneme binaen hemen her dönemde taşınmaz ve mülkiyet hakkı unsurlarının kayda alınması ve zaman içerisindeki değişikliklerinin takip edilmesine dair çalışmalar yapılmış ve bu doğrultuda kadastro kavramı ortaya çıkmıştır (Alkan ve Can, 2009).

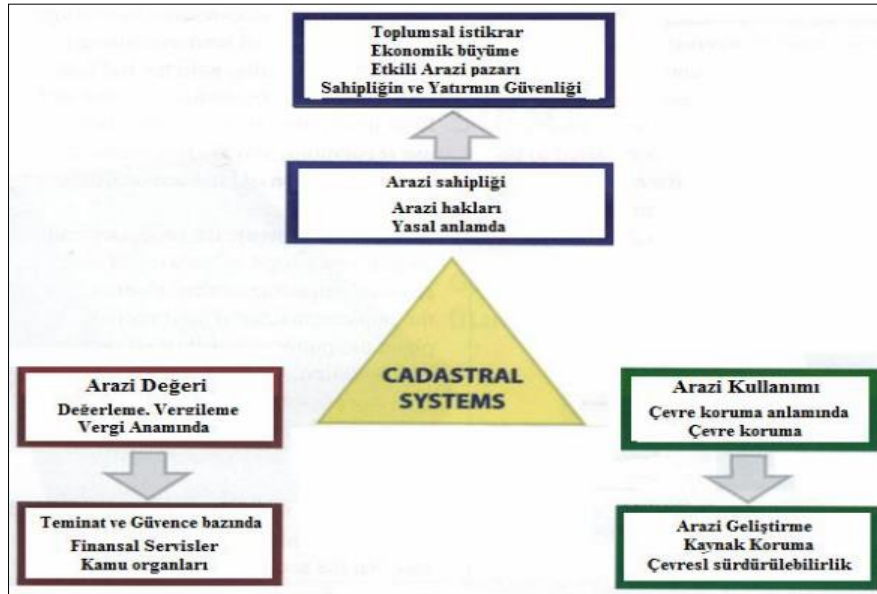
Geçmişten günümüze zamanla basit tanımıyla “kadastro, tapu vermektir” şeklinde dile getirilen ve çok da doğru olmayan kavram, değişmiş ve kadastro hizmetlerinin nitelik ve kapsamı genişletilmiştir (Köktürk, 2009).

3402 sayılı Kadastro Kanununda kadastronun amacı; “Ülke koordinat sistemine göre memleketin kadastral veya topoğrafik kadastral haritasına dayalı olarak taşınmaz malların sınırlarını arazi ve harita üzerinde belirterek hukukî durumlarını tespit etmek suretiyle 4721 sayılı Türk Medeni Kanununun öngördüğü tapu sicilini kurmak ve mekânsal bilgi sisteminin alt yapısını oluşturmaktır.” şeklinde tanımlanmıştır (Resmi Gazete, 1987). Bu tanımla, günün teknolojisi ve ihtiyaçları göz önünde bulundurularak taşınmazların sınırlarını arazide belirtecek harita üzerine aktaracak teknik çalışmalar, ülke genelinde ele alınmakta ve üretilecek haritalara da nitelik açısından yeni boyutlar getirilmektedir.

Bununla birlikte taşınmazların sınırlandırılması suretiyle yüzölçümlerinin belirlenip kayıt altına alındığı tarihteki bazı sebeplerden doğan hatalar neticesinde hataların çıkması kaçınılmaz olmaktadır. Bazen parsellerin sınırlarında ve yüzölçümlerinde, bazen de sadece yüzölçümlerinde var olan bu hatalara sıklıkla rastlanılması ve gerek teknik gerekse hukuki sebeplerce bu hataların düzeltilmesinin zorunluluk arz etmesi, “yüzölçümü düzeltmesi” denilen iş ve işlemlerin oluşumuna sebebiyet vermiştir.

MATERYAL ve METOD

Şekil 1.’de Kadastro sisteminin etkin rol oynadığı kategoriler şema halinde gösterilmektedir.



Şekil 1. Kadastronun Rollerini (Enemark, 2004)

Bir nevi taşınmaz yönetimi süreci de denilebilen tüm bu iş ve işlemlerde verimli ve sistematik bir düzenin işleyebilmesi için ilk yapılması gereken çalışma o yerin kadastronun eksiksiz olarak yapılmasından geçmektedir. Ancak kadastronun yapıldığı tarihte kullanılan teknolojik yöntem farklılığı ve eksikliği, ölçü, sınırlandırma, tersimat ve hesaplamalardan doğan hatalar sebebiyle yüzölçümünün olması gerekenden eksik ya da fazla olduğu fark edilebilmektedir. Bu durumda var olan hatanın kaynağına ve çeşidine göre yüzölçümü düzeltmesi işlemi yapılmaktadır.

Yüzölçümü düzeltmeleri kadastro sırasında yapılan teknik hataların düzeltilmesini ve çizgisel verilerin kartografik olarak sayısallaştırılmasını öngörerek bir anlamda kadastral düzeltme olarak bir anlam kazanmaktadır (Çete, 2008).

Bu düzeltme, kadastru yapılarak tescili sağlanmış olan bir taşınmazın kadastro paftasının teknik sebeplerce yetersiz kalması, uygulama niteliğini kaybetmesi, zemindeki sınırlarının gerçeği yansıtmadığının belirlenmesi gibi sebeplerden de kaynaklanabilmektedir.

Yüzölçümü tashihi ismiyle de anılabilen yüzölçümü düzeltmeleri, 3402 sayılı Kadastro Kanununun 22. ve 41. Maddelerinde kendisine yer bulmaktadır. Kanunun 22.maddesinde “Tapulama, kadastro veya değişiklik işlemlerine ilişkin; sınırlandırma, ölçü, çizim ve hesaplamalardan kaynaklanan hataları gidermek üzere uygulama niteliğini kaybeden, teknik nedenlerle yetersiz kalan, eksikliği görülen veya zemindeki sınırları gerçeğe uygun göstermediği tespit edilen kadastro haritalarının tekrar düzenlenmesi ve tapu sicilinde gerekli düzeltmelerin sağlanması amacıyla tapulama ve kadastro görmüş yerlerde yüzölçümü düzeltmesi yapılır” denilmektedir. Kanunun 41. Maddesinde de “Kadastro sırasında veya sonrasında yapılan işlemlerle geometrik durumları kesinleşmiş olan taşınmazlarda ölçü, sınırlandırma, tersimat ve hesaplamalardan doğan hatalar, ilgilinin müracaatı veya kadastro müdürlüğünce re’sen düzeltilir. Düzeltme, taşınmaz malikleri ile diğer hak sahiplerine tebliğ olunur. Tebliğ tarihinden başlayan 30 (otuz gün) içinde düzeltmenin kaldırılması yolunda sulh hukuk mahkemesinde dava açılmadığı takdirde, yapılan düzeltme kesinleşir” hükmü açıkça yer almaktadır (Resmi Gazete, 1987).

Yüzölçümü düzeltmesi işlemi, isminden ve yapılan tanımlarından da anlaşılacağı üzere; var olan bir hatanın düzeltilmesine ışık tuttuğundan dolayı, bu hataların sadece şahıslar mülkiyetindeki parseller üzerinde değil, kamu mülkiyetindeki parsellerde de olabileceğinden hareketle Hazine parselleri üzerinde de sıkça uygulanmaktadır.

Kadastru ve aynı zamanda bu suretle tapulaması yapılırken aynen şahıs mülkiyetindeki taşınmazlarda olduğu gibi teknik işlemlere dâhil olan kamu parselleri üzerinde de yüzölçümü hatası ve buna bağlı yüzölçümü düzeltmesi işleminin uygulanması gayet doğaldır. Söz konusu kamu parselleri içerisinde en çok öne çıkan tasarruf hak ve yetkileri Milli Emlak Genel Müdürlüğüne ait olan Hazine parselleridir.

3402 sayılı Kadastro Kanununun ilgili maddeleri ve bu maddelere istinaden tanzim edilerek yürürlüğe girmiş olan Kadastro Yönetmeliklerince yapılan yüzölçümü düzeltmelerinin Milli Emlak Genel Müdürlüğünce incelenmesine olanak tanıyan mevzuat, 327 sayılı Milli Emlak Genel Tebliğidir. Bu tebliğ uyarınca Hazine hak ve menfaatleri yönünden incelenen düzeltme işlemleri, söz konusu düzeltmeye ilişkin Milli Emlak Müdürlüğünce izlenecek usul ve esasları içermektedir.

BULGULAR

327 sayılı Milli Emlak Genel Tebliği mülkiyeti Hazineye ait olan taşınmazlar üzerinde yapılan yüzölçümü düzeltmelerini incelerken hangi durumlarda nasıl karar verileceğini kategorize etmektedir. Genel anlamda, yüzölçümü düzeltmesiyle eğer Hazine parselinin alanında azalma meydana gelmişse; bu azalmanın komşu parsellerde herhangi bir artmaya sebep olup olmadığı incelenmektedir.

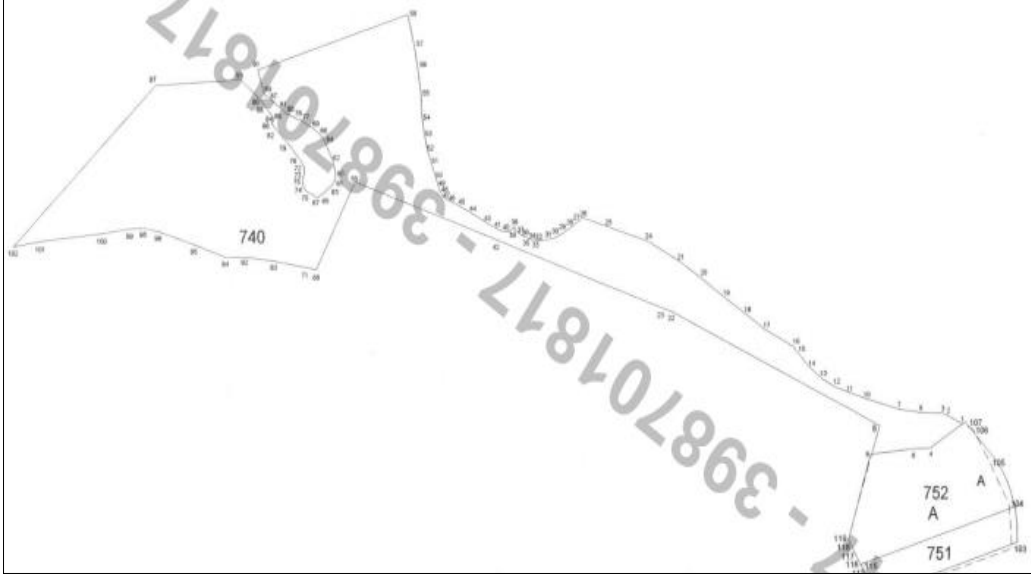
**6TH INTERNATIONAL CONFERENCE ON
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August 1-2, 2022 / Tokyo - Japan**

TEKNİK HATALAR DÜZELTME FORMU				
İli : ŞANLIURFA		DÜZELTMENİN DAYANAĞI		
İlçesi : EYYÜBİYE		(X) 3402 sayılı Kadastro Kanununun 41. Maddesi		
Mah / Köy : KADIKENDİ		() 2019/13 sayılı Genelge		
İŞLEME KONUSU PARSEL / PARSELLERİN				
Pafta	Ada	Parsel	Eski Yüzölçümü	Yeni Yüzölçümü
N41-d-14-b	-	740	158833. m ²	125302.63 m ²
İnceleme Raporu				
İnceleme Nedeni: Şanlıurfa Millî Emlak Müdürlüğü'nün bila tarih ve 3591899 sayılı yazısı.				
Yapılan İnceleme: Şanlıurfa ili Eyyübiye ilçesi Kadıkendi mahallesi 740 nolu parseldeki yüz ölçüm farklığı ile ilgili olarak zeminde, paftasında ve diğer fenni evraklarda yapılan inceleme neticesinde aşağıda ayrıntılı gösterilen hususlar tespit edilmiştir.				
a- Söz konusu parselin, tapulama ve kadastro çalışmaları sırasında Kadıkendi mahallesi kadastro çalışma alanı içinde tescil harici bırakılan yerin Şanlıurfa Millî Emlak Müdürlüğü'nün talebi doğrultusunda hali arazi vassı ile ihdasen Maliye Hazinesi tahdit ve tespiti sonucu oluştuğu, parselin Tapu Müdürlüğüne tescil işleminin 03.01.2022 tarih 43 nolu yevmiye ile yapıldığı.				
b- Fotogrametrik pafta üzerine sınırlandırılması yapılarak yüzölçümünün parsel köşe koordinatlarından sayısal olarak hesaplandığı,				
c- Parselin yüzölçümünün hesap karnesinde 158833. m ² olarak hesaplandığı, fen klasörüne yazıldığı ve tapu kütüğüne de bu şekilde tescil edildiği, parselin sınırlandırılması yapılırken yine Şanlıurfa Millî Emlak Müdürlüğü'nün talebi doğrultusunda tescili yapılan 751 ve 752 nolu parsellerin sınırlarına itibar edilmediğinden ekli krokide A harfi ile gösterilen kısımda 740 nolu parsel ile 751 ve 752 parseller arasında binme oluştuğu ve hatalı sınırlandırma yapıldığı,				
d- Tapu da tescilli yüz ölçüm ile parseller arasındaki binme çıkarıldıktan sonra yeniden hesaplanan yüz ölçüm arasındaki farkın tecviz sınırları dışında olduğu, yüzölçümündeki farklığın basit yazım hatasından kaynaklanmadığı,				
e- Yüz ölçümler arasındaki farkın ise (c) maddesinde belirtilen hatadan ileri geldiği,				
f- Anılan parselin yüzölçümü sayısal verilere göre yeniden hesaplandığında:				
740 no.lu parselin alanının 158833. m ² olmayıp 125302.63 m ² olması gerektiği hususları tespit edilmiştir.				

Şekil 2. Düzeltme Formu (Millî Emlak Müdürlüğü, 2022)

Şekil 2.'de Şanlıurfa İli, Eyyübiye İlçesi, Kadıkendi Mahallesinde bulunan 740 nolu Hazine parseli üzerinde gerçekleştirilen yüzölçümü hatasına istinaden yapılan yüzölçümü düzeltmesi işlemine ait teknik hatalar düzeltme formu verilmektedir. Parselin yüzölçümü 158.833,00 m²'den 125.302,63 m²'ye düşmüştür. Teknik hatalar düzeltme formundan da anlaşılacağı üzere burada hata 740 nolu Hazine parselinin tescili sırasında, zeminde var olan başka bir kadastro parselinin sınırlarına tecavüz etmesidir. Yani 740 nolu Hazine parseli tescil edilirken daha evvel kadastro sırasında kayıt altına alınan başka bir parselin üzerine kısmen binme olmuştur. 3402 sayılı kanun çerçevesinde "bir yerin kadastro 1 (bir) kez yapılır" düsturundan hareketle; söz konusu binme, var olan parselin üzerine yeni bir kadastro yapıldığı anlamı ihtiva ettiği için Hazine parselinin evvelden kadastro yapılan yere denk gelen mükerrer kısmının iptal edilmesi gerekmektedir. Bu sebeple Hazine parselinin alanı her ne kadar 33.530,37 m² azalsa da yapılan yüzölçümü düzeltmesi işlemine muvafakat edilmiştir.

Şekil 3.'te yüzölçümü düzeltme formu eklerinde yer alan düzeltme krokisine yer verilmektedir. Söz konusu 740 nolu parselin 752 ve 751 nolu parsellerle mükerrer olan kısımları görülmektedir.



Şekil 3. Düzeltme Formu Eki Kroki (Milli Emlak Müdürlüğü, 2022)

TEKNİK HATALAR DÜZELTME FORMU				
İli : ŞANLIURFA		DÜZELTMENİN DAYANAĞI		
İlçesi : KARAKÖPRÜ		(X) 3402 sayılı Kadastro Kanununun 41. Maddesi		
Mah / Köy : KASIMKUYU		() 2019/13 sayılı Genelge		
İŞLEME KONU PARSEL / PARSELLERİN				
Pafta	Ada	Parsel	Eski Yüzölçümü	Yeni Yüzölçümü
N41-A-02-D	-	223	20750.00 m ²	22972.63 m ² ✓
			✓	✓
İnceleme Raporu				
İnceleme Nedeni: Arazi Toplulaştırma Çalışmaları.				
Yapılan İnceleme: Şanlıurfa ili, Karaköprü ilçesi, Kasımkuşu mahallesi 223 nolu parseldeki yüz ölçüm farklılığı ile ilgili olarak zeminde, paftasında ve diğer fenni evraklarda yapılan inceleme neticesinde aşağıda ayrıntılı gösterilen hususlar tespit edilmiştir. a- Söz konusu parselin, tapulama ve kadastro çalışmaları sırasında Kasımkuşu mahallesi kadastro çalışma alanı içinde, senetsizden Tarla vasfı ile şahıs adına tahdit ve tespitinin yapıldığı, b- Fotoğrametrik pafta üzerine sınırlandırılması yapılarak yüzölçümünün planimetre ile hesaplandığı, c- Tapulama sırasında sınırlandırılan parselin yüzölçümü; Planimetre hesap karnesinde 21750.00 m² olarak hesaplandığı, fen klasörüne ve tapulama tutanağına 20750.00 m² yazıldığı ve tapu kütüğüne de bu şekilde tescil edildiği, tapulama işleminden sonra sınırlarında eylemli bir değişikliğin olmadığı, orijinal ölçü değerlerine göre komşu parsellerle aralarındaki sınırlarla ilgili olarak herhangi bir ihtilafın bulunmadığı, yapılan düzeltmenin komşu parselleri etkilemediği, d- Tapu da tescilli yüz ölçüm ile sayısal olarak yeniden hesaplanan yüz ölçüm arasındaki farkın tecviz sınırları dışında olduğu, yüzölçümündeki farklılığın basit yazım hatasından kaynaklanmadığı, e- Yüz ölçümler arasındaki farkın ise planimetre çevrimine bağlı hesap hatasından ileri geldiği, f- Anılan parselin yüzölçümü sayısal verilere göre yeniden hesaplandığında; 223 nolu parselin alanının 20750.00 m² olmayıp 22972.63 m² olması gerektiği, g- Parsel sayısal yüzölçümü iktisap tarihindeki ziyetlik esaslarınca verilmesi gereken 20000.00 m²'yi aşarak miktar fazlalığı oluştuğu, hususları tespit edilmiştir.				

Şekil 4. Düzeltme Formu (Milli Emlak Müdürlüğü, 2022)

Şekil 4.'te Şanlıurfa İli, Karaköprü İlçesi, Kasımkuyu Mahallesiinde bulunan 223 nolu şahıs parseli üzerinde gerçekleştirilen yüzölçümü düzeltmesi işlemine ait teknik hatalar düzeltme formu verilmektedir. Parselin yüzölçümü 20.750,00 m²'den 22.972,63 m²'ye çıkmaktadır. Burada söz konusu parsel, Hazine parseli değildir. Kadastro Müdürlüğünce tanzim edilen yüzölçümü düzeltme formunda söz konusu parselin tarla vasfı ile tahdit ve tespitinin senetsizden yapıldığı ve parselin sayısal yüzölçümünün iktisap tarihindeki zilyetlik esaslarında verilmesi gereken 20.000,00 m²'yi aşarak miktar fazlalığı olduğu tespit edilmiştir. Yüzölçümü düzeltmesi işlemine konu olan 223 nolu parselin senetsizden şahıs adına tescil edildiği göz önünde bulundurulduğunda; en fazla 20.000,00 m²'ye kadar miktarın tescil edilebileceği ve bu miktarı aşan kısmın ise Hazine adına tescil edilmesi gerektiğinden hareketle parselde meydana gelen 2.222,63 m²'lik kısmın Hazine adına tescil edilmesi gerektiği kanaatine, yapılan yüzölçümü düzeltmesi işlemine muvafakat verilmemiştir.

TARTIŞMA

327 sayılı Milli Emlak Tebliği her ne kadar Hazine parseli üzerinde gerçekleştirilen yüzölçümü düzeltmeleri işlemine yasal dayanak olarak yayımlansa da bu tebliğin yetersiz kaldığı işlemler olabilmektedir. Şekil 2.'de yer alan örnekte Hazine parselinin yüzölçümündeki azalmanın komşusu olan şahıs parsellerinin yüzölçümlerinde bir artışa sebep olmadığından ve söz konusu parsellerin sınırlarında eylemli bir değişikliğe sebep olmadığından Kadastro Müdürlüğünce yapılan işleme muvafakat verilmiştir. Ancak Şekil 4.'te yer alan örnekte 327 sayılı tebliğde herhangi bir açık hüküm bulunmadığından dolayı parsel dosyası ve yüzölçümü düzeltme formundaki bilgiler ışığında kamu menfaati yönünde kanaat getirilerek karar verilmiş ve Kadastro Müdürlüğünce yapılan işleme muvafakat verilmemiştir.

SONUÇ

Her türlü tasarruf yetkisi Milli Emlak Müdürlüğüne bağlı olan Hazine parselleri üzerinde yapılagelen her türlü kontrollük işlemi gibi yüzölçümü düzeltmesi de dikkatlice irdelenip Hazine hukukunca karar verilmesi gereken bir işlem olarak öne çıkmaktadır. Bu işlemler, 3402 sayılı Kadastro Kanununun 22. ve 41. maddeleri başta olmak üzere, kanunun bu maddelerine istinaden çıkarılmış olan Kadastro Sırasında veya Sonrasında Yapılan İşlemlerle Geometrik Durumları Kesinleşmiş Olan Taşınmazlarda Ölçü, Sınırlandırma, Tersimat ve Hesaplamalardan Doğan Hataların Düzeltilmesi Yönetmeliği ve Tapulama ve Kadastro Paftalarını Yenileme Yönetmeliğine göre yapılırken, Milli Emlak Müdürlüklerince kontrolü ise 327 sayılı Milli Emlak Genel Tebliğine göre gerçekleştirilmektedir. Ancak bazı durumlarda söz konusu tebliğin yetersiz kaldığı ya da yapılan işlem detayına daire bir düzenleme içermediği durumlarla karşılaşılabilir. Bu durumlarda da Hazine hak ve menfaatlerine zeval vermemek adına işlem her yönüyle kontrol edilmeli ve işlemin içerdiği her detaya ışık tutacak bilgi ve belgeler araştırılarak nesnel kararlar verilmelidir. Kadastro Müdürlüğünce yapılan yüzölçümü düzeltmesine eğer muvafakat verilmeyecekse yasal süresi olan 30 (otuz) gün içerisinde işleme karşı dava yoluna gidilerek olası bir Hazine zararının önüne geçilmiş olacaktır.

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**DEVELOPMENT OF MAINTENANCE COST ESTIMATION FOR SMALL HYDRO
POWER PLANTS**

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Abstract

In this study, a new equation model is proposed to improve the maintenance costs of small hydroelectric power plants (SHPP). The proposed equation model consists of 4 terms and 7 parameters using the Peafowl (*Pavo muticus/cristatus*) Optimization Algorithm (POA). In the study, corrected data from 8 SHPP in India were used. These data cover the maintenance costs of all components for the years 2015-2016. In the study, different from the literature, the flow parameter was added to the power and head parameters. In this way, a more sensitive equation model was developed for SHPP data. In addition, realistic results were obtained by applying constraints to the parameters. In this case, the average error value for 14 maintenance items required for a SHPP was calculated as 17.4819%.

Keywords: Small Hydroelectric Power Plants, Maintenance Cost Estimation, Sensitivity Analysis

1. Introduction

The need for energy is increasing rapidly with developing technology and increasing world population. This increasing energy demand is mostly provided by fossil-based sources. Considering the damage caused by this situation to the environment, the importance of renewable energy sources increases (Karmendra Kumar Agrawal, Shibani Khanra Jha, Ravi Kant Mittal 2022; Uzar 2020). The main renewable energy sources are; hydroelectric, wind, solar, geothermal and biomass energy sources.

This study was carried out in three stages. First, the error rates of the correlation model developed in the literature were recalculated using the corrected SHPP data. In the second stage, new coefficients were obtained by adding the flow parameter to the correlation model and the calculated error values were compared with the results in the literature. In the last stage, unlike the literature, the changes of the proposed equation model depending on the parameter values were examined and a sensitivity analysis was performed. As a result, it was seen that the correlation model proposed in the study determined the maintenance costs with less errors.

2. Small Hydropower Plant and Components

Energy production in river type HPP's, which is one of the types of hydroelectric power plants, is proportional to the flow of water. Although the unit costs of small HPPs are high, they have a long life and negative effects on people and the environment are negligible. A river type HPP consists of water intake unit, gallery, transmission channel, forebay, powerhouse, water outlet unit. In addition, the powerhouse consists of turbines, generators, transformers, switchyard facilities, command, control and control elements and auxiliary equipment.

A HPP basically consists of construction, electromechanical and hydromechanical equipment and their subcomponents. These components are given in detail in Figure 2 (Kumar et al. 2020).

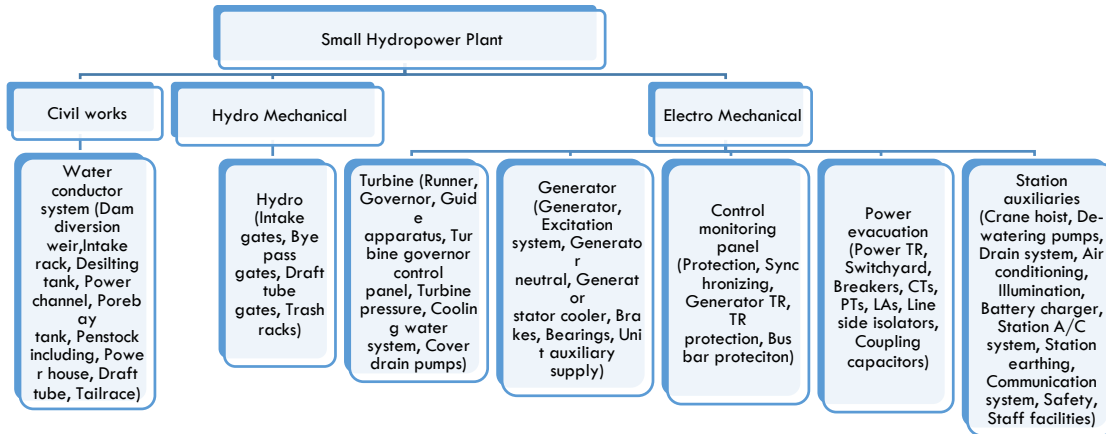


Figure 4. Detail of SHPP Components

Repair and maintenance works in HPP directly affect the operating life of the system. For this, maintenance work includes regular and systematic work. Effective operation and maintenance is one of the most cost-effective approaches to achieving higher energy efficiency. Insufficient maintenance of power plants causes unit energy costs to increase.

2.1. Data Collection

In this study, data from 8 SHPP in India were used. These data cover the maintenance costs of all components for the years 2015-2016. The power plant data for SHPP are given in Figure 3 (United Nations Framework Convention on Climate Change n.d.).

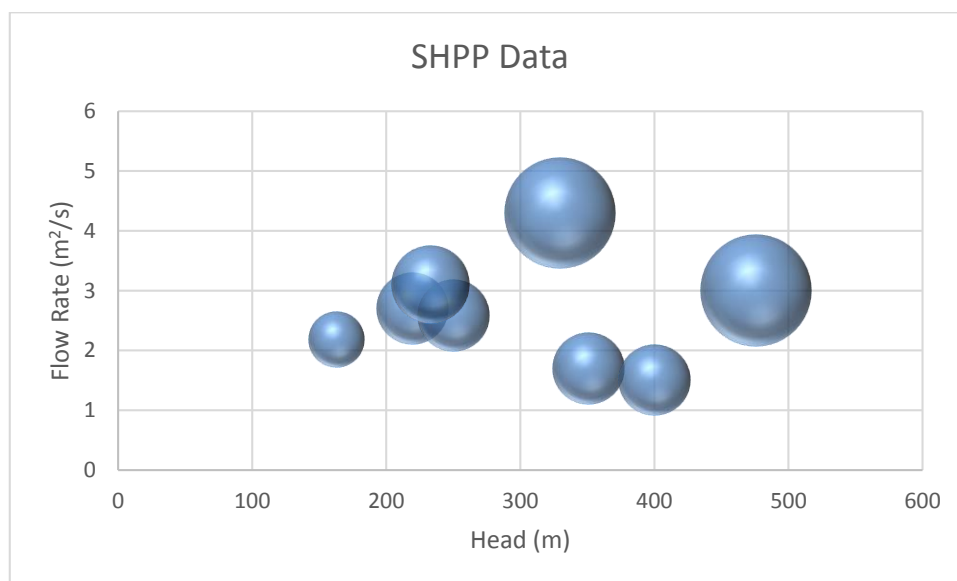


Figure 5. SHPP Data

2.2. Developed Equation Model

Many analytical correlation methods have been proposed in the literature for cost calculation of electromechanical equipment. It is generally represented by the following equation (Cavazzini et al. 2016; Celikdemir, Yildirim, and Ozdemir 2017).

$$\text{Cost } [\$] = a P^b + c H^d + e Q^f + g \quad (1)$$

In Equation 1, “a and b” are the weight of the P (kW) power expression, “c and d” are the weight of the H (m) head expression, and “e and f” are weight of the Q (m³/s) flow expression. Although better results may be obtained when these weights are taken as negative, the weights must be positive to be more realistic. For this, the weights are positive real numbers. Equation 1 proposed for the investment cost model HPPs has been developed.

For this, the optimum values of the coefficients in Equation 1 were determined separately for each maintenance cost using POA and are given in Table 2 (Wang et al. 2022).

Table 1. Coefficient Parameters for the Proposed Equation Model

Component	a	b	c	d	e	f	g
Turbine	0.698557	4.294794	32.72562	0.562217	2081.046	1.714907	144.5411
Main inlet valve (MIV)	851.2471	0.791228	7.01079	0.791732	3.874605	4.081728	-264.658
Generator	1047.519	1.107083	10.67688	0.132195	74.67233	2.901739	96.94424
Thrust bearing	0.393331	3.707275	8.8809	0.816154	0.190436	5.783192	6.051182
Governor	678.0206	1.023596	0.464932	0.452947	124.7796	2.193964	-25.8276
Oil pressure unit (OPU)	107.4133	1.462108	12.2603	0.462201	196.0348	1.633853	794.357
Control panel	27.75594	2.568188	2.860927	0.718667	4112.165	0.762245	-5344.14
Transformer	3.517244	2.530749	0.742108	1.258029	0.555896	4.256665	897.8485
Switchyard	1.857732	2.49357	10.71817	0.915983	4.046528	4.305202	4758.941
Desilting tank	0.997891	2.811734	359.8555	0.429108	0.487902	4.863487	-1.93133
Power channel	0.001008	0.286092	11139.34	1.07E-06	14.14716	9.72E-06	-653.26
Penstock	1.68E-05	0.079193	419.7806	0.386657	39.57226	0.00281	-8.27214
Gates	11.21851	2.729121	0.006329	0.361564	2818.363	0.683863	-3780.71
Station auxiliaries	46.02745	0.562321	2.91556	1.229814	515.1306	1.538834	1297.404

2.3. Sensitivity Analysis

Sensitivity analysis was performed in order to see the effects of the parameters in the proposed equation model on the cost. For the sensitivity analysis, the parameters in the equation model were examined

respectively. In this way, the effect of the parameters on the cost can be clearly seen. In the proposed equation model, sensitivity analyzes are given for some maintenance costs by using the parameters in Table 2.

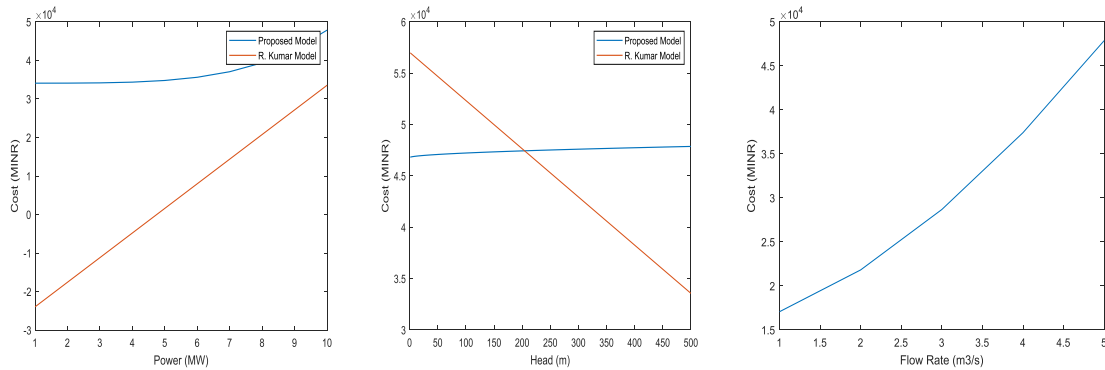


Figure 6. Sensitivity Analysis for Turbine Cost

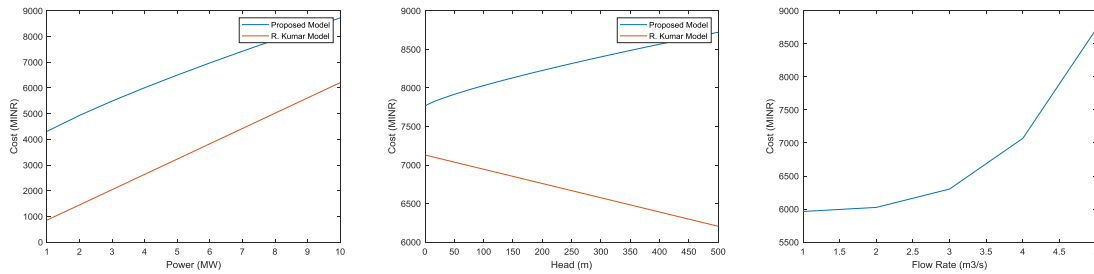


Figure 7. Sensitivity Analysis for MIV Cost

Sensitivity analysis of turbine maintenance costs is given in Figure 3. According to this; In the literature correlation, it is seen that the maintenance cost decreases with the increasing flow parameter, but the maintenance cost increases in the developed correlation. Similarly, the sensitivity analysis of main inlet valve maintenance costs is given in Figure 4.

3. Result and Discussion

In this study, a correlation model was developed by examining the maintenance costs of 8 river type HPPs in India. For this, actual maintenance costs and adjusted plant data for the years 2015-2016 were used. Developed and literature correlation model mean error results are given in Table 3.

Table 2. Error Rates of Maintenance Costs

Plant Name	Turbine	MIV	Generator	Thrust Bearing	Governor	OPU	Control Panel	Trans former	Switchyard	Desilting Tank	Power Channel	Penstock	Gates	Station Auxiliaries	Total
Proposed Model	23.9 9	11.6 7	14.3 4	12.0 8	14.3 8	13.5 4	20. 51	13. 45	11.1 8	14.5 0	35.0 9	17.6 2	29.9 0	12.4 2	17.4 8
R. Kumar Model (Kumar)	27.0 2	15.2 5	17.6 9	14.2 2	16.3 6	14.9 8	23. 14	16. 74	13.6 5	16.1 8	6.91	15.3 5	35.1 9	14.0 4	17.6 2

Considering the 14 different maintenance cost parameters examined in the study, the correlation model was carried out to give better results than the literature for 12 maintenance costs except the power channel and penstock cost.

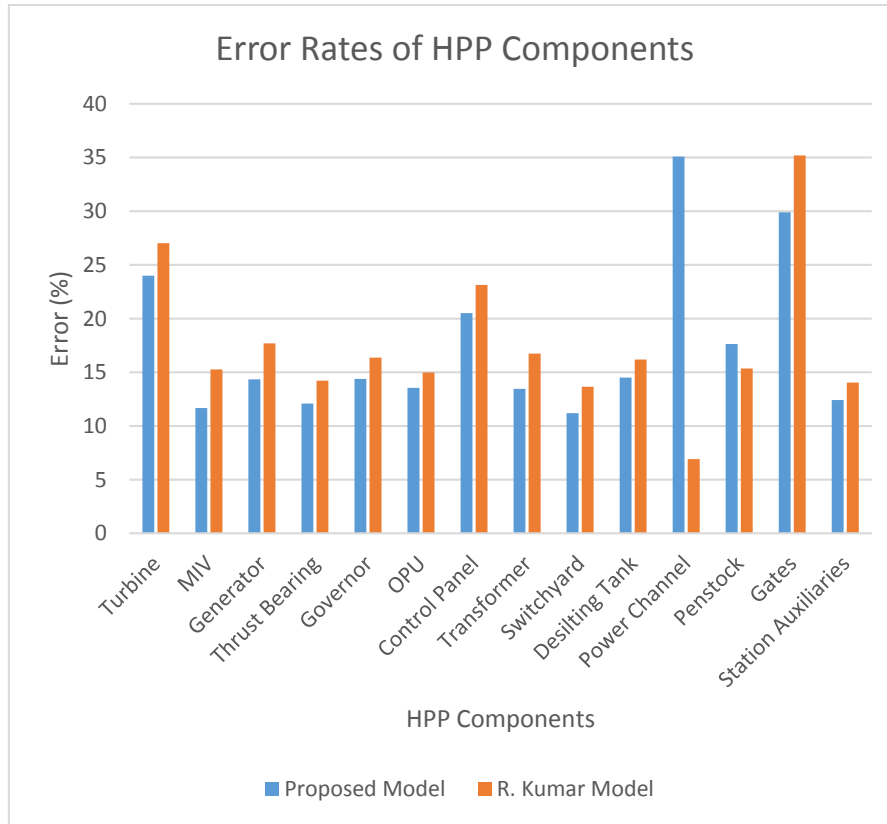


Figure 8. Literature and Proposed Equation Model Error Graph

Similarly, when the results of the developed and literature correlation model are examined, the biggest error rate belongs to Gaj HPP. Since this error rate is not within the acceptable range, it can be assumed that there is an error in the data and maintenance costs of this plant.

4. Conclusions

Considering the 14 different maintenance cost parameters examined in the study, a correlation model was proposed to give better results than the literature for other maintenance costs except the power channel and penstock cost.

With this study, the cost of a HPP to be maintained can be predicted with high accuracy using the proposed equation model. Also, in the future, its accuracy can be further improved by adding new HPP data to the proposed equation model. The proposed cost equation model, unlike this study, can be developed by adding or subtracting different terms and parameters.

The literature of this study;

- Suggesting a more sensitive equation model by adding a new parameter to the correlation model,
- Obtaining more realistic results by limiting power, head and flow parameters in the correlation model,
- Suggesting a Peafowl (*Pavo muticus / cristatus*) optimization algorithm to estimate these cost equation parameters

contributions have been made.

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**INVESTIGATION DIFFERENT USAGE METHODS OF GREEN HYDROGEN BASED ON
FLOATING SOLAR PHOTOVOLTAIC IN VESSELS: THE CASE OF VAN LAKE**

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Abstract

In the study, alternative approaches for the energy needs of vessels and obtaining this needed energy from renewable energy sources (RES) are suggested. These approaches include producing and storing green hydrogen with zero carbon emissions and using different types of fuel. Solar Power Plant (SPP) sizing has been done for hydrogen production. For this, 19 different situations were analyzed, including the internal combustion engine of vessels. Among the analyzed cases, different use cases of hydrogen were also considered. These are compressed and liquefied hydrogen. In addition to this use case, different fuel cell operating conditions are also examined. These fuel cells are Polymer Electrolyte Membrane Fuel Cells (PEMFC) and Solid Oxide Fuel Cell (SOFC). As a result, the highest efficiency is the use of compressed hydrogen in fuel cells with 30.59%. On the other hand, the lowest efficiency is the use of marine gas oil with 13.85%.

Keywords: The Van Lake Basin, Hydrogen Energy, Techno-Economic Analysis

I. Introduction

The need for energy is increasing rapidly with the increase in the world population and economic development. Today, this increasing energy need is mostly supplied from fossil-based sources. (Colak, Memisoglu, and Gercek 2020). Considering the damage of fossil-based resources to the environment and their depletion, the search for new resource emerges. This situation increases the importance of RES. Among the RES, solar energy has a large share. In the study, the conversion of the energy produced by floating SPP's to a different energy source and its use were examined. In this regard, hydrogen; although it is not among the energy sources, it has an important share as an energy carrier.

Hydrogen is the most abundant element in the universe, with the highest energy content among all known energy sources. The energy produced with hydrogen can be transported from one place to another with less loss. Another feature that makes hydrogen an ideal energy carrier is its high energy content. Hydrogen is an energy carrier and can be transported more efficiently than electrical energy. It was stated by Dinçer that the hydrogen age started (Dincer 2020). As a result, hydrogen production is now an important engineering application.

As in the rest of the world, maritime transport is one of the most preferred methods in Turkey. Today, these transportation activities are carried out by diesel-powered ships. These fossil fuel-using ships have many harmful effects on human health and the environment. In the study, different methodological approaches were examined to minimize these harmful effects. For this, 19 different situations were analyzed, including the internal combustion engine of vessels. Among the analyzed cases, different use cases of hydrogen were also considered.

In the study, Van Lake, Turkey's largest lake, where maritime transport is actively used, has been examined as a sample location. Maritime transportation in Van Lake has high carbon emission values. This situation constitutes the most important source of motivation for the study. The study was carried out in three stages. As a first step, the annual energy needs of vessels on Van Lake were calculated. As a second step, the conditions of supplying the energy needed for maritime vehicles from different sources were examined. It has been designed to obtain the green hydrogen required for this from solar

energy. As a final step, the system efficiencies were compared, including the sub-components of the different scenarios examined.

II. Van Lake and Maritime Transport

Van Lake is the largest lake in Turkey, located in the Eastern Anatolia Region. Van Lake, which has salty and soda water features, has an altitude of 1646 m and an area of 3713 km² (Republic of Türkiye Ministry of Environment Urbanization and Climate Change n.d.). In Van Lake, freight and passenger transportation is carried out between Tatvan and Van by ferries belonging of Turkish State Railways (TCDD) Vangölü Ferry Directorate. In addition, there are sea buses for tourism purposes and many boats that carry out fishing activities. The visual of the vessels on the Van Lake is given in Figure 1.

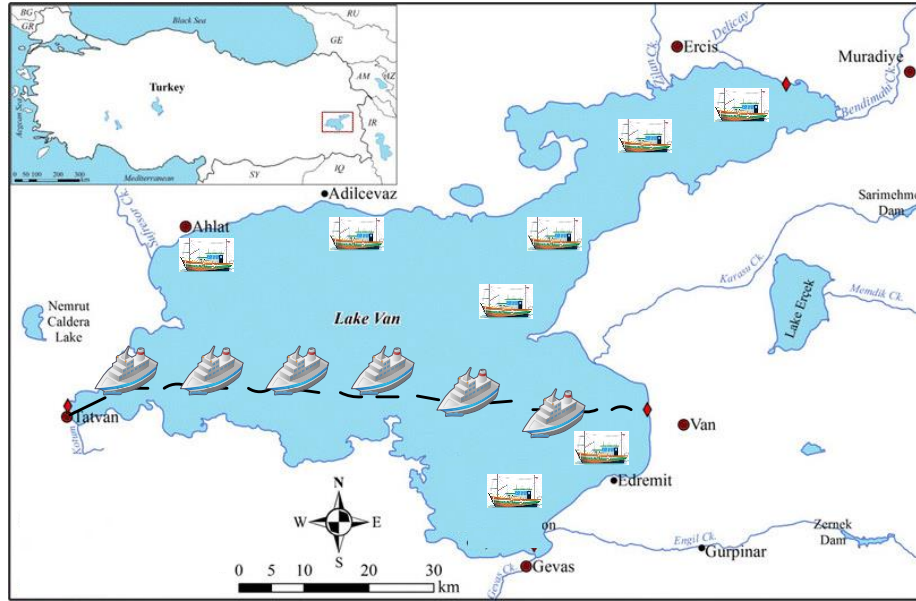


Figure 9. The Van Lake and Vessels Map

The energy needs of vessels operating in Van Lake are met from fossil fuels. In the study, it is proposed to meet this needed energy with a different approach. This proposal covers the transition from fossil fuel to green hydrogen. At the same time, it was preferred to be met by SPP for green hydrogen production. The energy produced by the SPP will be used in the electrolysis of the water of Van Lake. There are many electrolysis technologies in the literature. In this study, the most advanced and widely used Polymer Electrolyte Membrane (PEM) electrolysis is taken as reference.

II. Solar Power Plant Design

The total power of the vessels operating in Van Lake is 36780 kW and the total fuel consumption of these vessels in 2020 is approximately 3400 tons of diesel (Aygül 2021). Accordingly, 19 different situations are given in Table 2 to meet the amount of energy needed by the vessels in the Van Lake.

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Table 3. Energy Outputs for Different Fuel States

Electric Motor	Fuel Cell Efficiency	Reformer	Electricity	Hydrogenation	Engine Efficiency	Reformer	Electricity	Hydrogenation	Hydrogen Losses	Compression Electricity	Liquefaction Electricity	Synthesis	Fuel Plant Electricity	Metanol Plant Electricity	Ammonia Plant Electricity	Methanation	Electricity (DAC)	Electrolysis
36780	37920.2								66829.3		70433.7							85476.7
36780	37920.2								66829.3		70433.7							85476.7
					36780				81725.2		86138.8							104528.8
36780	37920.2								66829.3	67160.3								74516.3
36780	37920.2								66829.3	67160.3								74516.3
					36780				81725.2	82129.7								91104.1
36780	37920.2	66829.3	99563.5	100556.5														103572.5
36780	37920.2	74700.2	78451.7	79224.1														81614.8

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					36780	81725.2	102174.8	103204.7											106294.2
36780	37920.2										62452.4						63997.2	76833.4	95591.2
36780	37920.2										62452.4						63997.2	76833.4	95591.2
					36780						73560.0						75399.0	90478.8	112546.8
36780	37920.2	66829.3										88823.7				101807.0			109825.1
36780	37920.2											62452.4				71573.9			77201.2
					36780							73560.0				84299.8			90920.2
36780	37920.2	66829.3										83527.4			102579.4				161868.8
36780	37920.2											62452.4			76723.1				121043.0
					36780							81725.2			100372.6				158411.5
					36780							81725.2	122367.1						182318.5

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Among the 19 analyzed cases, the worst case scenario is calculated as 265514.8 kWh for MGO-ICE, which is shown in red, and the best case is calculated as 120197 kWh for CGH₂-PEM FC and CGH₂-SOFC, which is shown in green. For the SPP to be sized, it should have an installed power of 180 kWp when the worst-case scenario is taken as reference, and 80 kWp when the best-case scenario is taken as a reference. The data for the region for the worst-case scenario are given in Table 3.

Table 4. The Data for the Region

	Latitude	Longitude	DNI (kWh/m ²)	GHI (kWh/m ²)	DIF (kWh/m ²)	Elevation (m)	Power (kW _p)	Annual Energy (MWh/year)	Temperature (°C)
Zone	38.6383	43.124084	2146.2	1859.5	567.7	1645	180	270.562	11.8

Annual energy amounts of the SPP to be installed on Van Lake are given in Table 4.

Table 5. Monthly Average Energy

Months	PVout (kWh/kWp)	Energy (kWh)	DNI (kWh/m ²)
Jan	66.8	12028.9	109.4
Feb	80.7	14519.6	112.8
Mar	116.8	21020.4	144.2
Apr	135.4	24375.8	150.3
May	166.4	29943.7	207.1
Jun	184.9	33282.4	276.9
Jul	186.5	33564.7	267.2
Aug	173.4	31207.4	252
Sep	147.8	26606.4	231.3
Oct	107.7	19387.3	157.2
Nov	77	13866.6	131.7
Dec	59.8	10758.7	108.5
Annual	1503.1	270562	2148.8

IV. Results

In this study, 19 different scenarios were examined to meet the energy needs of maritime transport vessels in Van Lake. Among these scenarios, different uses of hydrogen and its working in different

fuel cell situations are discussed. For each scenario situation, the sub-parameters were examined separately. As a result, the efficiency of the scenario and sub-parameters are given in Figure 1.

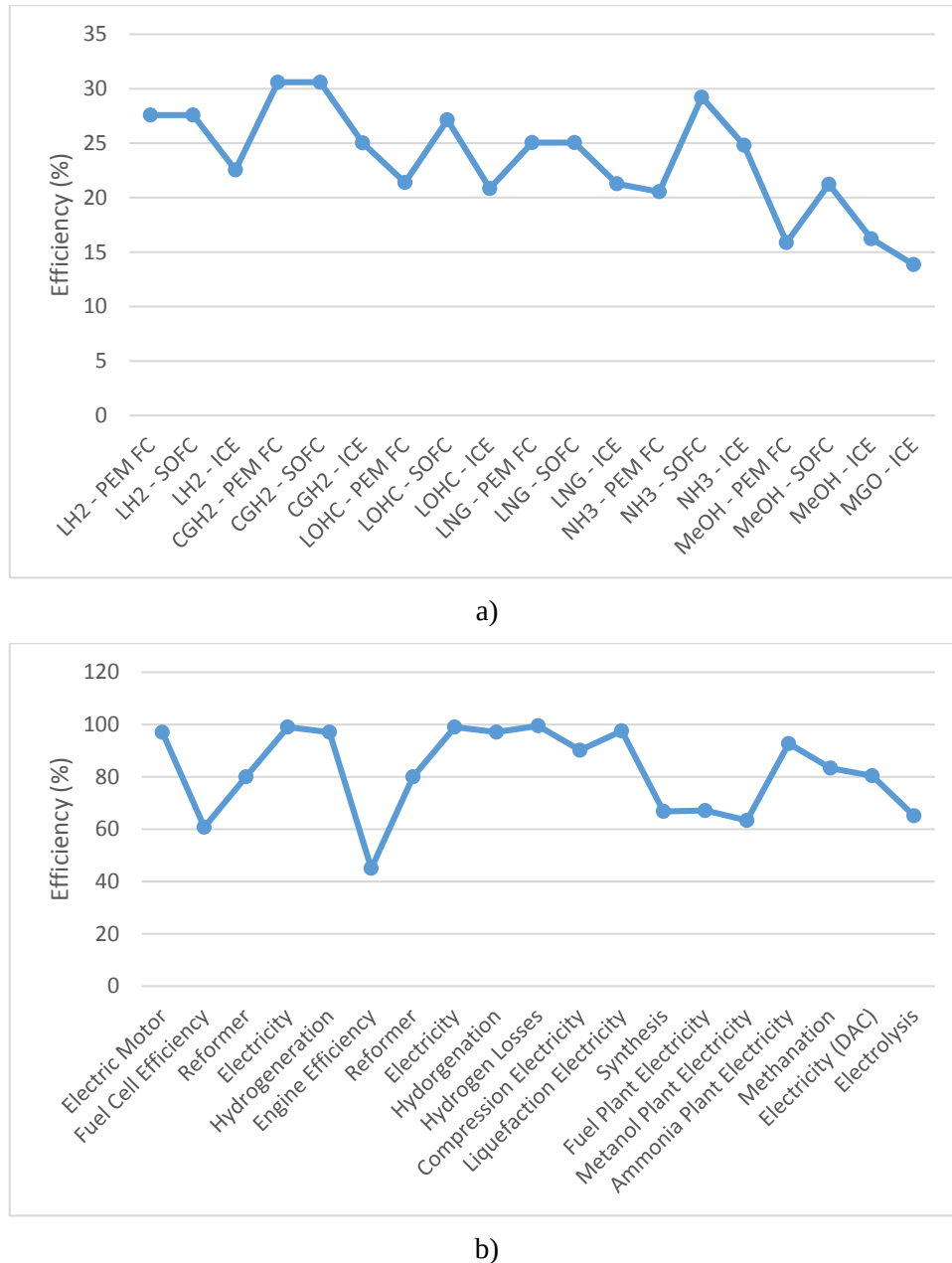


Figure 10. a) Efficiency of Scenario Situations b) Efficiency of Sub-parameters

According to these results, the highest efficiency is CGH₂-PEMFC and CGH₂-SOFC (30.59%). On the other hand, the lowest efficiency is the use of MGO-ICE with 13.85%.

V. Conclusions

In this study, alternative approaches with zero carbon emissions are proposed for vessels operating on fossil fuels. These approaches are; It is based on the principles of production, storage and different use of green hydrogen. In the study, SPP, one of the important RES, was preferred for green hydrogen production. The use of compressed hydrogen produced by SPPs is more efficient than other fuel uses. Similarly, the use of PEMFC and SOFC fuel cells is more efficient than internal combustion engines. Among the 19 different cases examined in the study, the worst case scenario was calculated as 265514.8 kWh for MGO-ICE, and the best case scenario was calculated as 120197 kWh for CGH₂-PEM FC and CGH₂-SOFC. For the SPP to be sized, it should have an installed power of 180 kWp when the worst-

case scenario is taken as reference, and 80 kWp when the best-case scenario is taken as a reference. In this case, 270.562 MWh of energy will be produced annually by SPP.

As a result, the energy needs of vessels will be met with the RES to be established on Van Lake. For this, green hydrogen will be produced with SPPs, which are one of the important RESs. The green hydrogen produced will be compressed and used in fuel cells. In this way, the carbon emission values given to the environment by vessels will be significantly reduced.

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TÜRK ROMANINDA MÜBADELE

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Özet

Mübadele, Arapça kökenli mubādala¹ sözcüğünden gelmekte olup değiş tokuş etme, bedeliyle değiştirme ve bedel anlamlarına gelir. Türkiye Cumhuriyeti tarihinde Lozan Barış Antlaşması'na 30 Ocak 1923 tarihli ek protokol ile "mübadele" resmen yürürlüğe girer. Buna göre Türk topraklarında yerleşmiş olan Rum Ortodoks dininden Türk uyrukları ile Yunan topraklarında yerleşmiş Müslüman dininden Yunan uyruklar yer değiştirirler. Bu uygulama Türkiye'de ve Yunanistan'da yaşayan Rumların ve Türklerin büyük trajediler yaşamasına sebep olur. Mübadele ile ilgili anlatımlar Türk romanına da yansır. Bu eserlerde ayrılık, ölüm, zulüm, aşk, hasret gibi temalar öne çıkar.

Mübadele ve göç temalarının işlendiği ilk eserler şunlardır: Sarduvan (Faik Baysal), Dikmen Yıldızı (Aka Gündüz), Panaroma (Yakup Kadri Karaosmanoğlu), Ateş Gecesi (Reşat Nuri). 1960'lı ve 1970'li yıllarda yazılan bazı romanlar şöyledir: Ateş Yılları (Hasan İzzettin Dinamo), Anayurt Otel (Yusuf Atılgan), Kurt Kanunu (Kemal Tahir). 1990'lardan sonra mübadele ile ilgili romanların sayısı artar. Bu yıllarda göç ve mübadele konularına ağırlık veren eserlerin bir kısmı şunlardır: Bir Avuç Mazi (Fügen Ünal Şen), Ah Bre Sevda Ah Bre Vatan (Demet Altınyeleklioğlu), Mor Kaftanlı Selanik (Yılmaz Karakoyunlu), Emanet Çeyiz - Mübadele İnsanları (Kemal Yalçın), Ulya Ege'nin Kıyısında (Ahmet Yorulmaz), Ah Mana Mu (Handan Gökçek), Giritli Mustafa (Ertuğrul Erol Ergir), Çalı Harmanı (Akın Üner), Mübadele Günlerinde Aşk (Belgin Karabulut), Maria - Göç Acısı (Ertuğrul Aladağ), Mübadil (Handan Öztürk), Elveda Rumeli (Murtaza Kölemesli), Pavli Kardeş (Fikret Otyam), Düşlerde Kalan Girit, Düşlerde Kalan Mübadele (Ferda Bozoklar Ardalı), Büyük Ayrılık (Kemal Anadol), Mübadiller (Yılmaz Gürbüz), Fırat Suyu Kan Akıyor Baksana,

Karınca'nın Su İçtiği, Tanyeri Horozları,

Çıplak Deniz Çıplak Ada (Yaşar Kemal), Hasret (Canan Tan). Bu çalışmada amaç, Türk edebiyatında mübadele konusunun işlendiği bazı romanlar hakkında bilgi vermektir.

Anahtar Kelimeler: Türk romanı, mübadele, ayrılık, aşk, özlem temaları.

POPULATION EXCHANGE IN TURKISH NOVEL

Abstract

Population exchange comes from the Arabic word mubādala¹, which means exchange, exchange with price and price. With the additional protocol dated January 30, 1923 to the Lausanne Peace Treaty in the history of the Republic of Turkey, the "population Exchange" officially entered into force. Accordingly, Turkish nationals from the Greek Orthodox religion settled in Turkish territory and Greek nationals from the Muslim religion settled in Greek territory are exchanged. This practice causes great tragedies for Greeks and Turks living in Turkey and Greece. The narratives about the exchange are also reflected in the Turkish novel. In these works, themes such as separation, death, cruelty, love and longing come to the fore.

The first works that deal with the exchange and migration themes are: Sarduvan (Faik Baysal), Dikmen Yıldızı (Aka Gündüz), Panorama (Yakup Kadri Karaosmanoğlu), Ateş Gecesi (Reşat Nuri). Some of the novels written in the 1960s and 1970s are as follows: Ateş Yılları (Hasan İzzettin Dinamo), Anayurt Otel (Yusuf Atılgan), Kurt Kanunu (Kemal Tahir). After the 1990s, the number of novels about

exchange increased. Some of the works focusing on migration and population exchange in these years are: *Bir Avuç Mazi* (Fügen Ünal Şen), *Mor Kaftanlı Selanik* (Yılmaz Karakoyunlu), *Emanet Çeyiz - Mübadele İnsanları* (Kemal Yalçın), *Ulya Ege'nin Kıyısında* (Ahmet Yorulmaz), *Ah Mana Mu* (Handan Gökçek), *Çalı Harmanı* (Akın Üner), *Mübadele Günlerinde Aşk* (Belgin Karabulut), *Maria - Göç Acısı* (Ertuğrul Aladağ), *Mübadil* (Handan Öztürk), *Elveda Rumeli* (Murtaza Kölemezli), *Pavli Kardeş* (Fikret Otyam), *Büyük Ayrılık* (Kemal Anadol), *Mübadiller* (Yılmaz Gürbüz), *Fırat Suyu Kan Akıyor Baksana*, *Karınca'nın Su İçtiği*, *Tanyeri Horozları*, *Çıplak Deniz Çıplak Ada* (Yaşar Kemal), *Hasret* (Canan Tan). The aim of this study is to give information about some novels in Turkish literature that deal with the subject of exchange.

Key Words: Türk romanı, population exchange. themes of separation, love, longing.

GİRİŞ

Mübadele, mubādala¹ sözcüğünden gelen Arapça kökenli bir kelime olup bedel, değiş tokuş etme, bedeliyle değiştirme anlamlarına gelir. Mübadele, Lozan Barış Antlaşması'na 30 Ocak 1923 tarihli ek protokol ile yürürlüğe girer. Bu bağlamda Türk topraklarındaki Romlar ile Yunan topraklarındaki Türkler yer değiştirecektir. Mübadil Türkler ve Rumlar yeni mekânlarında büyük zorluklar yaşamışlardır. Bir kısmı ötekileştirilmiştir. Yunanistan'da 1.200.000 Rum göçmen gitmeden önce bu ülkenin nüfusu 5.000.000 civarındadır. Türkiye'nin nüfusu 10.200.000 iken 460.000 göçmen Türkiye'ye gelir (Erdal, 2012: 342). Uzun süre yaşadıkları yerleri terk etmek mübadiller için trajik sonuçlar ortaya çıkarır. "Türklerin büyük nüfus içerisinde dağılmaları kolay olmuştur ve Yunanistan'daki Rumlar kadar ötekileştirme tehlikesi yaşamamışlardır" (Doğruyol, 2016: 10). Türkiye Cumhuriyeti, bir yıldan fazla bir sürede 500.000 halkı Yunanistan'dan Türkiye'ye getirip yerleştirir. "Viyana ve Varşova kapılarından bugünkü kapılarımıza kadar olan bu gün üzerinde büyük büyük devletler teşekkül etmiş bulunan geniş sahada milyonlarca Türk yaşamaktadır. Bu sahalarda Türk hâkimiyeti kalktıkça Türk halkı da dönüş göçünü yapmaya mecbur kalmıştır. İki buçuk asırdan beri devam edegelen bu dönüş göçü içinde (Bütün menkul mallarını alıp veya değerleri ile satıp gayrimenkullerini de bedellerini tamam alıp göçen) tek bir kafil gösterilemez." (Kopar, 2018: 308) Türkler, büyük baskılar altında yurtlarını bırakarak hiç bir şey almadan kaçarak Türkiye'ye gelirler. "Balkan Savaşları (1912-1913) akabinde Osmanlı coğrafyası demografik açıdan büyük bir altüst oluş yaşadı. Bu dönemde Balkanlar'da yaşanan nüfus hareketlerinin o dönem açısından Avrupa'da bir benzeri yoktu. Birinci Dünya Savaşı (1914-1918) esnasında ve sonrasında da yüz binlerce insan yaşadıkları toprakları terk etmeye zorlandı" (Şenışık, 2016: 85).

Türk edebiyatında mübadele ve göç temaları birçok romanda işlenmiştir. Bu romanlardan bir kısmını şöyle ifade etmek mümkündür: *Ateş Yılları* (Hasan İzzettin Dinamo), *Bir Avuç Mazi* (Fügen Ünal Şen), *Mübadiller* (Yılmaz Gürbüz), *Ah Bre Seveda Ah Bre Vatan* (Demet Altınyeleklioğlu), *Ulya Ege'nin Kıyısında* (Ahmet Yorulmaz), *Mor Kaftanlı Selanik* (Yılmaz Karakoyunlu), *Mübadele Günlerinde Aşk* (Belgin Karabulut), *Ah Mana Mu* (Handan Gökçek), *Giritli Mustafa* (Ertuğrul Erol Ergir), *Maria - Göç Acısı* (Ertuğrul Aladağ), *Çalı Harmanı* (Akın Üner), *Emanet Çeyiz - Mübadele İnsanları* (Kemal Yalçın), *Elveda Rumeli* (Murtaza Kölemezli), *Pavli Kardeş* (Fikret Otyam), *Mübadil* (Handan Öztürk), *Büyük Ayrılık* (Kemal Anadol), *Düşlerde Kalan Girit*, *Düşlerde Kalan Mübadele* (Ferda Bozoklar Ardali), *Fırat Suyu Kan Akıyor Baksana*, *Karınca'nın Su İçtiği*, *Tanyeri Horozları*, *Çıplak Deniz*, *Çıplak Ada* (Yaşar Kemal), *Hasret* (Canan Tan). Bu çalışmada Türk edebiyatında mübadele konusunun işlendiği bazı romanlar hakkında bilgiler verilecektir.

TÜRK ROMANINDA MÜBADELE

Türk edebiyatında birçok romanda mübadele konusu işlenmiştir. Özellikle 1990'dan sonra kaleme alınan birçok romanda bu konuyu görmek mümkündür. Bazı romanlarda mübadele hususu asıl izlek iken bazılarında ikincil derecede tema olarak yer alır. Bununla beraber bütün romanlarda mübadelenin trajik tarafları ön plandadır.

Yılmaz Gürbüz Mübadiller (2007) başlıklı romanı, mübadele anlaşmasına dayanarak insanların evlerini, yurtlarını terk etmeleri ve yaşanan trajedileri dile getirir. “Yılmaz Gürbüz’ün romanı; Yunanistan’daki hayat, gemi yolculuğu ve Anadolu’daki hayat olmak üzere üç kısımdan oluşur. Bu üç kısmın ağırlığı romanda eşit dağılmıştır. Ana karakter Halim Bey, büyük bir mücadele ile ailesini sağ salım Anadolu’ya getirir” (Doğruyol, 2016: 139). Romanda Yunan topraklarındaki Türkler, Rum çetelerinin saldırılarına uğrar. Mallarını bırakan Türkler Selanik limanına zorluklarla ulaşırlar. Yolda tecavüz, ölüm, gasp vb. büyük kötülükler ile karşılaşılır. Bununla beraber romanda Türkiye’deki bir milyondan fazla Rum’un Yunanistan’a gidecek olması ise olumlu bir gelişme olarak verilir: “Dokuz yüz yıldır yekpare, tamamıyla Türk olmamış Türkiye, böyle Türk milleti bütünlüğüne kavuşuyor” (Gürbüz, 2007: 274).

Handan Gökçek, Ah Mana Mu (2010) adlı romanı Rumca olup Türkçesi “Ah Anneciğim” anlamına gelir. Romanın başkışısı Rena’dır. “Rena, bir Rum’dur. Kocası, Türk olduğu için yıllar önce mübadeleye tabi tutulmuştur. Üç tane çocuğu ile Hatay’da yaşamaktadır. O, yıllarca sessiz kalmış bir kadındır. Evinde ikonalarının önünde Hristiyan inançlarının gereğini yerine getirir. Gelini Melek, bir torun dünyaya getirince Rena birden değişir. Suskun kadın konuşur ve hayata karışmaya başlar” (Doğruyol, 2016: 147). Romanda geriye dönüş yöntemiyle mübadeleden hemen önceki yıllara gidilerek Rena ve Sakuş’un aşklarından bahsedilir. Mübadeleden sonra Yunan topraklarındaki Türklerin malları yağmalanır, camilere kimse gidemez, büyük trajediler görülür. Büyükanne bu hususta şöyle der: “Bu bizim ailemizin masalı. O masal sayesinde sen varsın; ikizler o masal sayesinde var, halaların, baban, annen hep bu masalın kahramanları” (Gökçek, 2010: 265).

Canan Tan’ın Hasret adlı romanında Tacettin ile Patricia’nın aşkı ön plandadır. Romanda, “Aşk temasının yanında; Rum, Ermeni ve Türk gençlerin, Kırşehir’de ortaya koydukları arkadaşlık, birlikte yaşama ve dayanışma kültürü de gözler önüne serilmektedir. Meyhaneci Omorfia’nın kızı olan Patricia ile bölgede nüfuzlu bir beyin oğlu olan Tacettin’in aşklarından bir çocukları olmasına rağmen mübadele onları ayırır” (Düşgün, 2017: 52). Eserde olaylar ağırlıklı olarak Keskin’de yaşanır. Cerid Aşireti Beyi Hacı Ali Bey’in en küçük oğlu Tacettin ile Rum Omorfia’nın kızı Patricia’nın aşk hikâyesi eserin asıl kurgusunu oluşturur. Bir Müslüman’ın bir Hristiyan’la evlenmesi hoş karşılanmaz. Tacettin buna karşı çıkarak “İlk evlenen ben olurum” (Tan, 2013: 48) der. Bir süre sonra Patricia, daha sonra Tacettin’den hamile kalır. Tacettin’in ailesi buna rağmen bu evliliğe yine onay vermez. 1922 yılına gelindiğinde Lozan Barış görüşmeleri başlar. Bu dönemde Türkiye’den Yunanistan’a ve Yunan adalarına binlerce Rum gider. “30 Ocak 1923 tarihinde Türk-Rum Nüfus Mübadelesi Sözleşmesi başka bir ifade ile zorunlu göç antlaşması imzalanır. Bu antlaşma aslında Tacettin ve Patricia’nın ayrılıklarının habercisidir. “Bu anlaşma, Keskin’deki Rum ve Ermeni ailelerini de kapsamaktadır. Tacettin Bey, Patricia ve üç yaşındaki oğlunun Keskin’den ayrılmasını önlemek amacıyla onunla evlenmek istese de ailesinden izin alamaz.” (Vural, 2017: 24). Mübadele, büyük acılara sebep olur. “Acıyı, sevinci paylaştıkları yıllardır aynı topraklarda kardeşçe yaşadıkları birçok insan, bu antlaşma gereğince Keskin’den ayrılacak uzak diyarlara gidecektir” (Sakallı, 2015: 26). Omorfia, ailesiyle birlikte, Keskin’den ayrılarak Selanik’e yerleşirler. Patricia bundan sonra kimseyle evlenmez.

Belgin Karabulut’un Mübadele Günlerinde Aşk (2014) romanında olaylar mübadeleden önce başlar. Eserde olaylar ağırlıklı olarak Girit’in Resmo kentinde geçer ve mübadele öncesinden 1980’li yıllara kadarki zaman dilimini içerir. Romanda Sare ve Adras’ın aşkı anlatılırken arka planda mübadele teması ele alınır. “Mübadele Günlerinde Aşk romanı altmış beş, yetmiş yıl gibi geniş bir zaman diliminde geçmektedir. Romanın başkahramanı Sare’nin ölümünden sonra doğan torunu Elay romanın başkahramanı olmuştur. Elay babaannesinin reen Karnesi gibidir. Elay’ın babaannesini, Girit ve tanımadığı bir çocukla ilgili uzun yıllar gördüğü rüyalar sonucunda romanın çözülmesi farklı bir kurgu ortaya çıkarmaktadır” (Aypak, 2019: 47). Romanda öne çıkan tema aşk olmasına rağmen vatan özlemi ve mübadele de bu tema etrafında dile getirilmiştir. Romanda bu efsanevi aşktan söz edilir: “Ben Sare ile Adras’ın yaşadıklarını, aşklarını dinleyerek büyüdüm. Aşkları öyle bir efsaneydi ki benim için, kimseye âşık olamadım. Kelimelere dökemediklerimi, öğrendiklerimi çizerek yaşattım” (Karabulut, 2014: 233).

Yaşar Kemal'in yazdığı "Bir Ada Hikâyesi" adlı dörtlü romanları mübadele konusuna da yer verir. Bu eserlerin isimleri şöyledir: Fırat Suyu Kan Akıyor Baksana (1997), Karıncanın Su İçtiği (2002), Tanyeri Horozları (2002), Çıplak Deniz, Çıplak Ada (2012).

Bir Ada Hikâyesi adlı dört eserde yazar, Rumların boşalttığı ıssız bir adaya yerleşen insanların trajik hayatlarını dile getirir. Bu adanın neresi olduğu kesin olarak belli değildir. "Bu adada dönen olaylara ve mekân içinde yer alan evlere, bağlara, bahçelere, kimi izlere ve hatta gölgelere bakıldığında, adanın dokusuyla Anadolu Rumluğu kaynaşık bir durum gösterir. Orada onlardan evler, bağlar, bahçeler, türlü eşyalar, renkler, hatta gölgeler kalmıştır. Uzunca süre kendilerinin mübadele dışı kalacağını uman Rumlar, bir anda gelen bir haberle, hızlı biçimde neredeyse hiçbir şeylerini yanlarına alamadan adalarını terk etmişlerdir" (Arı, 2017: 21). Bu bağlamda Rumlardan kalan malların paylaşımı konusunda kargaşalar yaşanmıştır.

Yaşar Kemal'in adayı mekân olarak seçmesinin sebebi, mübadillerin yaşadığı sıkıntıları dile getirmektir. "Yazar, buna uygun olarak Ege kıyılarında olduğu söylenen ancak aynı zamanda karşısında -Rumların 'İda Dağı' dediği- Kaz Dağı'nın olduğu kurgusal bir mekân olan Karınca Adası'nı kurgular. Roman serisinin ana mekânı olarak bir adanın seçilmesinin diğer sebebi ise kurgulanan konuya uygun olarak romanın başkahramanı olan Poyraz Musa'nın bedevilerden kaçıyor olmasıdır" (Altıntop, 2019: 17). Etrafı denizle çevrili olan bu mekân saklanmak isteyen kişi için önem taşır. Dörtleme, Nüfus Mübadelesi nedeniyle yer değişimine zorlanmış Yunan ve Türk vatandaşların Karınca Adası'nda yaşadıkları maceralar üzerine yoğunlaşmaktadır (Onural, 2017: 224). Bir Ada Hikâyesi dörtlemesi, "Mübadillerin yerleştikleri yere uyum sorunları, iş, aile, dil, çevre ilişkileri, toplumsal yapı içinde konumlanışları, anıları" (Şeker, 2011: 450) dile getirir.

Fırat Suyu Kan Akıyor Baksana, dörtlemenin ilk eseridir. "Mübadele ile değişen hayatlar ekseninde bir kaçma-kovalama hikâyesini konu alan, psikolojik bir romandır. Dönemin tarihsel gerçeklikleri ile kahramanların yarı düş yarı gerçek maceraları iç içe geçtiği eser, büyülü gerçekçiliğe yakın duran bir yapıdadır. Eserin baş kişisi, bir Çerkes olan Poyraz Musa'dır. Poyraz Musa'nın, Mübadele sonrasında Karınca Adası'na (Mirmingi) yerleşmesi ve akabinde gerçekleşen olaylar, temel çatışmaları oluşturmaktadır" (Onural, 2017: 228). Romanın mekânı olan Karınca Adası, hayali bir yer olup dar mekândır. Romanda yurtlarını terk etmek zorunda olanların trajedileri şöyle verilir: "Yaşlılar, orta yaşlılar iki büküm olmuşlar, ayakta duramıyorlar, yalpalıyorlardı. Öylece, geminin üstünde kaskatı kesilmişler, yüzleri de apak olmuştu. Kadınlar, kızlar ağlaşıyorlardı" (Kemal, 2014: 167).

Nüfus Mübadelesi ile Yunanistan'daki Türklerle Türkiye'deki Yunanlar yer değiştirmeye başlar. Bu değişim iki toplumda da travmaya sebep olur. Daha da önemlisi, bu insanlar yaşadıkları yeri vatan olarak görmekteydiler. Onlar için Türk veya Yunan olmalarından daha önemli olan, vatan saydıkları topraklardır. Ali Paşa Selim, Yunanistan'dan Türkiye'ye gelen ilk kişilerdendir. Onu Poyraz Musa karşılar. Ali Paşa Selim, inatçı bir adamdır, durumu kabullenemez, Yunanistan'dan sonra ada ona cehennem gibi gelir" (Onural, 2017: 239). Karıncanın Su İçtiği adlı roman Bir Ada Hikâyesi dörtlemesinin ikinci romanıdır. Eserin epigrafında "Deniz o kadar durgun, o kadar durgundu ki karıncalar su içerdi" (Yaşar Kemal, 2013: 7) ifadesi yer alır. Tanyeri Horozları, Bir Ada Hikâyesi Dörtlemesi'nin üçüncü romanıdır. Eser karakterlerinden Nişancı Veli, kendisini bütünüyle adalı olarak görür: "Dönmeyeceğim, dedi Nişancı. 'Dönüp de burada ne yapayım, babamın, anamın mezarları burada, burada güle güle kalsınlar. Onlar benden ekmek istemiyorlar su istemiyorlar'" (Kemal, 2015: 209). Romanda mübadele antlaşmasının etkileri kendini gösterir. Çıplak Deniz Çıplak Ada, dörtlemenin dördüncü ve son romanıdır. "Savaşın ve antlaşmanın tarihten silinmesi imkânsızdır. Karakterler bunun yerine, yaşadıkları gerçeklikle barışmayı seçmişlerdir. Hayali bir evrende, savaşlar ve kavgaların olmadığı yeni bir yaşam yaratırlar. Ancak eser, gerçeklikle olan bağını son sahnede korur ve Yunanistan'a gitmeyi reddeden kaçak Hırsto, zorla geri gönderilir" (Onural, 2017: 290).

SONUÇ

"Türk Yunan Mübadelesi", Lozan Barış Antlaşması'na 30 Ocak 1923 tarihli ek protokol ile yürürlüğe giren ve Türk topraklarındaki Romlar ile Yunan topraklarındaki Türkler yer değiştirdiği bir husustur. Mübadele sürecinde topraklarından ayrılmak zorunda kalanlar büyük acılar yaşamışlardır. Türk edebiyatında mübadele ile ilgili birçok eser kaleme alınmıştır. Özellikler 1990 sonrasındaki romanlarda

göç ve mübadele konularına daha fazla yer verilmiştir. Yılmaz Gürbüz Mübadiller adlı romanında mübadele anlaşmasına bağlı olarak evlerini terk eden insanların trajedileri anlatılır. Yunan topraklarındaki Türkler, Rumların saldırılarına uğrar. Dönüş yolculuğundaki Türklerin başına tecavüz, ölüm, gasp vb. olaylar ile karşılaşılır. Handan Gökçek, Ah Mana Mu adlı romanı Rumca olup Türkçesi “Ah Anneciğim” anlamına gelir. Romanın başkişisi Rena’dır. “Rena, bir Rum’dur. Kocas, Türk olduğu için yıllar önce mübadeleye tabi tutulmuştur. Romanda geriye dönüşle mübadeleden hemen önceki yıllara gidilerek Rena ve Sakuş’un aşklarından bahsedilir. Mübadeleden sonra Yunan topraklarındaki Türklerin malları yağmalanır, namusları büyük tehlikeye girer. Canan Tan’ın Hasret adlı romanında aşk ve mübadele temaları iç içe ele alınır. Eserde Tacettin ile Patricia’nın aşkı anlatılırken mübadele temasına da önem verilir. Yaşar Kemal’in kaleme aldığı “Bir Ada Hikâyesi” adlı dürtlemde mübadele konusuna da yer verilir. Bu eserlerin isimleri şöyledir: Fırat Suyu Kan Akıyor Baksana (1997), Karıncanın Su İçtiği (2002), Tanyeri Horozları (2002), Çıplak Deniz, Çıplak Ada (2012). Sonuç olarak, Türk romanında mübadele konusu genel olarak ayrılık, özlem, aşk, ölüm vb. konularla birlikte ele alınır.

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**PREPARATION OF A NANOCOMPOSITE FOR USE IN THE DEVELOPMENT OF AN
ELECTROCHEMICAL SENSOR SENSITIVE TO ELECTROSENSITIVE ANALYTES**

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Abstract

Electrochemical sensors are analytical systems with unique binding properties to target analytes. These systems can be widely used in clinical pharmacy R&D, pharmaceutical industry, drug delivery, medical diagnostics and healthcare, analytical chemistry, food analysis testing, environmental monitoring, and military applications. Electrochemical sensors have many advantages in terms of high sensitivity, low cost, fast and real-time sampling capability, and low detection limit. In recent years, scientists have accelerated surface modification studies to add new properties to a limited number of electrode materials. Nanomaterials such as gold nanoparticles, metal oxide nanoparticles, carbon nanotubes and quantum dots are used as immobilization support for diagnostic molecules in electrochemical sensors. They have different electronic properties and are highly advantageous for transmitting electrical signals generated upon target recognition due to the unique structure of nanomaterials. In addition to these advantages, nanostructures can also be in strong interactions with chemical species, thanks to their mechanical, thermal and electronic properties. They are used as highly sensitive modifiers when nanostructures form composites with natural polymers. Considering all these, in this study, the nanocomposites were formed by combining a natural polymer and metal oxide nanoparticles in different proportions. After spectroscopic and electrochemical characterization of nanocomposites, it was tested as a modifier. The glassy carbon electrode surface was modified with the nanocomposite, which exhibited the best electrocatalytic effect and presented as an electrochemical sensor sensitive to electrosensitive analytes. The electrochemical sensor performed very well with features such as high sensitivity, low detection limit, wide linear range, long-term stability good repeatability, and reproducibility.

Keywords: Electrochemical sensors, modification, nanocomposites

INTRODUCTION

Electrochemical methods examine the chemical transformations and physical changes that occur as a result of the interaction of a substance with electrical energy. In order for an electrochemical reaction to occur, an electrode system in which the analyte undergoes a chemical transformation in the analyte solution and a conversion system that connects these electrodes is required. The electrolyte solution is used to provide electrical conductivity. In electrochemical methods, an electrical effect is exerted on the electrode-solution system, and information about the characteristics of the system is obtained by measuring the responses of the system. Almost all electrochemical methods have potential, current and time parameters and these parameters determine the name of the method (Saleh Ahammad, Lee, & Rahman, 2009; Sharp & Burkitt, 2014). Electrochemical sensors are superior to other sensors in detecting potential changes and currents resulting from oxidation-reduction reactions. Electrochemical sensors are frequently preferred in many in-vivo and in-vitro studies due to their ease of use in different areas, low cost, repeatable use, rapidity, easy adaptation to physiological and biological media, high selectivity, high stability, minimum degradation and stability (Scholz, 2021). The most sensitive and accurate determination of the analyte to be analyzed depends on the support of the electrode surfaces by modifying them with various modifiers and the selection of quality materials. With the developing technologies, the use of nanomaterials (carbon nanotubes, carbon nanorings, carbon nanofibers, graphene, etc.) as a modifier in electrochemical sensors has expanded the usage areas of sensors (Maduraiveeran & Jin, 2017; Maduraiveeran, Sasidharan, & Ganesan, 2018; Zhao, Gan, & Zhuang, 2002). Electrochemical sensors designed with nanotechnology are used in medicine, pharmacy, food, industry, environmental technologies, agriculture, paint industry, etc (Zhang, Liu, Chu, & Bai, 2021).

They are used in many industries. Especially in pharmacological studies, the most promising are the sensors developed with nanotechnology, which enable more sensitive monitoring in the determination of drug active ingredients, drug production stages and clinical laboratory studies (Kango et al., 2013; Lotfi, Gholivand, & Shamsipur, 2021). In electrochemical sensors obtained by modifying biological structures, optical-based structures, metal oxide-based compounds, inorganic complex compounds and natural polymers, it is aimed to increase the electrolytic activity, increase efficiency, extend the electrode life, and increase the reaction kinetics (Bagheri, Afkhami, Panahi, Khoshshafar, & Shirzadmehr, 2014; Huang, Peng, Jin, Zhang, & Kong, 2008).

Metal oxide nanostructures, which are preferred for surface modification, have recently gained more importance in terms of their semiconductor properties, catalyst properties, immobilization abilities and chemical stability (Motsaathebe & Fayemi, 2021). When metal-oxide-based nanostructures are supported with organic-inorganic complex compounds, they are used in important application areas such as monitoring and detection of biological-based structures such as heavy metal ions, gas molecules, food additives, dyestuff, drug components, toxic substances and antibodies (Meena et al., 2021). Holmium(III) oxide nanoparticles, which are a metal oxide nanostructure, perform better than their other counterparts in terms of high surface area, surface permeability, chemical and thermal stability, and unique optical and electrical properties. Therefore, there is great interest in the use of Holmium(III) oxide nanoparticles, which have various application potentials, in electrochemical sensors as a modifying material due to their excellent electron mobility (Mortazavi-Derazkola, Zinatloo-Ajabshir, & Salavati-Niasari, 2015). In addition, Holmium(III) oxide nanoparticles are used in the production of nanocomposites to remove certain defects of various modifying materials and to obtain enhanced electrocatalytic activity, so that the target analyte can be determined more precisely (Z. Fathi, Jahani, & Foroughi, 2021). However, these superior properties alone increase when hybrids are formed by combining them with organic or inorganic structures. Thus, they can be used as modifying composites in more sensitive electrochemical sensors designs for analytes (Noroozifar, Khorasani-Motlagh, Jahromi, & Rostami, 2013; Sriram, Baby, Hsu, Wang, & George, 2021). These hybrids offer some advantages such as higher synergistic energy, high electrocatalytic activity, high chemical stability, controllable structural properties, low cost and high adsorption (Alekseeva, Rodionova, Bagrovskaya, & Agafonov, 2016; Hashemian, Saffari, & Ragabion, 2015; Motshekga, Ray, Onyango, & Momba, 2013).

The voltammetry technique encompasses a group of electroanalytical methods in which information about the analyte is obtained by utilizing the measurement of current as a function of the applied potential under conditions in which a working electrode is polarized. Voltammetric techniques are among the most preferred techniques in the application areas of electrochemical sensors (Bobrowski, Królicka, & Zarębski, 2009). They are more advantageous than spectroscopic techniques due to many features such as inexpensive equipment, easy use, and high sensitivity (Mettakoonpitak et al., 2016).

In this study, various composites were formed by combining metal oxide nanoparticles and natural rock clay in different proportions as modifiers and were characterized and used. The sensitivity to electroactive molecules of the modifier nanocomposite, which offers the best electroactivity and has the highest surface area, was investigated by cyclic voltammetry and square wave voltammetry techniques. Thus, this nanocomposite has been shown to be a promising candidate for its applicability to real samples with its low detection limit and high stability.

MATERIALS AND METHODS

Electrochemical measurements were recorded using the Gamry Interface 1000B Potentiostat/Galvanostat/ZRA instrument. As a cell system; The three-electrode Bioanalytical System (BAS) cell system, which consists of a working electrode, reference electrode and counter electrode, platinum wire (Pt) as counter electrode and Ag/AgCl/KCl(sat.) reference electrode as the reference electrode in aqueous media. However, voltammograms were recorded using Ag/AgNO₃ reference electrode in non-aqueous studies. For pH measurements, Thermo Scientific Orion 4 Star brand device was used.

Electrode cleaning procedure: The glassy carbon electrode surface, used as the working electrode, was washed with ultrapure water and cleaned and brightened with equal numbers of clockwise and counterclockwise circular movements in the alumina suspension of 0.30 μm and 0.05 μm , which was applied separately to the velvet fabric surface. The electrodes were sonicated in pure water for 3 minutes and freed from alumina residues. In order to purify other impurities that may remain on the electrode surface, the impurities were removed by sonicating for 3 more minutes in ethanol. Thus, the electrode surface was cleaned, polished and made ready for electroanalytical studies.

RESULTS and DISCUSSIONS

Electrochemical behavior of nanocomposite

Nanocomposites were obtained by combining metal oxide nanoparticles (Holmium(III) oxide) and natural rock clay in different proportions. These composites were analyzed by scanning electron microscopy, Fourier transforms infrared spectroscopy, energy dispersion X-ray spectroscopy and cyclic voltammetry techniques. The results obtained with these characterization techniques and the structural and morphological properties of the composites were examined. Haloperidol, one of the drug active ingredients, was used to determine the one that is sensitive to electroactive molecules among the characterized nanocomposites. The nanocomposite structure assembled at 5% doping rate against haloperidol showed higher sensitivity ([Incebay & Ucar, 2022](#)). For this reason, the active surface area of the composite modified surface was compared with the composite components and the bare electrode. In order to examine the parameters such as reversibility and electron transfer pattern of haloperidol on bare GCE, nanocomposite/GCE, natural clay/GCE and metal oxide nanoparticle/GCE surfaces, voltammograms of all surfaces were taken 1.0 mM ferrocene probe at the potential range of -0.2/0.4 V against the Ag/AgNO₃ reference electrode at scanning rates of 50, 100, 200, 300, 400, 500 and 600 mV/s by cyclic voltammetry technique ([Figure 1](#)).

When the cyclic voltammograms between 50–600 mV/s of the bare GCE and modified GCEs surfaces were examined, almost no change was observed in the peak potentials with the increase of the scan rate, while a linear increase in the peak currents was observed. In addition, the peak currents increasing linearly with the increase of scan rate were also observed in reverse scanning. In order to make the reaction mechanism on the electrode surface more understandable, the square root of the scan rate versus the peak currents was plotted and a linear relationship between the square root of the scan rate and the peak currents was obtained. To claim that an adsorption-controlled process takes place at both bare GCE and modified GCE surfaces, the graph drawn must be linear and its slope must be greater than 0.5. However, if there is a slope value less than 0.5, it is known that the reaction takes place in a diffusion-controlled process ([Sebastián et al., 2017](#)). The R^2 values were calculated in the plot of the square root of the scan rate versus the peak currents, and it was determined that the electrochemical reaction occurring on all surfaces was an adsorption-controlled reaction, since it was very close to the theoretical value of 1.0 for the bare GCE surface and the slope values were greater than 0.5.

A

B

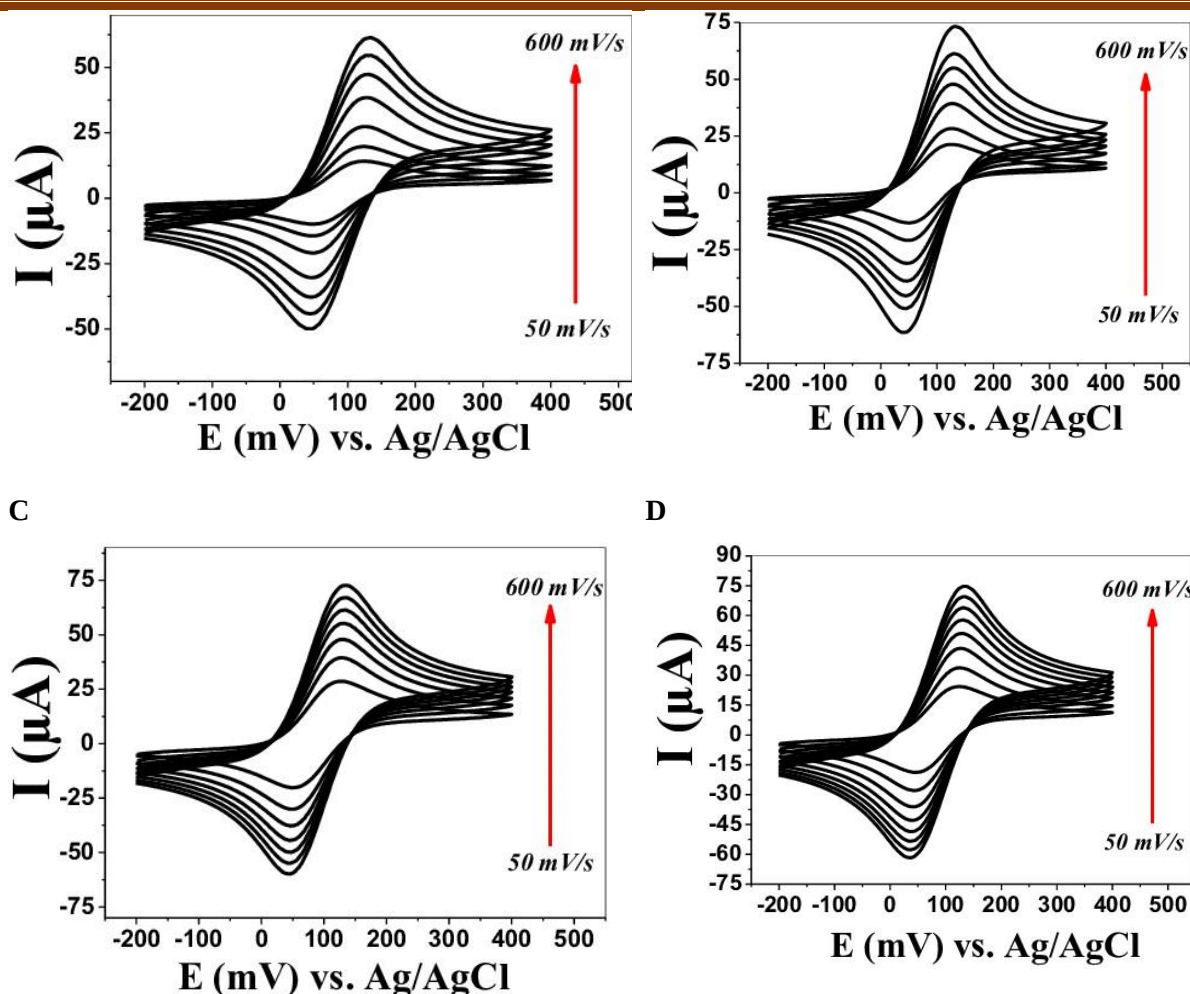


Figure 1. Voltammograms of A) Bare/GCE, B) Natural clay/GCE C) Metal oxide nanoparticles/GCE, D) Nanocomposite modified/GCE surfaces in 1.0 mM ferrocene solution taken using CV technique against Ag/AgNO₃ reference electrode at scan rates of 50, 100, 200, 300, 400, 500, 600, 700 mV/s.

Investigation of electrochemical performance of bare and modified surfaces

In order to compare the active surface areas of bare GCE and nanocomposite modified GCE surfaces, 1.0 mM HCF(III) solution prepared in 0.1 M KCl was used. The active surface area of the electrodes was calculated using the Randles-Sevcik equation. For this purpose, voltammograms of bare GCE and nanocomposite-modified surfaces were recorded at scan rates of 50, 100, 200, 300, 400, 500, 600 mV/s using the CV technique. The Randles-Sevcik equation ($I_{pa} = 2.69 \times 10^5 n^{3/2} A C_0 D^{1/2} \nu^{1/2}$) (at 25°C) is used to determine the effective surface area in reversible processes (Ahmad, Kumar, & Mobin, 2020). All parameters used for the HCF(III) probe, such as electron transfer number ($n = 1$), diffusion coefficient ($D = 7.6 \times 10^{-6} \text{ cm}^2 \text{ s}^{-1}$), and concentration of HCF(III) ($C_0 = 1 \times 10^{-3} \text{ mol L}^{-1}$) are constant. Therefore, the slope of the plot of the square root of the scan rate ($\nu^{1/2}$) against the anodic peak current (I_{pa}) is proportional to the effective surface area of the modified electrode (M. R. Fathi, Almasifar, Fathi, & Almasifar, 2017). Active surface area calculated from I_{pa} vs $\nu^{1/2}$ slopes (Figure 2) was calculated as 0.283 cm² and 0.589 cm² for bare GCE and nanocomposite modified surfaces, respectively. A comparison of the two slopes showed that the GCE modified with the combination of the nanocomposite was 2.08 times greater than the bare GCE. This can be attributed to the excellent interaction of metal nanoparticles with a large specific surface area in combination with natural rock clay.

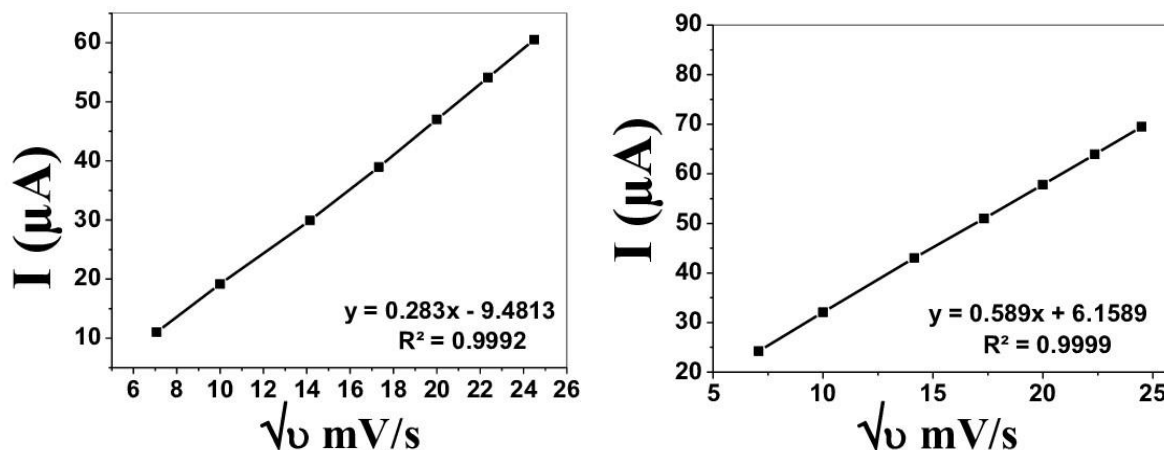


Figure 2. Graph of the anodic peak current values of the cyclic voltammograms of A) the bare GCE and B) nanocomposite modified GCE surfaces versus the square root of the scan rates.

Applicability Of The Proposed Electrochemical Sensor

In order to use the proposed nanocomposite-modified GCE surface as a sensor, the electrochemical susceptibility of active pharmaceutical ingredients with electrosensitivity was investigated. It has been observed that the proposed electrochemical sensor performs well with high sensitivity, stability and selectivity.

CONCLUSION

To examine the electrochemical properties of the bare and modified surfaces, the scan rate parameters were examined by cyclic voltammetry and it was determined that the reaction took place on all surfaces with an adsorption-controlled process. The active surface areas of the bare GCE and nanocomposite modified surfaces were calculated and it was found that the nanocomposite modified surface was approximately 2.08 times larger than the bare GCE. For the applicability of the nanocomposite modified GCE electrode as an electrochemical sensor, its sensitivity to electroactive drug substances was investigated. It was found that it showed high sensitivity, good selectivity and stability.

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WHY IS STEM A MALE DOMAIN?

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Abstract

The authors problematize the division of science into the so-called hard or male sciences and the so-called soft sciences, which receive the epithet "women's sciences." Such a division is the result of socialization processes as well as all other social processes that have built gendered expectations and rationales into biology as the destiny of women and men. School systems carry the burden of gender stereotypes that are part of a broader belief system that includes attitudes about female and male family roles, female and male occupations, and gendered perceptions of self. Bipolar constructs, male and female, determine that everything that is difficult should be done by men, while easier jobs should be carried out by women. Gender stereotypes often become mechanisms of gender segregation, which may justify defining STEM as a male domain because the conditions are created for men to succeed, i.e., there are no conditions in which women are directed to the STEM domain. Local environment is deemed important in disrupting the inequality between genders and creating the alternative constructions of genders. Consequently, schools and classrooms represent locations where gendered expectations about STEM fields are shaped and a starting point for recreation of traditionally gendered beliefs and roles. The physical environment of classrooms and a syllabus may serve as a barrier which tends to cause women to underestimate their own abilities. The authors believe that it is necessary to redesign all gender-tinted curricula and create stimulating environments in educational systems for all students to show their potential so that STEM can be a women's field as well.

Keywords: gender stereotypes, gender roles, gender segregation, STEM field

Introduction

Although science is a feminine noun in some languages (Croatian, English, German), a large part of its development is androcentric (Vince Pallua, 2011), i.e., "science interwoven with patriarchal relations manifests itself in the practice of holders of dominant knowledge in relation to women" (Gvozdanović, 2008, p.35.). The entire history of mankind has patriarchal characteristics and the 21st century bears the burden of previous times that position men and women differently in society. The categories of sex and gender are present and significant in society, as well as in social interaction, and many activities and roles are gendered-coloured. Moreover, gender is not only a binary, structurally neutral difference between women and men, but a hierarchically structured and value marked difference. Gender differences are rarely neutral, and in almost all societies gender is an important form of social stratification and a criterion for the appearance of social inequalities and discrimination. It is certain that the articulated criticism of patriarchy, the (dominant) position of men, the relation between women and children, is more significant during recent times, which confirms that it is still gaining and that it still has legitimacy.

In the 21st century, there are no communities that are completely "cleansed" of ideologies that maintain that women should be subordinated to men and that there are jobs that can only be performed by men because women's work is perceived as being inadequate. Much of what is associated with the improper valorisation of gender is resistant to change, even though such valorisation has been transferred to a completely different context of cultural norms and political, social, and institutionalized rules (Vrcelj, 2014; Castillo, Grazzi and Tacsir, 2014). The patriarchal structure takes biology as a justification for performing easier and therefore less significant and paid jobs as well as performing more difficult and significant jobs. STEM is a difficult and important field, which is why there are fewer women in STEM

fields. Such justifications have no basis because studies of brain structure and function, hormonal modulation, human cognitive development, and human evolution have found no significant biological difference in the ability of men and women to work in STEM field (Ceci and Williams, 2007). This is the main reason why girls in school often perform equally well or even better than boys, which excludes the assumption that girls are biologically programmed to perform less well than boys in math- and science-related careers and at the same time creates conditions for reducing gender inequalities in STEM field (Halpern et al., 2007).

Although the rhetoric of educational politicians emphasizes equality in all segments and areas of education (Ceci, Ginther, Kahn, and Williams, 2014), in practice, if the numbers are to be believed, the situation is not equal. According to ESA (Economics and Statistics Administration) report in 2009, college-educated women are much less likely than men to major in STEM fields. But even when women choose STEM degrees, their typical career paths are different from their male counterparts, which means that 40 percent (2.7 million) of men with STEM college degrees remain employed in STEM jobs, whereas only 26 percent (0.6 million) of women with STEM degrees work in STEM jobs (Wang, Degol, 2017). The inequality between men and women in STEM field is also observed in workplaces where women often receive lower wages than men and are employed in less remunerative sectors (European Commission; 2015, 2016).

According to UNESCO data, in 2019 the global average percentage of female researchers was only 29.3% (UN WOMEN May, 2020) and at the level of tertiary education, only 35% of women are enrolled in STEM field, despite the fact that in all previous levels of education, girls and boys attended mathematics and science courses in approximately equal numbers, and there are roughly equal numbers of girls and boys after high school who can enrol in STEM, but fewer women than men attend these courses (Hill, Corbett, and Rose, 2010).

One of the important questions that arises is why women participate less in STEM, which is often interpreted as the driving force of higher education and economic development?

Socialization - are we deceiving boys and girls in the educational process?

The position of women in the academic community, especially in the so-called “hard sciences” is a topic that is massively researched around the world and gives contradictory conclusions, but the majority agree that women are underrepresented in all math-intensive fields at college and graduate studies and the professoriate level (Mihaljević and Santamaría, 2020).

Considering the fact that it is difficult to find consensus on whether the patriarchal structure and culture are the main barriers to women’s penetration into STEM or biology (Ceci and Williams, 2007), i.e., biological differences in the achievements of boys and girls (Burušić and Šerić, 2015), a considerable amount of relevant literature finds the causes more often in socialization (Engida, 2021; Nicolson, 2015; Piyakamon and Dusadee, 2019; Hoominfar, 2019), which affects the progress of women in education and at work. Socialization (and education) is the process of organizing and integrating knowledge that is transmitted through the negotiation of meanings in (pre)determined contexts. (Pre)determined contexts have always been uneven and unequal, so socialization processes have a tendency to support behaviour that tolerates gender inequality (Vrcelj and Mušanović, 2011). Little attention has been paid to achievements of women in science, who mostly have “fathers”, even though many women are responsible for the formation of certain sciences and/or scientific discoveries. Rarely do we find information in school textbooks about, for example, mathematicians Hypatia, Amalie Emmy Noether, Mary Everest Boole, Marie Sophie Germain or British astrophysicist Cecilia Helena Payne-Gaposchkin (Pavić, 2021). Through open and hidden curriculum in educational institutions, the message that is conveyed is that men are important and women are not so they are often depicted in textbooks as persons submissive to men and other authorities, they push carts or cook and they are represented as sex symbols that “sell” cars (Skelton, 1993).

Although the importance of the inherent and instrumental value of girls’ education is recognized at the global and national level (Evans, Akmal Jakiela, 2019) because it is considered that educated women are better mothers, give more support to the family and contribute to the productivity of society, the

strength of productivity and progress of society is still assigned to men and the so-called hard sciences including STEM.

Since World War II and the Sputnik shock, great hopes have been placed in STEM field to ensure America's advantage in the global economy (White, 2014). At the global level, mathematics is "understood as the "language of science" and math education represents the basis of the technological and socioeconomic development of society" (Puzić and Baranović, 2012, p.164; Tsatsaroni, 2006). This position is vehemently opposed by critical pedagogues who believe that education does not exist separately from the wider society because it is connected to patterns of different economic, political and cultural power (Apple, 1999). Therefore, „mathematical and scientific knowledge is not just any knowledge. It performs specific functions that are tied to the kind of economy that we have, the unequal pattern of benefits generated by this economy, and the distribution of social and economic power that supports this structure. Technical/administrative knowledge and the importance of its production, accumulation, control, and use may contradict a proposal for widespread distribution of such knowledge. Thus, in the absence of a recognition of the larger social functions of the knowledge itself, any call for a curriculum that is based on a wider distribution of mathematical knowledge that involves expensive changes in resources and time (and that may interfere with more elitist uses of the knowledge) is vulnerable unless it participates in much larger efforts to transform the use and control of knowledge in more democratic directions“ (Apple, 1999, p. 96-97).

The educational process, i.e. the hidden curriculum, is systematically carried out in schools even though it cannot acquire public and democratic legitimacy because usually disenfranchised marginalized social groups to which women belong, are additionally prevented from acquiring education as a public social good.

In the educational process, teachers can greatly contribute to negative academic and school culture by spending more time teaching boys math—both formally and informally—than they spend on girls in the early grades (Leinhardt et al., 1979; Astin 1974). Furthermore, the differences between girls and boys are also present during assessment, which leaves a long-term impact on girls. Similarly, Beilock et al. (2009) found that US first- and second-grade girls who were thought by female teachers with math anxiety were more likely than girls with female teachers without math anxiety to believe at the end of the school year that "boys are good at math and girls are good at reading".

Research evidence from TIMSS shows that girls and boys achieved equal results in mathematics in 26 out of 39 countries (Mullis, Martin, Foy, Kelly and Fishbein, 2020). In the Republic of Croatia, girls achieved lower scores than boys in all three cognitive domains (boys scored 10 to 13 points higher than girls on each level) (Elezović, 2019). The obtained results cannot serve as a valid argument about biological differences that tend to result in insufficient representation of women in STEM.

The underrepresentation of women in STEM mostly indicates a large connection of gender stereotypes that are present in families and in educational institutions (Lendák-Kabók, 2021). Blickenstaff (2005, according to Lendák-Kabók, 2021) uses a metaphor of a leaky pipeline where the proportion of girls continues to decrease and consequently women who choose a scientific career, especially STEM field, face a big challenge. Similar evidence in literature was mentioned in Cucca's paper (2019) where the author mentioned 2012 PISA data that show that a substantial percentage of Italian households tends to direct their children towards educational pathways differentiated by gender considering twice as likely a future career in the field of science, technology, engineering and mathematics for male children rather than for daughters. The mentioned orientations of parents do not seem to be based on the school performance of young people: on the contrary, Italian boys show less brilliant school performances than those of their female peers (Cucca, 2019; PISA, 2012; OECD, 2015). Eccles and Jacob (1986) and Eccles, Jacob, and Harold (1990) found that mothers' gendered stereotypes about math ability influenced their perceptions of their children's abilities and stated that if mothers held gendered stereotypes, their rating of their daughter's ability would be lower than the one predicted by the teacher's evaluation of ability.

Women, i.e. girls, experience negative school and academic culture in STEM subjects, which can easily become an obstacle to forming and expressing their future interests in STEM area, especially

professional and career ones (Burušić, 2018, p. 399). The lack of a female role model is one of the important reasons for the underrepresentation of women in the field of science, because even though women enrol in universities and study, their role becomes a filter for establishing a balance between career and family, and they often encounter the maternal wall (Vrcelj and Mušanović, 2011) because they are *destined to be mothers*.

The negative effect of the lack of female role models on future education and career path is confirmed by many studies; e.g., Antecol et al. (2015) found that primary school girls randomly assigned to teachers got better math scores if taught by women rather than men, but only when women teachers had strong math backgrounds. Data on similar topic but related to higher education refers to Bettinger and Long's research (2005) in which they concluded that exposure to female-instructor increased the likelihood of majoring in mathematics and geology.

Empowering women in STEM fields through education

The representation of women and men in STEM (see Roy, Guillopé, Cesa, Ivie, White, Mihaljevic and Chiu, Mei-Hung, 2020), should be taken as a very strong indicator of gender selection despite the educational ideologies that emphasize equality. Although great hopes have been placed in the providing of equal opportunities for men and women in education and other environments, the dominance of men in higher positions leaves an impression that gender imbalance is something completely natural and such experiences that children gained at school, are then transferred to higher levels of education, which consequently moves girls away from the "male" area. If the environment in which children's educational process takes place encourages androgyny, children will take such practices for granted and will use men as the frame of reference for success (in STEM).

If we were to give an overall analysis of the various discussions about gender imbalance in STEM field, we could conclude that it is based on a gender-oriented point of view that interprets the underrepresentation of women in this field in terms of sexual characteristics where gender is conceived as an immutable category. Understanding gender as an immutable category creates a simplified picture where binary categories imply a hierarchical relationship between men and women with a tendency of portraying male gender as the superior one that dominates and female gender that is subordinate and defined as inferior (Vrcelj, 2014).

However, since problems (in STEM) that women face still exist, it is obvious that it is difficult to "force" educational policy-makers to face the issue of equality in a different way. Some countries, for example the Republic of Croatia, provide scholarships for students; since 2017/2018, 3,400 scholarships for STEM studies were awarded every year, and there were 1,781 study programs in the Republic of Croatia, of which 727 are in STEM fields (38.9%). Funding for programs in STEM fields is more favourable as shown by the number of people who have completed their studies in STEM fields. According to statistics, the number is among the largest in the EU; in the Republic of Croatia the average is 27, and the EU average is 25.8 % (Education and Training Monitor, 2019).

As the abovementioned statistics and research papers confirmed, the pipeline does leak, so education should be focused on emancipatory change and cultivation of mind that understands how social power works in educational institutions. Different knowledge policies and epistemologies should be introduced into the educational process in order to understand the process of perpetuating privileges and subjugating the marginalized (Vrcelj and Mušanović, 2011). Bearing in mind that many curricula are marked by gender, the proposed supporting measure is to design intervention programs based on theories of social belonging and self-affirmation, which are used in the implementation of interventions on minority and vulnerable groups (women and ethnic minorities) in STEM field (Burušić, Blažev and Dević, 2017).

Despite the cynical attitudes about women's studies that some consider a passing trend, these studies have significant potential for the empowerment of women and represent possibly the most revolutionary new field of intellectual research of the modern age (Smith, 2013). The main idea of women's studies can be summarised in the following statement: "The issue of difference is one that provokes questioning

and that has led to some of the most important innovations not only in thinking about women but in thinking about society, the economy, and politics more generally” (Smith, 2013, p.42).

One of the main goals of women’s studies is the integration of the concept of gender into the new curriculum, which thus affects the education of women and men. The contents of women’s studies are oriented towards the search for answers to the question of what it means to be human in a culture marked by gender, race and class inequality. In this way, women’s studies shed light on the problems faced by girls and boys, men and women in different aspects of their lives with special reference to education and employment (in educational management). In addition to such goals, these studies play an important role in achieving a better gender balance in the field of higher education (Vrcelj, 2014). The conceptualization of women’s studies should be transferred to other educational institutions as examples of good practice, because it would lead to the creation of curricula that are not gender-coloured. It is very likely that in this way stimulating environments would be created for all students, which would encourage girls to participate in “hard” sciences, thus proving that STEM is not a male field after all. However, education is not isolated from the society in which it exists, so it is necessary to change (educational) policies that will be focused on reducing gender stereotypes at all levels and areas. The potential for changes in traditional (male) conventions (in education) lies in the correlation of social, political and scientific critical intellectual powers.

Exactly these goals are part of the recommendations of many authors who have studied the mentioned topic (Cucca, 2019; Šimunović et al., 2020; Holmes, Kathryn et al., 2018), which leads to the conclusion that it is therefore necessary to invest in education from childhood, allowing children and girls to approach the world of science, technology, mathematics and engineering without sense of fear, inadequacy or anxiety.

Along with these goals, there are innovative, active and informal learning models such as methodology based on the “*think-make-improve*” cycle. Applying the “*think-make-improve*” technology, girls and boys are encouraged to learn by trying and making a mistake in order to arrive at the desired result and by playing and exploring while operating on objects (material or virtual), which altogether develops intrinsic motivation for STEM area and affects the women’s perception of STEM disciplines (Cucca, 2019). The description of the method points out the important role of teachers who should, according to Halpern et al. (2007), strengthen girls’ beliefs regarding their abilities in math and science, provide prescriptive and informational feedback and expose girls to female role models who have succeeded in STEM.

In addition, other recommendations that could fill the existing gender gap include promoting female participation in STEM by removing gender bias in curricula and parental attitudes, raising students’ awareness about the likely consequences of choosing different fields of study, and facilitating women’s access to STEM-related jobs through apprenticeship (Cucca, 2019; OECD; 2016).

Conclusion

STEM field, often defined as the driving force of higher education and economic development, is followed by unequal representation of men and women. Evidence suggest that STEM field is still male because statistics are in favour of men, which is the result of social circumstances that do not sufficiently encourage women to conquer the “male field”. This suggests that gender roles obtained by biology or social expectations are a significant barrier. When it comes to repositioning women in STEM, it seems important to break down gender stereotypes through all the factors that encourage them.

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**COVID-19 PANDEMİ SÜRECİNDE ÜNİVERSİTEDE EĞİTİM ALAN ULUSLARARASI
ÖĞRENCİLERİN KORONAFOBİ DÜZEYLERİNİN DEĞERLENDİRİLMESİ**

EVALUATION OF CORONAPHOBIA LEVELS OF INTERNATIONAL STUDENTS STUDYING
IN UNIVERSITY DURING THE COVID-19 PANDEMIC PROCESS

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Özet

Amaç: Koronavirüs Hastalığı 2019 pandemisi eğitim ve sağlık sistemlerinde çeşitli zorluklar ve korkuya yol açmıştır. Bu çalışma, üniversitede eğitim gören uluslararası öğrencilerin koronavirüs korku düzeylerini belirlemek amacıyla yapılmıştır.

Yöntem: Çalışma uluslararası öğrenci statüsünde eğitim alan 100 öğrenci ile gerçekleştirilmiştir. Araştırmanın verileri sosyodemografik özellikleri içeren tanımlayıcı form ve “Koronavirüs Korkusu Ölçeği” kullanılarak internet üzerinden çevrimiçi ortamda toplanmıştır. Veriler IBM SPSS Statistics 23 programına aktararak sayı, yüzde, ortalama, standart sapma, minimum, maksimum, t testi, One Way ANOVA testleri kullanılarak analiz edildi.

Bulgular: Çalışmada, katılımcıların %47,0’si 17-22 yaş aralığında, %66’sı kadın, %65’i lisans öğrencisi, %70’i orta gelir düzeyine sahip, %77’si daha önce COVID-19 hastalığı geçirmemiş, %95’inin ailesinde koronavirüs hastalığı nedeniyle ölüm olmamış ve %53’ünün aile/akrabası koronavirüs hastalığı geçirmiştir. Katılımcıların koronavirüs hastalığı korkusu ölçeği ortalamaları 17,80±5,64’tür. Katılımcıların koronavirüs hastalığı korkusu ölçeği ortalamaları ile sosyodemografik özellikleri ve koronavirüs hastalığı geçirme durumu, ailesinde koronavirüs hastalığı nedeniyle ölüm durumu, aile/akrabasının koronavirüs hastalığı geçirme durumu arasında istatistiksel olarak anlamlı fark bulunmamıştır.

Sonuç: Sonuç olarak, çalışmaya katılan öğrencilerin koronavirüs korku düzeylerinin orta düzeyde olduğu belirlendi.

Anahtar kelimeler: COVID-19, Koronavirüs, Koronafobi, Pandemi, Öğrenci

Abstract

Objective: The Coronavirus Disease 2019 pandemic has caused various difficulties and fears in education and health systems. This study was conducted to determine the coronavirus fear levels of international students studying in university.

Method: The study was carried out with 100 international students. The data of the study were collected online through internet using a descriptive form containing sociodemographic characteristics and the “Coronavirus Fear Scale”. The data were transferred to the IBM SPSS Statistics 23 program and analyzed using number, percentage, mean, standard deviation, minimum, maximum, t test, and One Way ANOVA tests.

Results: In the study, 47.0% of the participants were between the ages of 17-22 years, 66% were female, 65% were undergraduate students, 70% had a middle-income level, 77% did not have COVID-19 disease before while 95% of participants had no family members dying due to COVID-19 disease

although 53% reported a member of family/relatives had coronavirus disease. The participants mean scores obtained from fear of coronavirus disease scale was 17.80 ± 5.64 . There was no statistically significant difference between the participants' mean scores of fear of coronavirus disease scale and their sociodemographic characteristics and having coronavirus disease previously, losing a family member due to coronavirus disease, and coronavirus disease status of their family/relatives.

Conclusion: In conclusion, it was determined that the coronavirus fear levels of the students participating in the study were moderate.

Key words: COVID-19, Coronavirus, Coronaphobia, Pandemic, Student

GİRİŞ

İnsanlık tarihi boyunca insanoğlunun farklı olağanüstü afetler ve beklenmeyen doğal olaylar ile karşı karşıya kalması söz konusudur. Tarihsel süreçte insanların hayatı her geçen yıl yeni bir salgın hastalığa şahit olmuştur. Çin'in Wuhan şehrin' den başlayıp hızla tüm dünyaya yayılan yeni koronavirüs hastalığı (COVID-19, SARS-CoV-2) akut bulaşıcı pnömoni salgını olarak bilinmektedir (Bao et al., 2020). Bu salgını diğer korona virüs salgınlarından ayıran iki önemli özelliği yüksek patojenite ve yüksek bulaşıcılığa sahip olmasıdır (Doshi et al., 2020). Genellikle salgınlar bireyin fiziksel sağlığını etkileyip yaşamsal tehdit oluşturmaktadır. Bununla birlikte bireylerin psikolojik ve sosyal açıdan da etkilendiği göz ardı edilmemelidir (Yakut, 2020). COVID-19 salgını da dünya genelinde bireyleri psikolojik açıdan olumsuz yönde etkilemiştir (Xiao, 2020).

Pandeminin en büyük psikolojik etkilerinden biri korkudur. Korku çok yönlü bir faktör olarak; kişilerin ruh sağlığını ve iyilik halini olumsuz yönde etkileyen en önemli unsurlardan biridir (Zolotov et al., 2020). COVID-19 enfeksiyonu korkusu, durumsal korkuların yerini alarak, hastalığın bulaşma korkusu (Tze et al., 2022), beklenmedik sokağa çıkma yasakları, öğrencilerin yüz yüze derslerinin uzaktan öğretim ile tamamen çevrimiçi bir formata değiştirilmesi (Perz et al., 2022) ve belirsizlik (Amiruddin et al., 2022) gibi durumlar öğrenciler arasında strese, kaygıya ve diğer duygusal sorunlara yol açmaktadır (Lai et al., 2020).

Salgınların fiziksel etkileri her ne kadar olumsuz ve ölümcül olsa da psikolojik etkileri fiziksel etkilerinden çok daha uzun iyileşme süresine ihtiyaç duymaktadır (Yakut, 2020). Salgınla mücadele amacına alınan tedbirlerin arasında eğitim sisteminin uzaktan çevrimiçi bir şekilde yürütülmesi de yer almaktadır. Özellikle kendi ülkelerinden uzakta olan öğrenciler hem alışık olmadıkları farklı sağlık sistemine sahip bir ülkede neyi nasıl yapacaklarını bilmedikleri açısından endişe duyarken aynı zaman da sokağa çıkma kısıtlamaları sürecinde eğitimlerini sürdürme ve sosyal destek sağlama açısından da endişe yaşamaktadırlar (Lai et al., 2020). Bu durum uluslararası öğrencilerin daha fazla korku yaşamalarına neden olmuş olabilir. Bu nedenle çalışmada üniversitede öğrenim gören uluslararası öğrencilerin koronafobi düzeylerini belirlenmesi amaçlandı.

YÖNTEM

Kesitsel tipte planlanan çalışma, uluslararası öğrencilerin koronafobi düzeyleri ve etkileyen faktörleri belirlemek amacıyla yapıldı. Araştırmanın verileri, sosyodemografik özellikleri içeren tanımlayıcı form ve "Koronavirüs (COVID-19) Korkusu Ölçeği" kullanılarak internet üzerinden çevrimiçi ortam aracılığıyla toplandı.

Katılımcı Veri Toplama Formu

Bu form, çalışmaya dahil edilen katılımcıların sosyodemografik verilerini, daha önce COVID-19 geçirme durumlarını, ailesinde COVID-19 nedeniyle ölüm ve COVID-19 geçiren olup olmadığını belirlemek amacıyla araştırmacı tarafından oluşturulmuş sekiz sorudan oluşmaktadır.

COVID-19 Korkusu Ölçeği

COVID-19 Korkusu Ölçeği (The Fear of COVID-19 Scale), Ahorsu ve arkadaşları (2020) tarafından geliştirilmiştir (Ahorsu et al., 2020). Ölçeğin Türkçeye uyarlanması, geçerlilik ve güvenilirliği Bakioğlu

ve arkadaşları (2020) tarafından yapılmıştır (Bakioğlu et al., 2020). Ölçek, 7 maddeden oluşan 5'li likert tipli bir ölçektir (1: Kesinlikle katılmıyorum ila 5: Kesinlikle katılıyorum). Ölçekten 7 ile 35 arasında puan alınmaktadır. Ölçekten alınan yüksek puan COVID-19 pandemi korku düzeyinin yüksek olduğunu göstermektedir. Ölçeğin Cronbach's Alpha iç tutarlılık katsayısı 0,81'dir.

Araştırmanın Etik Yönü: Bu çalışma için bir üniversitenin Girişimsel Olmayan Araştırmalar Etik Kurul'undan Etik Kurul izni alınmıştır. COVID-19 Korkusu Ölçeği'nin kullanımı için Bakioğlu ve arkadaşlara E-mail yoluyla ulaşılarak izin alınmıştır.

Verilerin Analizi

Veriler IBM SPSS Statistics 23 programına aktararak tamamlanmıştır. Çalışma verileri değerlendirilirken kategorik değişkenler için frekans dağılımı (sayı, yüzde), sayısal değişkenler için tanımlayıcı istatistikler (ortalama, standart sapma, minimum, maksimum) verilmiştir. İki grup arasında fark olup olmadığına bağımsız örneklem t testi ile, ikiden fazla grup arasında fark olup olmadığına tek yönlü varyans analizi (One Way ANOVA) ile bakılmıştır.

BULGULAR

Katılımcıların %47,0'sinin 17-22 yaş aralığında, %66,0'sının kadın, %65,0'inin lisans eğitimi aldığı, %70,0'inin gelir durumunun orta düzeyde olduğu belirlenmiştir. Öğrencilerin %23,0'ünün daha önce COVID-19 geçirdiği, %5,0'inin ailesinde COVID-19 nedeniyle ölüm yaşandığı ve %53,0'ünün aile/akrabası COVID-19 geçirdiği görülmüştür (Tablo 1).

Tablo 1. Demografik Dağılımlar (N=100)

		N	%
Yaş	17-22	47	47,0
	23-30	46	46,0
	30-36	7	7,0
Cinsiyet	Erkek	34	34,0
	Kadın	66	66,0
Medeni durum	Bekar	90	90,0
	Evli	10	10,0
Eğitim durumu	Lisans	65	65,0
	Lisansüstü	35	35,0
Gelir durumu	İyi	13	13,0
	Orta	70	70,0
	Kötü	17	17,0
Daha önce COVID-19 oldunuz mu?	Evet	23	23,0
	Hayır	77	77,0

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Ailenizde COVID-19 nedeniyle ölüm oldu mu?	Evet	5	5,0
	Hayır	95	95,0
Ailenizde/akrabanızda COVID-19 olan var mı? (Şimdi/Önceden)	Evet	53	53,0
	Hayır	47	47,0

Katılımcıların Koronavirüs (COVID-19) korkusu ölçeği skoru ortalaması 17,80±5,64'tür. Ölçeğin Cronbach's Alpha değeri 0.81olarak hesaplanmıştır (Tablo 2).

Tablo 2. Koronavirüs (COVID-19) Korkusu Ölçeğine Dair Tanımlayıcı İstatistikler (N=100)

Koronavirüs (COVID-19) Korkusu Ölçeği				
Ortalama	Std. Sapma	Minimum	Maksimum	Cronbach's Alpha
17,80	5,64	8	35	0,812

Öğrencilerin sosyo-demografik ve hastalığa ilişkin özellikleri ile Koronavirüs (COVID-19) korkusu ölçek skor ortalamaları arasında istatistiksel olarak anlamlı derecede bir farklılık bulunmamaktadır ($p>0,05$) (Tablo 3).

Tablo 3. Demografik Değişkenlere Göre Koronavirüs (COVID-19) Korkusu Ölçek Skoru Bakımından Farklılıkların İncelenmesi

		Koronavirüs (COVID-19) Korkusu Ölçeği		Test	p
		Ortalama	Std. Sapma		
Yaş	17-22	18,26	5,63	0,385 ^F	0,681
	23-30	17,26	5,47		
	30-36	18,29	7,23		
Cinsiyet	Erkek	18,76	6,44	1,232 ^t	0,221
	Kadın	17,30	5,15		
Medeni durum	Bekar	17,62	5,57	-0,946 ^t	0,347
	Evli	19,40	6,28		
Eğitim durumu	Lisans	18,29	5,18	1,193 ^t	0,236
	Lisansüstü	17,87	4,87		
Gelir durumu	İyi	17,38	6,02	0,527 ^F	0,592
	Orta	18,16	5,70		

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	Kötü	16,65	5,20		
Daha önce COVID-19 oldunuz mu?	Evet	17,13	5,43	-0,647 ^t	0,519
	Hayır	18,00	5,71		
Ailenizde COVID-19 nedeniyle ölüm oldu mu?	Evet	13,40	3,51	-1,812 ^t	0,073
	Hayır	18,03	5,64		
Ailenizde/akrabanızda COVID-19 olan var mı? (Şimdi/Önceden)	Evet	17,49	4,98	-0,581 ^t	0,562
	Hayır	18,15	6,33		

*F: One-way ANOVA testi, t: Bağımsız örneklem t testi, *: $p < 0,05$*

TARTIŞMA

Koronavirüs Hastalığı (COVID-19) pandemisi, sağlık başta olmak üzere yaşamın her alanını olumsuz olarak etkilemiş ve bireylerin korku yaşamalarına neden olmuştur (Nguyen et al., 2020). Bu pandemi nedeniyle özellikle kendi ülkeleri dışında eğitim alan uluslararası üniversite öğrencilerinin hem eğitim hem sosyal yaşam hem de eğitimlerine ilişkin yaşadıkları korku ve stres düzeyleri etkilenmiştir (Perz et al., 2022). Bu çalışmada, uluslararası öğrencilerin koronafobi düzeyleri ve etkileyen faktörlerin belirlenmesi amaçlanmıştır. Katılımcıların koronavirüs (COVID-19) korkusu ölçeği skoru ortalaması $17,80 \pm 5,64$ olup, orta düzey korkuya sahipti. Çalışma bulgularımızın aynı ölçek kullanılarak yapılan çalışmalarla benzer olduğu görüldü (Duman, 2020; Kalafatoğlu & Yam, 2021; Tektaş, 2021).

Literatürde COVID-19 korkusu ölçeği kullanılarak yapılan çalışmalarda, katılımcıların yaşı (Nguyen et al., 2020; Tzur Bitan et al., 2020), sağlık çalışanı olma durumu (Doshi et al., 2020), evli olma durumu, düşük eğitim düzeyine sahip olma (Doshi et al., 2020; Perz et al., 2022) ve orta sosyoekonomik düzeye sahip olma durumları önemli ölçüde daha yüksek koronavirüs korkusu ile ilişkilendirilmiştir (Haktanir et al., 2020). Çalışmamızda; koronavirüs korkusu ölçeğinden alınan puanların ortalamaları ile katılımcıların yaşı, cinsiyeti, medeni durumu, eğitim düzeyine ve sosyoekonomik durumuna göre istatistiksel olarak farklılık göstermemiş olsa da 23-30 yaş grubundaki katılımcılar 17-22 yaş ve 30-36 yaş aralığındakilere oranla; kadınlar erkeklere oranla, bekarlar evlilere oranla ve lisansüstü öğrencilerin lisans öğrencilerine oranla daha düşük koronavirüs korkusu puan ortalamalarına sahiptiler. Haktanir ve arkadaşların yapmış olduğu çalışmada ise bizim çalışmamızda olduğu gibi katılımcıların koronavirüs korkusu puan ortalamaları ile yaş, sosyoekonomik durumları ve eğitim durumları arasında farklılık bulunmamıştır (Giordani et al., 2022).

Yapılan iki farklı çalışmada katılımcıların kronik hastalığa sahip olma durumları, risk grubunda olma durumları ve aile üyelerinin COVID-19'dan ölmesi durumlarının COVID-19 korku düzeylerini etkilediği belirlenmiştir (Giordani et al., 2022; Tzur Bitan et al., 2020). Çalışmamızda ise ailesinde COVID-19 nedeniyle ölüm yaşayanların korku düzeylerinin etkilenmediği görülmüştür.

Koronavirüs korkusu ölçeği kullanılarak yapılan çalışmaların çoğunluğunda; katılımcıların cinsiyetinin (kadın olma durumu) (Doshi et al., 2020; Haktanir et al., 2020b; Reznik et al., 2021; Rodríguez-Hidalgo et al., 2020; Sakib et al., n.d.; Zolotov et al., n.d.), daha yüksek koronavirüs korkusu ile ilişkili olduğu belirtilmiştir. Giordani ve arkadaşlarının yapmış olduğu çalışmada da özellikle 18-19 yaş aralığındaki kadınların daha yüksek COVID-19 korkusuna sahip olduğu bildirilmiştir (Giordani et al., 2022). Broche-Pérez ve arkadaşları ise yüksek korku düzeyine sahip bir kadının düşük korku düzeyine sahip olma olasılığı bir erkeğe göre 3,45 kat daha fazla bulunmuştur (Broche-Pérez et al., 2022). Bu durum kadınların psikolojik olarak daha kırılgan olduğunu göstermektedir. Ancak mevcut çalışmada cinsiyet korku düzeyini etkilememiştir. Bunun nedeni çok farklı kültürlere sahip katılımcıların çalışmada yer alması olabilir. Çalışmaların ve destek programlarının bu yönde uygulanması gerekmektedir.

Vietnam genelinde sekiz üniversitede 5423 öğrenci üzerinde kesitsel bir çalışmada; sağlık okuryazarlığı yüksek olan, daha büyük yaşa sahip, son akademik yılında olan ve ilaç parasını ödeyebilecek güce sahip

olan katılımcıların daha düşük COVID-19 korkusu ölçek puanlarına sahip oldukları; sigara ve alkol kullananların ise COVID-19 korkusu puan ortalamalarının yüksek olduğu belirlenmiştir (Nguyen et al., 2020; Yakut, 2020). Martínez-Lorca ve arkadaşlarının üniversite öğrencileri ile yaptıkları çalışmada birinci sınıf öğrencileri ikinci, üçüncü ve dördüncü sınıf öğrencilerine kıyasla daha yüksek COVID-19 korkusu ölçek puan ortalamalarına sahip olduğu belirlenmiştir (Martínez-Lorca et al., 2020). Rodríguez-Hidalgo ve arkadaşlarının Ekvadorlu lisans öğrencilerinin karantina sırasında COVID-19 korku, stres, kaygı ve depresyon düzeylerini analiz etmişler, stres anksiyete ve depresyon beklenenin üstünde çıkarken kaygıyı pozitif yönde etkilediğini belirtmişlerdir (Rodríguez-Hidalgo et al., 2020). Birleşik Arap Emirlikleri'nde öğrencilerle yapılan çalışmada öğrencilerin %15,9'u kaygılı, %51'i psikolojik sıkıntı içinde olduğu belirlenmiştir (Lai et al., 2020). Mevcut çalışmada da lisans öğrencilerin istatistiksel olarak anlamlı olmasa da korku düzeylerinin daha yüksek olduğu görülmektedir.

SONUÇ VE ÖNERİLER

Sonuç olarak, çalışmaya katılan öğrencilerin koronavirüs korku düzeylerinin orta düzeyde olduğu belirlendi. Çalışmaya katılanların sosyodemografik ve hastalığa ilişkin özelliklerinin koronavirüs (COVID-19) korku düzeylerini etkilemediği bulundu. Öğrencilerin pandemi sürecinde sadece hastalığa ilişkin korkularının değil eğitim ve sosyal yaşamlarına ilişkin endişelerinin de derinlemesine inceleneceği nitel veya örneklemi daha büyük olan nicel çalışmaların yapılması önerilmektedir. Öğrencilerin pandemi nedeniyle yaşamlarının her alanında deneyimleyebilecekleri korku, endişe ve stresi hafifletmek için; rehberlik, çevrimiçi danışmanlık ve başa çıkma stratejilerini içeren web tabanlı atölye çalışmalarının yapılmasına gereksinim vardır.

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**INVESTIGATING THE COMBINED MODE FAILURE MECHANISM IN HONEYCOMB
PANELS AND CALCULATING ENERGY ABSORPTION IN DYNAMIC LOADS**

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Honeycomb panels are widely used in various industries due to their good strength and suitable weight. Among other advantages of honeycomb structures, it can be mentioned that the mechanical properties of the structures can be changed by changing the geometric shape and changing the internal angles. Therefore, the development of analytical and computational methods for predicting the mechanical behavior of the structure is very important.

In this research, in order to investigate the structural change of honeycomb panels with geometrical deformation, a composite failure mode test sample has been simulated using the developed finite element methods. By considering the different geometries of the cells as well as the position and dimensions of the holes, the effect of these parameters on the ability to absorb energy in honeycomb structures was investigated.

On the other hand, the amount of energy absorption in dynamic loadings in geometric deformation was investigated.

This research showed that the defect has a great effect on the amount of energy absorption, and with the increase of defects, the amount of energy absorption also decreases. Numerical integration was investigated in the enriched elements and by analyzing the number of Gauss points in these elements, the number of optimal points was investigated on the fracture parameter.

Keywords: Failure Mechanism, FEM, Honeycomb Panels, Energy Absorption

1. Introduction

Honeycomb is a structure that is created by stacking open cells together. These cells are formed by connecting very thin sheets of a special material to each other and have different shapes. The most famous of them are hexagonal, rectangular and Circles. For many years, sandwich structures with a light core have been a common proposal for structures under pressure. Due to saving in the cost of production or having a suitable weight in the structure of sandwich panels, designing them based on the minimum weight is of special importance.

In recent years, honeycomb structures have been widely used in modern industries. Honeycomb panels, due to having characteristics such as high strength and stiffness and low weight, have been noticed by engineers in the construction of all kinds of airplanes, cars, boats and building structures. Separating the outer plates from each other increases the moment of section and as a result the panel is more resistant to buckling and bending. Today, various arrangement structures and materials have been proposed to be used as cores. The most widely used of these structures are aluminum hexagonal honeycomb and also types of polymer foams.

Since honeycomb structures are more efficient in terms of energy absorption in the out-of-plane direction, therefore, their destruction behavior has been studied more in this direction. Although in cases such as energy absorbing parts in airplanes that are installed against the impact of birds or other objects, the impact may occur in the plane direction. Therefore, it is important to study the destructive behavior of honeycombs in planar directions (Xiao, et al, 2021).

In recent work the model of honeycomb structure designed in ANSYS and combined mode failure mechanism in honeycomb and energy absorption in dynamic loads were studied.

2. Material and Method

In order to investigate the deformation of the honeycomb, a finite element model was created in ANSYS software. All the degrees of freedom of the support rigid plane are also constrained. Honeycomb walls are also tied in an out-of-plane direction to prevent their out-of-plane buckling. The length of the edge of the cell and the thickness of the wall were considered equal to 3.175 and 0.235 mm, respectively. The thickness of common walls was considered equal to the thickness of non-common walls Fig 1. In the validation phase of the results, it was found that the meshed model with 1 mm elements can predict the stress-strain response of polyurethane foam well. Then, polyurethane foam was placed in the honeycomb cells. In order to determine the nature of the contact between the foam and the honeycomb core, assumption of complete adhesion was considered and the condition of contact dependence was applied. In order to desensitize the model to element dimensions, three types of mesh were analyzed with element dimensions of 1, 2 and 0.5 mm, respectively.

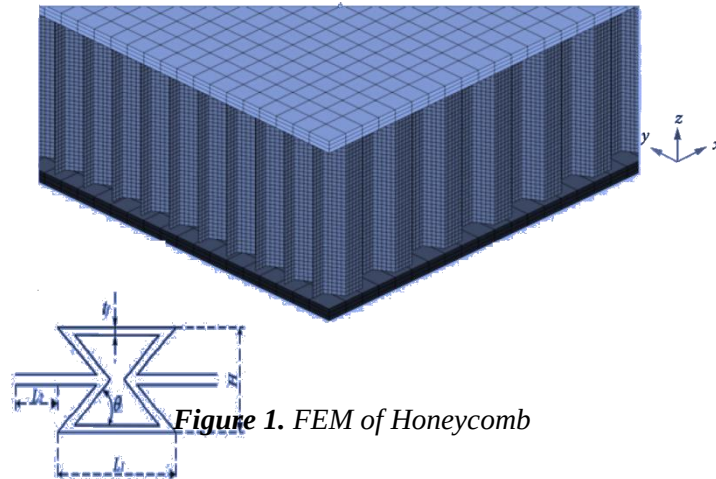


Figure 1. FEM of Honeycomb

One of the most important and complex issues in the developed finite element method is integration in enriched elements. Gaussian integration method is usually used for numerical integration in standard elements. Using suitable Gaussian points, this method is accurate for polynomial functions. In polynomial functions of degree n , for the integration to be accurate, the number of Gaussian points must be greater than or equal to $(\frac{n+1}{2})$. In this problem, due to the fact that the shape functions of the standard elements are linear, the number of Gauss points on each side is considered equal to 2. Since in the developed finite element method, the crack can arbitrarily pass through the element, the above standard method is not suitable for the integration of discontinuous fields in rich elements. In the elements that are completely interrupted by the crack and enriched with Heaviside step function, the numerical integration should calculate the contribution of each side of the discontinuity in the weak form of the equations.

Interactive integration method has been used to calculate the stress intensity coefficients in the combined mode. In this method, auxiliary fields are added to the real stress, strain and displacement fields. It is recommended to reduce the error and increase the accuracy in calculating the contour integration in the finite element method. The interactive integral in the area form is the following relation.

$$I_{1,2} = \int \left[\sigma_{ij}^1 \frac{\partial u_i^2}{\partial x_1} + \sigma_{ij}^2 \frac{\partial u_i^1}{\partial x_1} - W^{(1,2)} \delta_{1j} \right] \frac{\partial q}{\partial x_j} dA \quad (1)$$

Where, W is the strain energy and A is the integral area. $q(x)$ is a smooth weight function that takes a value of 1 on a path containing a crack and a value of 0 on an outer contour.

3. Results and Discussion

In this research, crack growth in mixed mode was developed using finite element methods, investigated and related relationships were presented. Then the crack growth under mixed mode loading is simulated using the developed finite element methods. At each stage of the analysis, using fracture criteria, the angle and amount of crack growth are determined. No assumptions are considered in the amount and growth of cracks and the complete process of crack growth is simulated. Numerical integration in enriched elements has also been investigated. It has been determined by using the influence of optimal Gauss points in the objective elements. The criterion of maximum tangential stress has been used for crack growth, and interactive integral method has been used to extract stress intensity coefficients. The recorded stress-strain diagrams showed that with the decrease in the density of honeycomb core, the increase in the collapse strength due to the presence of polyurethane foam is significant and vice versa. Figure 2 shows the collapse strength of the honeycomb for $v=10\text{m/s}$.

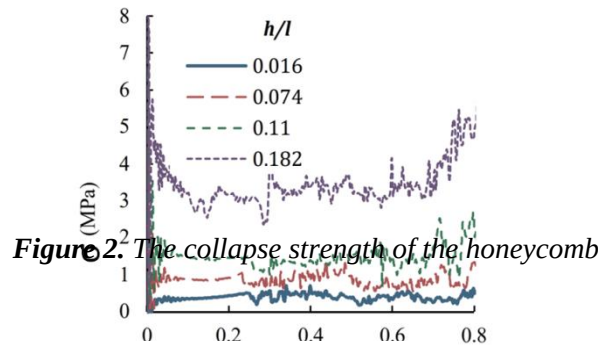


Figure 2. The collapse strength of the honeycomb

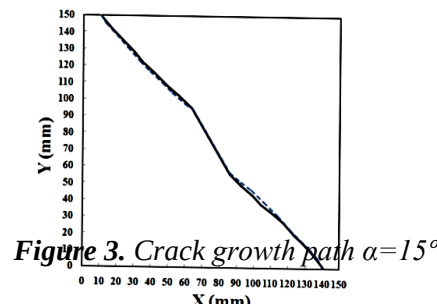


Figure 3. Crack growth path $\alpha=15^\circ$

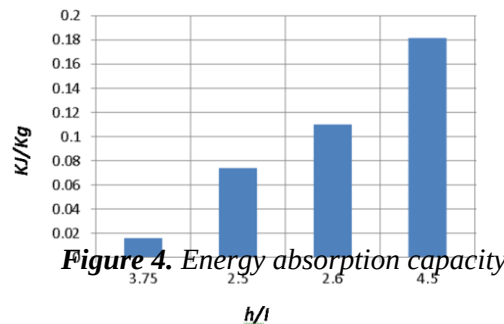


Figure 4. Energy absorption capacity

3. Conclusions

Considering the increasing consumption of honeycomb structures in various industries, their design and analysis in finite element software can greatly reduce construction costs.

The developed finite element method provides a new approximation of the finite element method. In this method, by adding appropriate functions to the standard approximation space, it is possible to consider the discontinuous field at the level of each element. As a result, the discontinuity boundary can pass through any element.

In modeling problems involving discontinuity using the finite element method, the elevation element must match the boundary of the discontinuity. Elementing should be done in such a way that the boundary of discontinuity does not pass through any of the elements. As a result, in issues such as cracks, the final answer depends on the method of elementing, their extension, and their shape and dimensions

One of the merits of the analytical method is a simple and specific formulation for design, although it can only be used in the elastic loading range and the complexity of the cross-section should be such that the design parameters do not exceed the number of limitations.

There is a good agreement between the crack growth path in the experimental tests and the developed finite element analysis (Dai, et al, 2022).

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Abstract

In this paper we will discuss importance of listening in education through elaboration of stages and forms of listening and its importance in educational process. Communication refers to the exchange of information and meaning with the purpose of managing the recipient's opinion, ideas, expectations and behaviours and achieving the desired goal or intention. Educational communication can be defined as a developmental-interactive process of creating and exchanging meaning between students and educators, which aims at the personal development of students. Interpersonal relationships are based on interaction. Integral part of that interaction is communication because it is impossible to create a human interaction without communication and vice versa. The educational process implies the establishment of relations between the educational subjects. If we accept that the establishment of relations is a communication process, then the educational process is also a communication process. In order to communicate effectively we need to have developed communication skills. One of communication skills especially important in educational process is listening. Research has proven that students spend on average half of their total communicating time on listening. In addition, effective listeners achieve greater academic success. Listening is extremely important for effective communication. In order to avoid the misunderstandings, it is not only important to hear but also to listen. Listening is not a natural process and requires effort and, being a skill, it can be learned.

Keywords: active listening, communication, communication skills, education, listening

INTRODUCTION

”Teaching is communication“ (Christensen, 2022:130). One of the numerous definitions of communication describe communication as “the exchange of information and meaning for the purpose of managing the thoughts, ideas, expectations and behaviour of the recipient and achieving a desired goal or intention” (Meffert, Burmann and Kirchgeorg, 2008:632). Educational communication can be defined as a developmental-interactive process of creating and exchanging meaning between students and educators (Bratanić, 1993), which aims at the personal development of students (Malić and Mužić, 1981:84). Interpersonal relationships are based on interaction. An integral part of that interaction is communication, because it is impossible to achieve human interaction without communication and vice versa. The educational process implies the establishment of relationships between educational subjects. Educational activity in an interpersonal relationship cannot take place if there is no interaction between the participants of that relationship, which is most often achieved through communication (Bratanić, 1993:75). If we accept that establishing relationships, regardless of their type and level, is a communication process, then the educational process is also a communication process. Namely, since the educational process implies the establishment of relations between the subjects of the process themselves, interpersonal communication is crucial for establishing relations. Therefore, there is no educational process without the communication process itself (Bavčević, 2016:1202).

In order to communicate effectively, we must have developed communication skills. One of the especially important communication skills in the educational process is listening. A person listens more than he or she speaks (Barker, Edwards, Gaines, Gladney and Holley, 1980; Davis, 2001; Rankin, 1930; Werner, 1975; Janusik, 2010). Research has shown that, on average, students spend half of their total communication time listening (Barker et al., 1980). Within the work context, listening is the most common form of communication (Wolvin and Coakley, 1991), while better listeners are more

successful in their careers and achieve higher levels in the organizations they work in (Sypher, Bostrom and Seibert, 1989). Listening has been identified as the most important skill for working effectively in teams (Hawkins and Fullion, 1999), and members of small groups view effective listeners as leaders of the groups (Johnson and Bechler, 1998). Effective listening is an essential ingredient of effective relational communication (Hjalone and Pecchioni, 2001) and is ranked as the most important communication skill in family and social settings (Wolvin, 1984; see also Adler and Rodman, 2006).

THE CONSTRUCT OF LISTENING

There is a lack of agreement about what listening is (Janusik, 2010). Although, there is agreement on the elements that the definition of listening should contain. A content analysis of fifty definitions of listening showed that the five most frequently used elements are *perception, attention, interpretation, remembering, and response* (Glenn, 1989; Janusik, 2010: 205), i.e. “The process of receiving, attending to, and assigning meaning to aural and visual stimuli” (Wolvin and Coakley, 1996:69). “Listening is hearing, understanding, remembering, interpreting, evaluating, and responding” (Brownell, 2002). “The dynamic, interactive process of integrating appropriate listening attitudes, knowledge, and behaviors to achieve the selected goal(s) of a listening event” (Thompson, Leintz, Nevers and Witkowski, 2004: 229-230).

Many wrongly think that listening and hearing are the same. „*Hearing* is the process in which sound waves strike the eardrum and cause vibrations that are transmitted to the brain. *Listening* occurs when the brain reconstructs these electrochemical impulses into a representation of the original sound and then gives them meaning. Listening isn’t automatic. Many times, we hear but do not listen. Sometimes we deliberately tune out unwanted signals“ (Adler and Rodman, 2006: 116-117). Successful listening consists of several stages (Adler and Rodman, 2006): a) *hearing*; b) *attending*—the act of paying attention to a signal; it is influenced by the needs, wants, desires, and interests of the individual; c) *understanding*—the process of giving meaning to the message; it often depends on the ability to organize the information we hear into recognizable form; d) *responding*—consists of giving feedback to the speaker; e) *remembering*—people immediately start to forget: research has shown that people remember only half of what they hear immediately after hearing (Nichols, 1948), within eight hours what is remembered drops to about 35 percent.

Listening is not a passive activity. Listeners are active participants in the communication process, simultaneously receiving and sending messages. It is not a natural process, it requires effort and as a skill it can and should be trained. We tend to assume that all listeners hear and understand the same message. But the truth is that each of us hear different messages due to physiological factors, social roles, cultural background, personal interests and needs (Adler and Rodman, 2006). People seem to get worse at the listening as they get older (Nichols and Stevens, 1957). Research has shown that 90 percent of children in the first and 80 percent of children in the second grade can repeat what the teacher said during the lecture. Only 44 percent of junior high students and 28 percent of senior high students could do the same. Adults listen even more poorly. Couples interrupt each another more often, are less polite to each other, and listen more carefully and politely to strangers than to their spouses (Winter, Ferreira and Bowers, 1973; Adler and Rodman, 2006). In addition, most people have habits (i.e. pseudo-listening, selective listening, defensive listening, ambushing, insulated listening, insensitive listening, stage hogging) that are an obstacle to effective listening. *Pseudo-listeners* pretend to listen, show interest while thinking about things unrelated to what the speaker is saying. *Selective listeners* respond only to the parts of the speaker’s remarks that interest them, rejecting everything else. *Defensive listeners* understand innocent comments as personal attacks. *Ambushers* listen carefully, but only because they are gathering information to attack what speaker has to say (e.g. cross-examining prosecutor). *Insulated listeners* avoid topics that they would rather not deal with, they simply do not hear or appreciate them. *Insensitive listeners* are unable to understand hidden meanings in words and behaviour. *Stage hogs* (sometimes called “conversational narcissists”) try to turn the topic of conversations on themselves instead of showing interest in the speaker (Vangelisti, Knapp and Daly, 1990; Adler and Rodman, 2006).

A lot of listening is not effective, and we often misunderstand others and in turn are misunderstood for various reasons. *Effort*—the physical changes that occur during attentive listening are similar to the body's reaction to physical effort: heart rate quickens, breathing increases, and body temperature rises (Nichols, 1987). *Message overload*—we listen to verbal messages for one third of our waking hours, which makes it impossible to listen carefully to everything we hear. *Rapid thought*—although we are able to understand speech at rates up to 600 words per minute, the average person speaks between 100 and 140 words per minute (Drullman and Smoorenburg, 1997), we have significant mental “spare time” to spend while someone is speaking, using it in ways not relating to the speaker's ideas. *Psychological noise*—we are often wrapped up in personal concerns that are of more important to us than the messages sent by others. *Physical noise*—the sound of traffic, music, other people's speech, fatigue, or other forms of discomfort are some of the distractions that interfere with listening. *Hearing problems* and *faulty assumptions* also affect listening accuracy. *Talking has more apparent advantages*—we often seem to gain more by talking than by listening. One study found a difference between male and female interrupters (Mulac, Wiemann, Widenmann and Gibson, 1988). Men tend to interrupt conversations far more than women. Their goal was usually to control the discussion. Women interrupt for very different reasons: to express agreement, to elaborate on the speaker's idea, or to participate in the topic of conversation. *Cultural differences*—the way members of different cultures communicate can affect listening (Kiewitz, Weaver, Brosius and Weimann, 1997). *Media influences*—trends in mass media (short segments in programming such as news, commercials, music videos; news consisting of short stories with less and less text and a more and more graphic information) discourage the focused attention required for attentive listening, especially complicated ideas and feelings (Adler and Rodman, 2006:121-125).

Having found that not everyone listens in the same way, communication researchers have identified four personal listening styles (Barker and Watson, 2000): content-oriented, people-oriented, action-oriented, and time-oriented. *Content-oriented listeners* are most interested in the quality of messages they hear. They like to look for details and are good at analysing problems from several perspectives. They give weight to the messages from experts and other credible sources of information. This approach risks annoying people who do not have the same kind of analytical orientation and may take more time than others might give, and the challenging ideas that comes with it may be perceived as overly critical or even hostile. *People-oriented listeners* are particularly concerned with creating and maintaining positive relationships. They are attuned to other people's moods, and respond to the speaker's feelings as well as their ideas, and are more interested in understanding and supporting people than in evaluating them (Chesebro, 1999). People-orientation also has its weaknesses. It's easy to become overly involved in other people's feelings. People-oriented listeners may lose their detachment and ability to assess the quality of information others provide in an effort to be accommodating and supportive. Less personally oriented communicators may find them overly expressive and even intrusive. *Action-oriented listeners* are most concerned with the task at hand. Their main concern is to understand what response the message requires. They want to get to the heart of things quickly, value clear, concise messages and often translate other people's remarks into well-organized mental outlines, but seem to minimize emotional issues and concerns, which can be an important part of business and personal transactions. *Time-oriented listeners* are most concerned with efficiency. For them, time is precious and should not be wasted. Time orientation can be an asset when deadlines and other pressures require quick action. On the other hand, time orientation can repel others when it seems to disregard their feelings (Adler and Rodman, 2006:126-127).

While listening, we generally use more than one listening styles (Watson, Barker and Weaver, 1995; Weaver, Richendoller and Kirtley, 1995; Bodie and Villaume, 2003; Villaume and Bodie, 2007), but we can control how we listen and use the styles that best suit the situation (Adler and Rodman, 2006). Listening style preferences refer to attitudes and beliefs about who, what, where, when, and how of information is received and encoding (Watson et al., 1995; Beall, Gill-Rosier, Tate and Matten, 2008). Some individual differences have been found among these listening styles, with women being more likely to be people-oriented listeners and men more likely to be action-, content- or time-oriented listeners (Johnston, Weaver, Watson and Barker, 2000; see also Beall et al., 2008: 124-125). People are generally inflexible when it comes to their listening preference(s). Individuals tend to continue to use

their preferred listening style(s) even when a different listening style might help them receive and/or retain information better (Bostrom, 1990; Langer, 1980; Steil, Barker and Watson, 1983). This is especially important for teachers because not only should they try to address all students' listening styles, but they also have to deal with students' stubbornness to listen in their preferred listening style. Teachers should also consider their students' learning styles when designing lessons, presenting materials, and encouraging effective listening (Beall et al., 2008).

LISTENING IN EDUCATION

Listening plays an important role in the teaching and learning process (Beall et al., 2008; Krković, 2020). Students who listen effectively during class are better students than those who listen less effectively in the classroom (Bommelje, Houston and Smither, 2003; Brigman, Lane, Switzer, Lane and Lawrence, 1999; Conaway, 1982; Dickinson, McCabe and Sprague, 2003; Beall et al., 2008). Not only is listening comprehension considered critical to success in college (Boyer, 1987), but listening ability has been associated with greater academic success (McDevitt, Sheenan and McMenamin, 1991) as well as an increased likelihood that a student will continue their education (Conaway, 1982; Janusik, 2010).

Žižak, Vizek Vidović and Ajduković (2012) divide listening in education into five forms of listening. *Discriminative listening*—attention is directed to the content of the message and its importance is assessed, and the person behaves in accordance with the assessment; during such listening, the teacher must assess the importance of the message sent by the student(s) and based on non-verbal signs, judge whether it is accurate information and whether it is necessary to react, because sometimes students tell teachers a lot of information during one teaching day that may not be essential for the content of the work, so it is up to the teacher to decide what to do with the given information. *Listening with understanding or content-oriented listening*—the listener's attention is directed towards the information, facts and main ideas presented, and this is the most common form of listening during teaching activities aimed at understanding the teaching content; this kind of listening is most often expected from students when it comes to teaching content, because this is the easiest way to remember information. *Evaluative, interpretive or critical listening*—this form of listening is used in situations when we have to make a certain decision, assume some obligation, and therefore listen carefully to facts and arguments in order to make the right choice or act; students use this form of listening when the teacher assigns them a certain task with the possibility of their own selection or evaluation. *Empathic listening or listening with compassion*—this form of listening is aimed at understanding the feelings, thoughts and viewpoints of the interlocutor; such listening significantly contributes to a deeper understanding of the person; it is very important that teachers listen to their students as much as possible in this way because this shows the students that the teacher understands and sympathizes with them. *Dialogic or relational listening*—communication develops through a two-way process, and messages are shaped by conversation; such an exchange of thoughts, feelings and points of view contributes to better mutual understanding and the creation of better relations.

It is important that the students listen to the teacher, but also that the teacher listens to the students (Krković, 2020). A variety of listening styles are present in each classroom, making it difficult for teachers to elicit attention, understanding, and retention from every individual student (Beall et al., 2008: 125). Instructors must try to reach all students in a limited amount of time, no matter what students' listening or learning styles may be (Beall et al., 2008: 124). Therefore, the teacher always applies all forms of listening in order to receive the student's message in the way it was sent. On the other hand, during classes, students most often apply listening with understanding or content-oriented listening and evaluative listening, as well as a combination of empathic and dialogic listening in the relationships with their peers (Matijević, Bilić and Opić, 2016).

Students admit that they do not listen to their ability because they do not have a clear concept of what listening is and how they can improve and control their own listening process (Ford and Wolvin, 1993; Imhof, 1998). Listening is not a natural process and requires effort, and because it is a skill, it can be learned (Spinks and Wells, 1991). Despite this fact, the amount of time devoted to teaching listening is far less than that devoted to other types of communication. Instructors resist teaching listening because

they feel they are not well trained, that it would take too much time, and there are not enough teaching material (Steil, 1984; Janusik, 2010). However, there are some research findings on teaching or training listening. After listening instruction or training, some researchers have reported significant increases in listening perception (Imhof, 1998; Johnson and Long, 2007; O'Hair, O'Hair and Wooden, 1988) and ability (Brown, 1954; Schramm and Wayne, 1993; Whitfield, 1964), while others have found no evidence to support positive changes in listening perception (Ford, Wolvin and Chung, 2000) or ability (Hollingsworth, 1966; Johnson and Long, 2007; Pétrie, 1964; Janusik, 2010:200).

Listening has been sidelined within the university curriculum due to limited scholarly classroom materials, lack of agreement as to the construct of listening, and inadequate research—much of what is believed to be known about listening is not supported by research, and some of what is supported by research is actually supported by outdated research (Janusik, 2010:194). Beall et al. (2008) suggest future research to identify successful teaching strategies that can help teachers elicit effective listening from students of all listening and learning styles; examine how teachers can address differences in listening and learning style in the classroom, reach all students equally, and best capture and maintain student attention while increasing student understanding; and explore the academic benefits associated with listening skills.

CONCLUSION

The role and importance of listening is unquestionable, both in everyday communication and in education. Despite this fact, listening still does not have the place it deserves in learning and teaching communication skills as well as in listening pedagogy research. Most of what is known about listening is not supported by research or is supported by outdated research. As we know, communication occupies a central place in teaching and education in general and is the basis for establishing good interpersonal relations between teachers and students, which are an important prerequisite for achieving quality education. Considering research results showing that students spend half of their communication time listening, and the fact that neither students nor teachers are trained in listening skills, this calls for urgent steps in listening research, teaching, and curriculum design.

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**6TH INTERNATIONAL CONFERENCE ON
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**METHODS OF TEACHING DIAGRAMS AT SCHOOL
DIAQRAMLARIN MƏKTƏBDƏ ÖYRƏDİLMƏSİ METODİKASI**

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Abstract. The main goal here is to synthesize and analyze information obtained by students from different sources; to receive new information and to process new information; to develop the ability to self-expression and creative self-expression, to increase interest in objects; conduct statistical analysis of the information obtained by means of a schematic description; construct charts on tables or other information; develop skills to work with different types of diagrams.

The main goal is to organize lessons with interdisciplinary links that can expand the knowledge of students at the expense of researching each subject and encourage them to pay more attention to the choice of future career and image.

As we know, after the 7th grade "Creating Word Tables" comes the season of "creating diagrams in Word". Today, in schools, the number of people in the course of the students in the school is very small. After teaching the rules of creating the Tables on "Tables" in Word to organize the lesson, as a homework, the students are investigating their loved ones, and even investigated them and even calling them on these subjects. The "Diagram in the text editor" can be offered to prepare a project for the section.

Keywords: Bar Chart/Graph, Pie Chart, Line Graph or Chart, Histogram Chart, Area Chart, Scatter Plot, Bubble Chart.

Məqaləmi Azərbaycan xalqının ümummilli lideri - Heydər Əliyevin kəlamı ilə başlamaq istərdim: Cəmiyyətin gələcək tərəqqisi bir çox cəhətdən indi gənclərimizə nəyi və necə öyrətməyimizdən asılı olacaqdır.

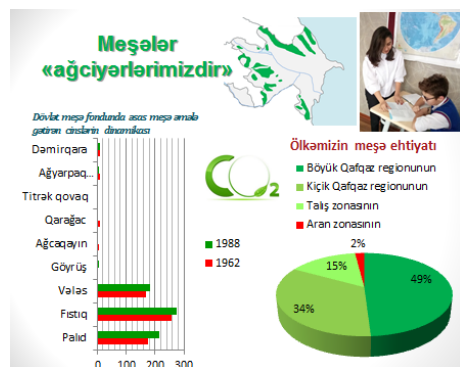
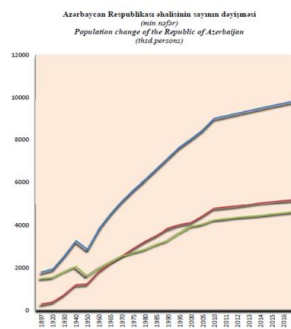
Giriş

Bildiyimiz kimi, 7-ci sinifdə “Word-cədvəllərin yaradılması”-dan sonra “Word-də diaqramların yaradılması” mövzusu gəlir. Bu gün məktəblərdə şagirdlərin arasında hansı istiqamətdə inkişaf etmələrini dəqiq təyin edənlərin sayı çox azdır. Dərsi düzgün təşkil etmək üçün “Cədvəllər”mövzusunda cədvəllərin necə Word-də yaradılması qaydaları öyrədildikdən sonra, ev tapşırığı olaraq, şagirdləri sevdikləri fənlər üzrə qruplara ayıraraq, onlara araşdırma apararaq, hətta bu fənlərdən kiçik layihələrini adlandırmaq da tapşırıqlıdır. “Mətn redaktorunda diaqram” bölmə üçün sinifə layihə hazırlamağı təklif etmək olar. Mən məktəbdə keçilən bir dərs nümunəmi təklif edirəm.

Araşdırma

Dərsdə, şagirdlərə bir neçə cədvəl və diaqram nümayiş edərək və onlardan hansının daha əyani təqdim olunma forması olduğunu aydınlaşdırıram.

Şagirdlər 5-ci sinifdən riyaziyyat fənnindən diaqramlarla tanışdılar. Buna baxmayaraq, diaqramların üstün cəhətlərini: diaqram verilənləri qrafik formada əyani təqdim etmək üçün nəzərdə tutulub və diaqramlar verilənləri daha yaxşı təhlil etməyə, onları müqayisə etməklə cədvəldə gözə çarpmayan qanunauyğunluqları aşkarlamağa imkan verdiyini diqqətə çatdırmaq olar. Daha sonra, Word mətn redaktoruna diaqramın əlavə olunmasını nümayiş etdirərək, bu prosesin Excel elektron cədvəl vasitəsilə baş verməsini qeyd edərək, əsas istifadə olan diaqramların: xətti, sütunlu, dairəvi diaqramlar haqqında kiçik məlumatlar vermək də tam yerinə düşər. **Xətti diaqram**, yaxud **qrafik** - vaxt ərzində

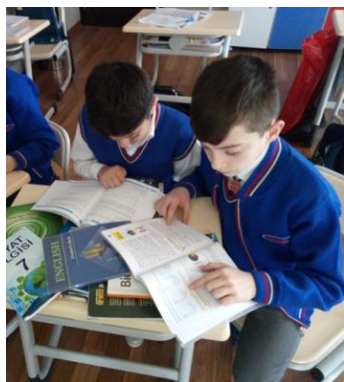
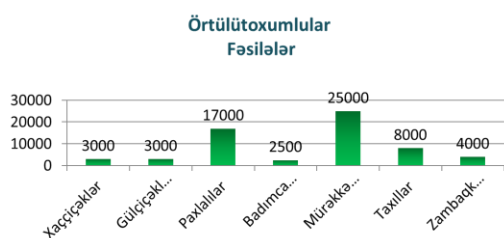


fənnini sevən qrup fənn müəllimi ilə birlikdə apardıqları araşdırmalar nəticəsində “**Atmosferi qoruyaq!**” adlı şuarı ilə çıxış edərək, bildirdilər ki, hava canlı aləm üçün önəmli faktordur. Havada olan qazlar 2 qrupa bölünür: 1) havada tapılan və miqdarı dəyişməyən (oksigen, azot) 2) havada daim tapılan və miqdarı dəyişən (ozon, karbon qazı, su buxarı). Bu qrup topladıqları məlumatları dairəvi və xətti diaqramdan istifadə edərək, son 150 ilin ən böyük bəlasının karbon qazının miqdarının artmasını əyani olaraq göstərdi. Həmçinin karbon qazının bitkilər tərəfindən mənimsənilərək oksigenə çevrilməsini və uzvi maddə üçün xammal olduğunu söylədilər. Amma, karbon qazı miqdarından artıq olduqda qlobal istiləşməsinin baş verməsinə,



artan aramsız yağışlara, fırtınalara səbəb ola bilər. Sonda, onlar, “Ona görə də hər birimiz bacardığımız qədər təbiəti qorumalıyıq!” şuarı ilə çıxışını bitirdi. Ondan sonra Meşələr «ağciyərlərimizdir» adla coğrafiyanı çox sevən şagirdlər fənn müəllimi ilə birlikdə hazırladıqları layihəni meşələrimizə həsr etmişdilər. Sütunlu diaqramdan istifadə edərək meşə fondumuzda üstünlük təşkil edən ağac cinslərini nümayiş etdirdilər. Digər dairəvi diaqramda isə ölkəmizin meşə ehtiyatını təsvir edərək, əyani olaraq ölkəmizin ən geniş meşə ehtiyatının 49%-nin Böyük Qafqaz meşələrinin payına, 34%-i Kiçik Qafqaz regionunun, 15%-i Talış zonasının və 2%-i Aran zonasının (Naxçıvan MR ilə birlikdə) payına düşməsinə göstərdilər. Azərbaycanda adambaşına 0,14 ha meşə sahəsi düşür. Hazırda 261 min hektar meşə fondu sahəsi Ermənistan tərəfindən işğal edilərkən və onlar çox pis vəziyyətə salınmışdır. Öz çıxışını isə, “Meşələrimiz planetimizin “ağciyərləri” sayılır, onu qoruyub saxlamaq, bərpasını davam etdirmək hər bir Azərbaycan vətəndaşının borcudur” şuarı ilə bitirdilər.

Biologiya sevarlər qrupu isə müəllimi ilə birgə araşdırmalar apararaq, layihə qatılmışdılar. Mövzu Örtülütoxumlular şöbəsi, fəsilələr və bu fəsilələrə aid olan növlər haqqında oldu. Növ sayını sütunlu diaqramda göstərərək, aydın olmuşdur ki, mürəkkəbçiçəklilər ən çox, badımcənçiçəklilər isə az növ sayına malikdirlər. Bizim



gündəlik qidalanmağımız üçün bu növlərə çox böyük ehtiyacımız var. Məsələn, çörəyi taxıllar fəsiləsinin bir növü olan buğdadan, kartof, pomidor, bibər, badımcanı badımcənçiçəklilər fəsiləsindən əldə etdiyimizi bildirdilər. Bu şöbə ən iri şöbə sayılır və 300.000 növü var. Toxumun üstü meyvəyanlığı ilə örtülü olduğuna görə toxum qorunur və bu şöbənin sayı artır. Bu da o deməkdir ki, yaxın zamanda biz insanlar qidasız qalmayacağıq. Bunun isə bütün bəşər üçün sevindirici hal olduğunu bildirdilər.

Digər şagirdlər qrupuna isə, istifadə etdikləri dərsliklərdəki diaqramların içərisində hansı diaqram növündən istifadənin dairəvi diaqram vasitəsilə təsvir etmələri və bu diaqramlardan ən çox istifadə olunan növü xətti, ən az istifadə olunan növü isə səpələnmiş diaqram olduğunu göstərmək tələb olunurdu. Bundan başqa, onlardan, sinif yoldaşları ilə sorğu keçirərək, onların boş vaxtlarında hansı kitabları oxuduqlarını araşdıraraq, sütunlu diaqram vasitəsilə ən çox oxunan hekayə, ən az oxunan isə texniki kitabların olduğunu əyani olaraq göstərildi və sonda müasir dövrümüzdə



Bir qrup isə məktəbin həkimi köməyi ilə şagird yoldaşlarının çəkirlərini silindirik diaqramla göstərərək sinfin ən ağır və ən arıq şagirdini müəyyənləşdirdilər. O, şagirdlərin boylarını isə konus şəkilli diaqramla göstərərək ən uca boy şagirdi və ən kiçik boylu şagirdi müəyyənləşdirərək, sonda onların sağlam qidalanmalarını və sağlam həyat tərzini keçirmələrini məsləhət gördülər.

Tarixçi qrupu isə fənn müəllim ilə əməkdaşlıqla Azərbaycan dövlətçiliyində tarixi ərazilərini sütun diaqramında göstərməyə çalışmışdılar. Buradan göründüyü kimi, tarixi torpaqlarımız Səfəvilər dövləti zamanında 100% təmin olunmuşdur. Hazırda yaşadığımız Azərbaycan Respublikası dünyada nadir dövlətdir ki, quru sərhədləri öz tarixi torpaqlarıdır. “Biz gələcək nəsillər daima çalışmalıyıq ki, öz tarixi ərazilərimizi bərpa edək!”-çağırışı ilə çıxışını bitirdilər.



Layihəni “Dədə qorqud” filmindən torpaqlar haqqında olan fraqmentlə bitirərək, sonda əlavə olaraq vətənimizi hər yerdə layiqincə tanıtmək və təqdim etmək üçün savadlı, elmi və müasir texnologiyalardan düzgün yerində istifadə edən gənclər lazımdır! şuarı ilə bitirdim.

Nəticə:

Burada əsas məqsəd, Şagirdlərdə müxtəlif mənbələrdən əldə edilmiş informasiyaların sintez və analiz edilməsi; yeni məlumatlar əldə etmək və yeni informasiyalar emal etmək;

müstəqil və yaradıcı formada özünü ifadə etmə bacarığını inkişaf etdirmək, fənlərə olan maraqlarını gücləndirmək; əldə edilən informasiyaların diaqram şəkilində təsviri vasitəsilə onların statistik təhlilini aparmaq; cədvəl və ya digər informasiya növləri üzərində diaqramların qurulması; müxtəlif diaqram növləri ilə işləmək bacarığını inkişaf etdirməkdir.

Ən başlıca məqsəd isə, fənlərarası əlaqələrlə dərslərin belə təşkili, şagirdlərin hər bir fənn üzrə araşdırma yolu ilə biliklərini artırma bilər və gələcək peşə seçimlərinə və yaşayış tərzlərinə daha da diqqətlə yanaşmalarına səbəb olar.

Ədəbiyyat

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