INTERNATIONAL EUROASIA CONGRESS ON SCIENTIFIC RESEARCHES AND RECENT TRENDS XV

OCTOBER, 03-10, 2026 / MECCA, KINGDOM OF SAUDI ARABIA

PROCEEDINGS BOOK

EDITOR: Assoc. Prof. Dr. Ahmet KARATAY

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INTERNATIONAL EUROASIA

Congress on Scientific

Researches and Recent Trends XV

October, 03-10, 2026 / Mecca, Kingdom of Saudi Arabia

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adapted by Mariam Rasulan

CONGRESS ID

CONGRESS TITLE
15th INTERNATIONAL EUROASIA Congress on Scientific Researches and Recent Trends XV

DATE and PLACE
October, 03-10, 2026 / Mecca, Kingdom of Saudi Arabia

PARTICIPATION
Keynote & Invited

ORGANIZATION
IKSAD Institute

CONGRESS COORDINATOR
Esma AKSAKAL

LANGUAGES
Turkish, English

PARTICIPANTS COUNTRY (13)
PARTICIPANTS COUNTRY (13): Algeria, Azerbaijan, Hungary, Guinea, India, Indonesia, Iran, Kazakhstan, Libya, Nigeria, Pakistan, Romania, Türkiye

NUMBER of ACCEPTED PAPERS-55
NUMBER of REJECTED PAPERS-10
TOTAL NUMBER of PAPERS FROM TÜRKİYE- 26
TOTAL NUMBER OF INTERNATIONAL PARTICIPANTS: 29

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15.
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KONGRESİ


15.
Uluslararası
AVRASYA
KONGRESİ
3-10 Ekim 2026
7 GECE 8 GÜN
UMRE PROGRAMI
İKSAD ENSTİTÜSÜ
İKTİSADİ KALKINMA VE SOSYAL
ARAŞTIRMALAR ENSTİTÜSÜ


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Certificate of Participation

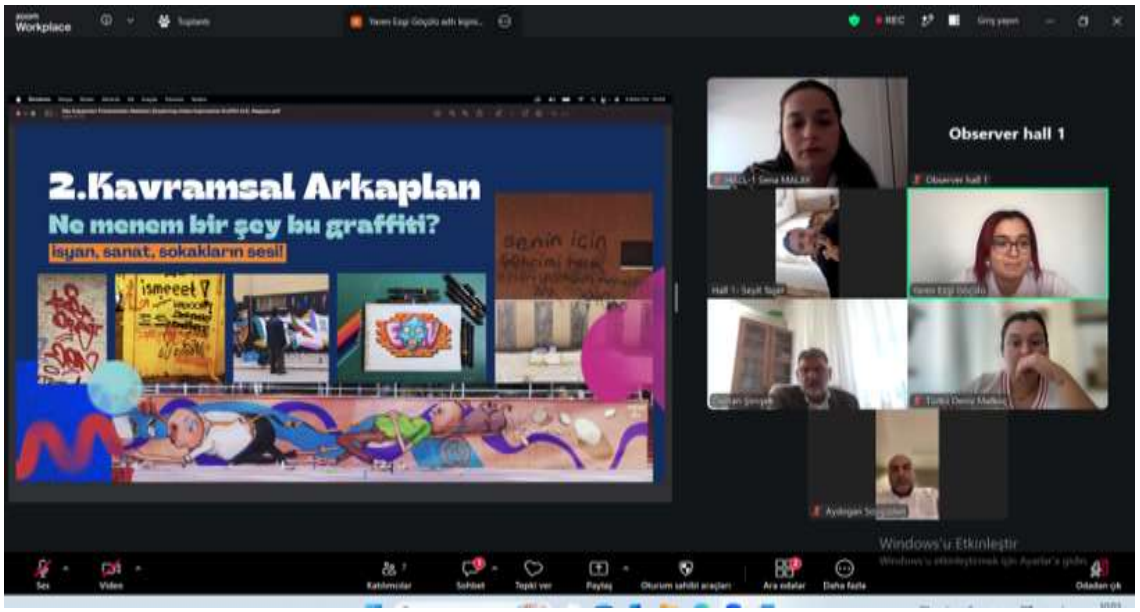

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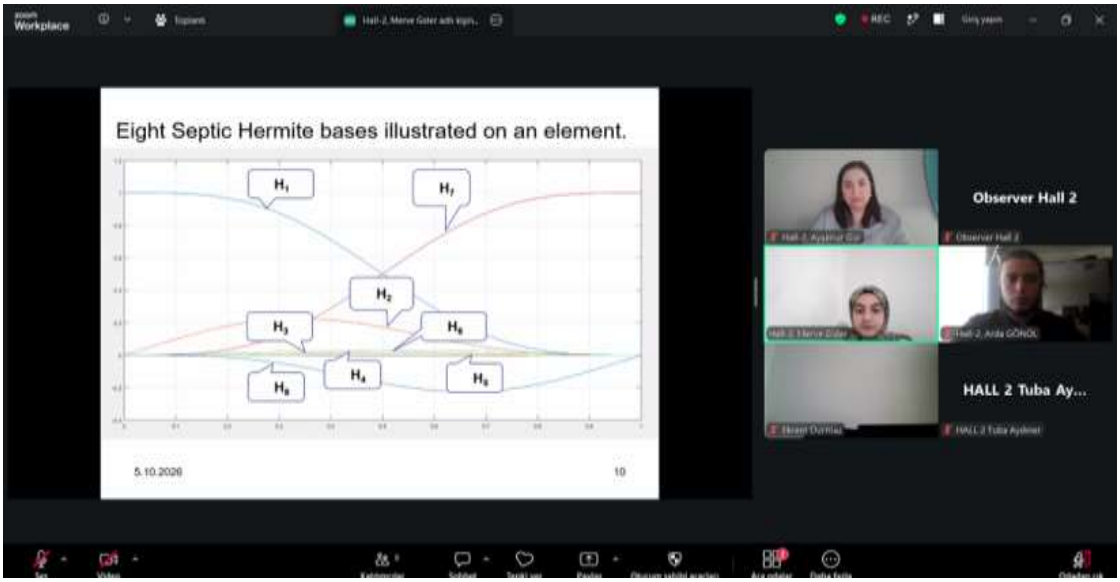


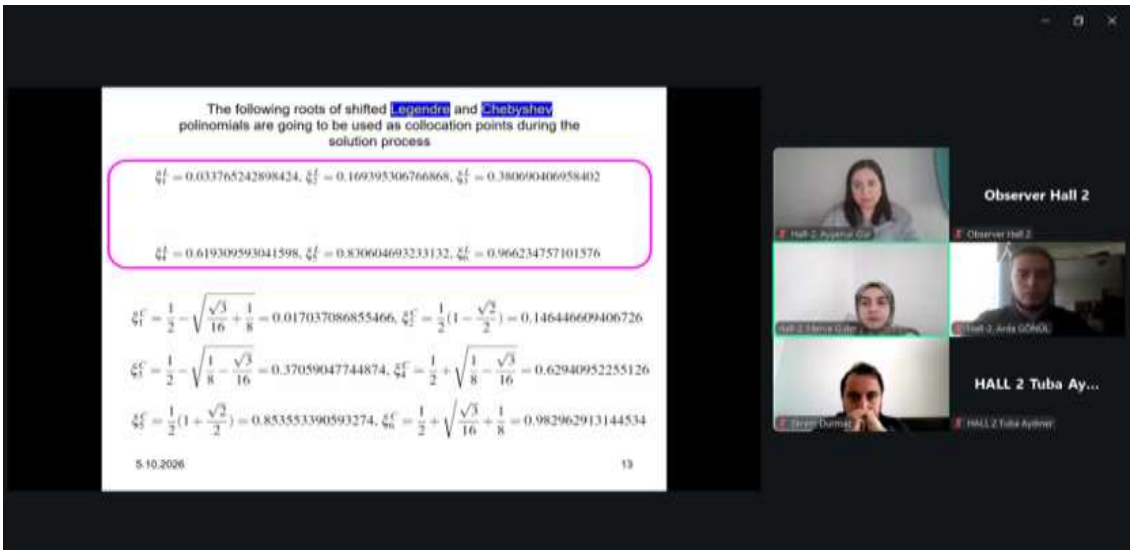


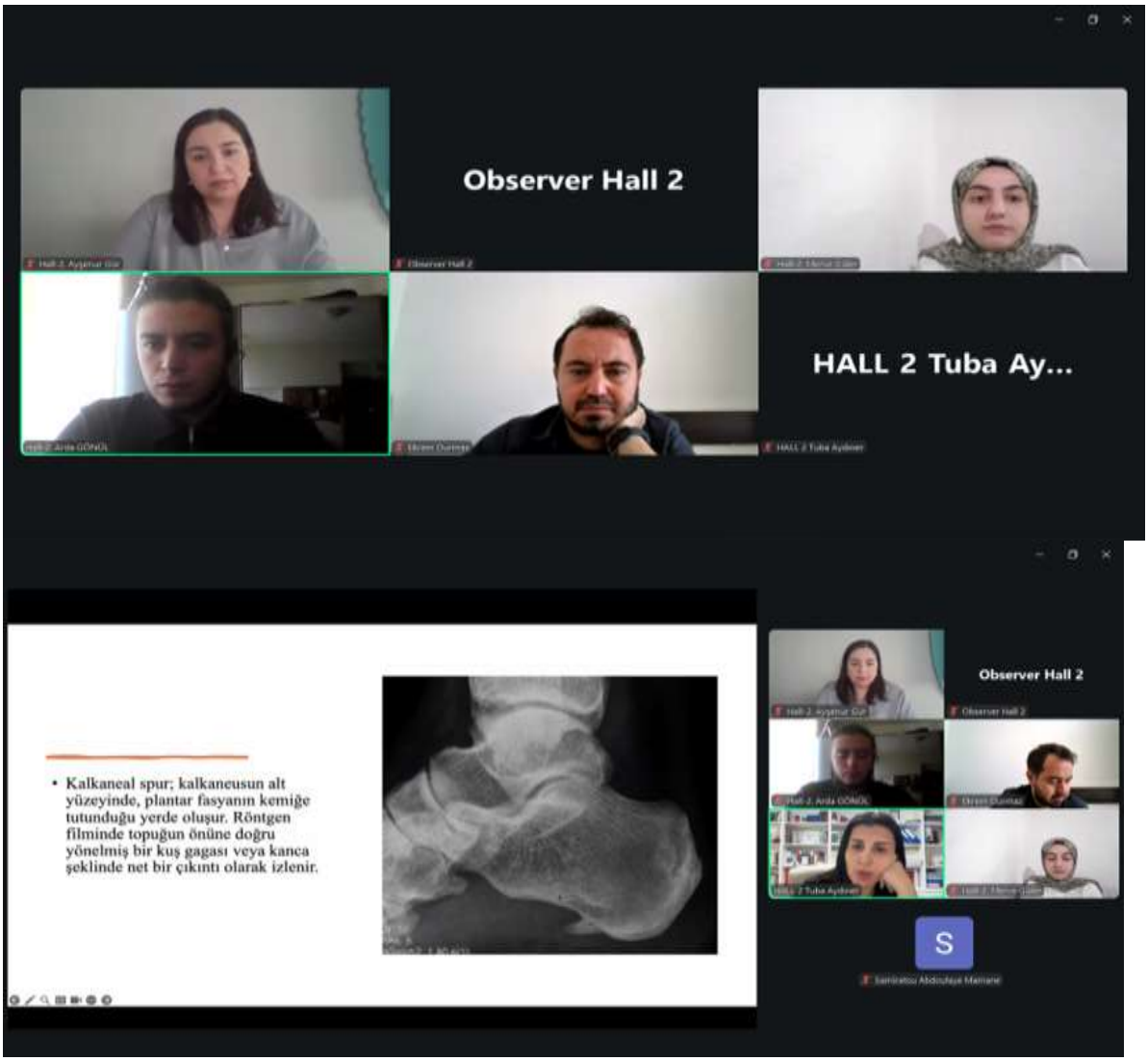

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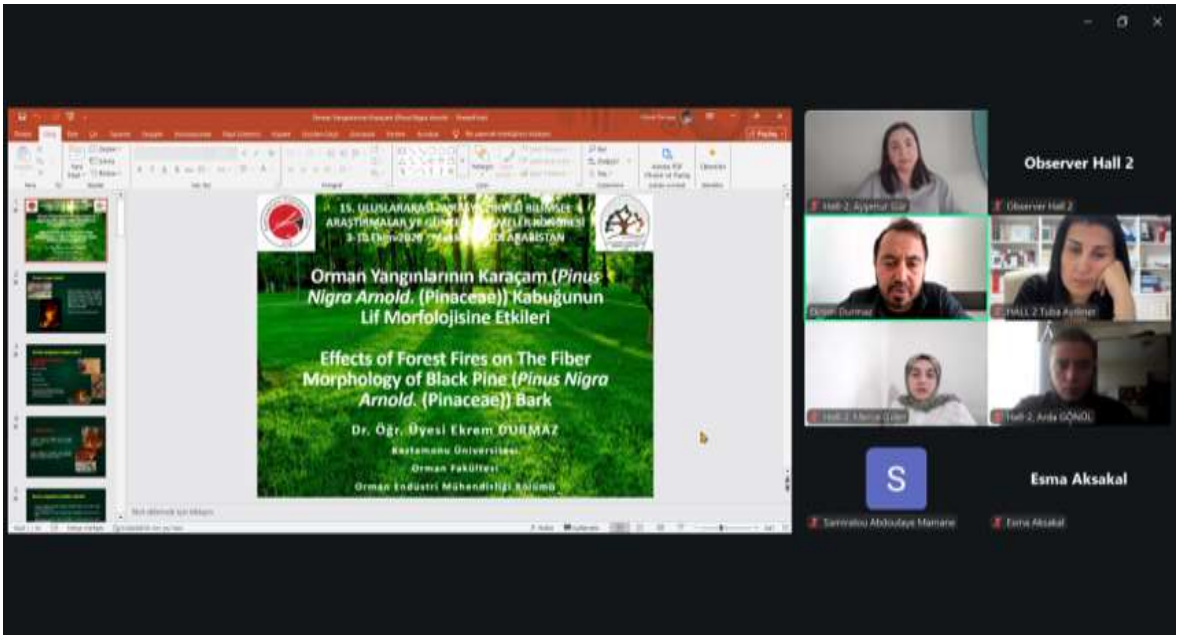


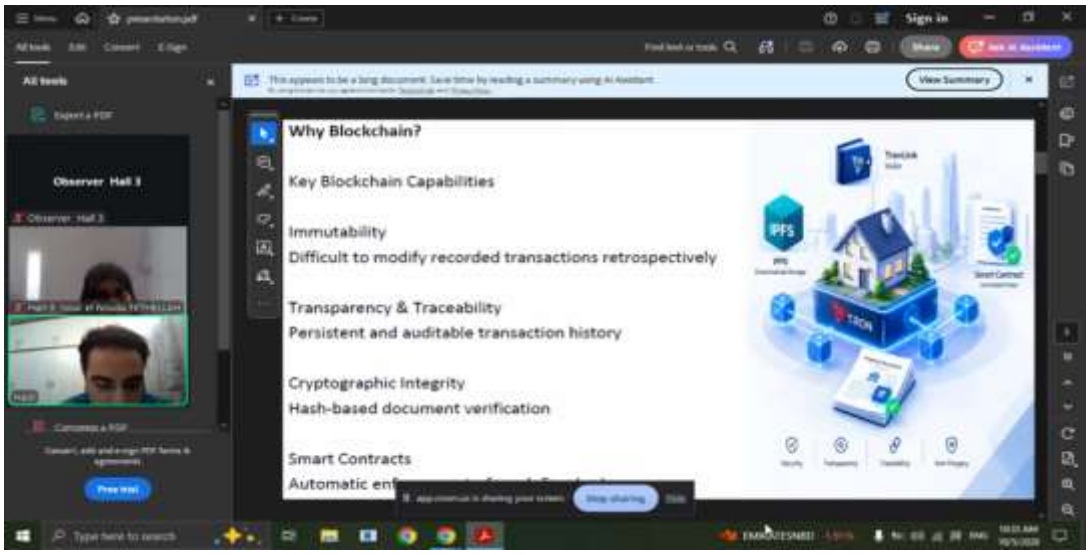

Workplace
2.Kavramsal Arkaplan
Ne menem bir şey bu graffiti?
isyan, sanat, sokakların sesi!
Observer hall 1
Windows'u Etkinleştir

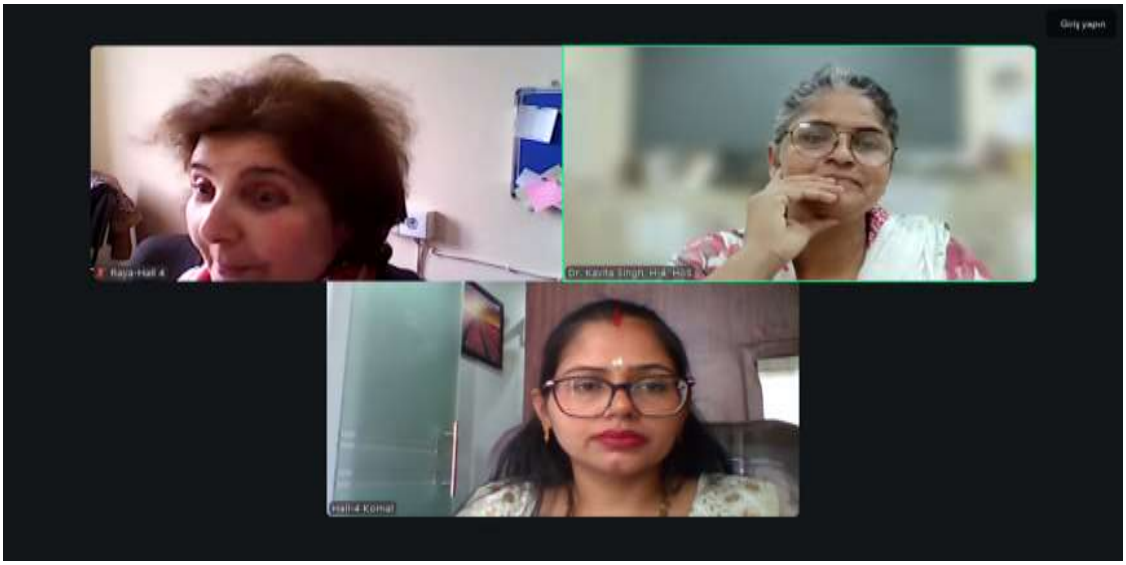

Workplace
Eight Septic Hermite bases illustrated on an element.
H1
H7
H2
H3
H6
H5
H4
H8
5.10.2026
10
Observer Hall 2
HALL 2 Tuba Ay...

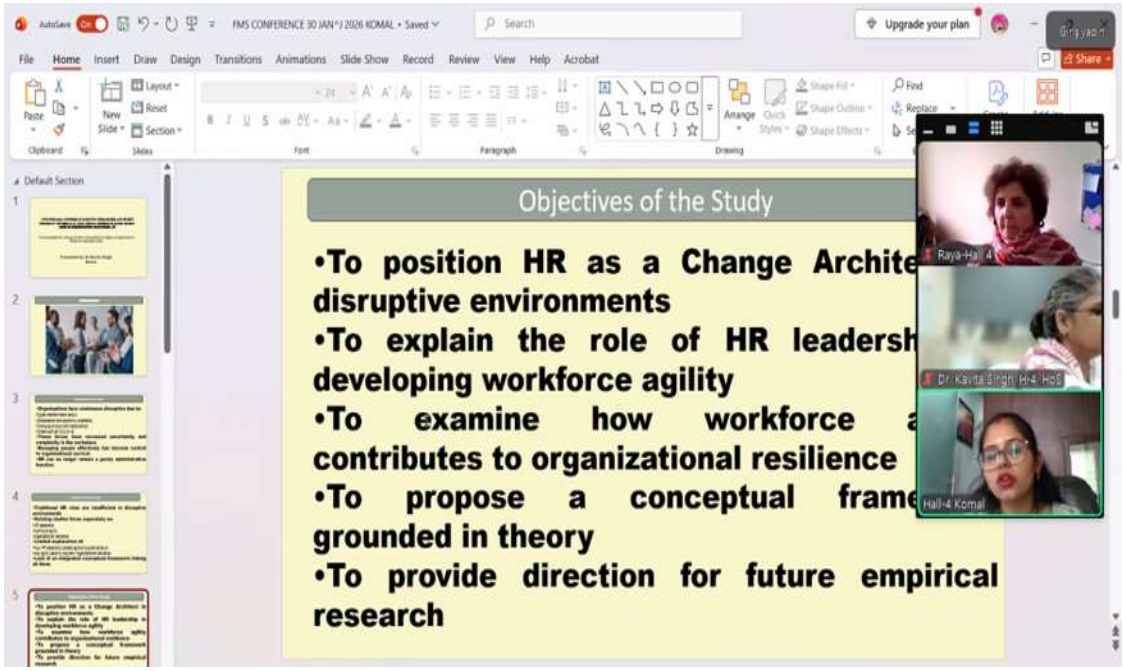

The following roots of shifted Legendre and Chebyshev polinomials are going to be used as collocation points during the solution process
$\xi_{01}^{L} = 0.033765242898424,\ \xi_{02}^{L} = 0.169395306766868,\ \xi_{03}^{L} = 0.380090406958402$
$\xi_{04}^{L} = 0.619309593041598,\ \xi_{05}^{L} = 0.830604693233132,\ \xi_{06}^{L} = 0.966234757101576$
$\xi_{01}^{C} = \frac{1}{2} - \sqrt{\frac{\sqrt{3}}{16} + \frac{1}{8}} = 0.017037086855466,\ \xi_{02}^{C} = \frac{1}{2}(1 - \frac{\sqrt{2}}{2}) = 0.146446609406726$
$\xi_{03}^{C} = \frac{1}{2} - \sqrt{\frac{1}{8} - \frac{\sqrt{3}}{16}} = 0.37059047744874,\ \xi_{04}^{C} = \frac{1}{2} + \sqrt{\frac{1}{8} - \frac{\sqrt{3}}{16}} = 0.62940952255126$
$\xi_{05}^{C} = \frac{1}{2}(1 + \frac{\sqrt{2}}{2}) = 0.8535533905932 74,\ \xi_{06}^{C} = \frac{1}{2} + \sqrt{\frac{\sqrt{3}}{16} + \frac{1}{8}} = 0.982962913144534$
5.10.2026
13
Observer Hall 2
HALL 2 Tuba Ay...

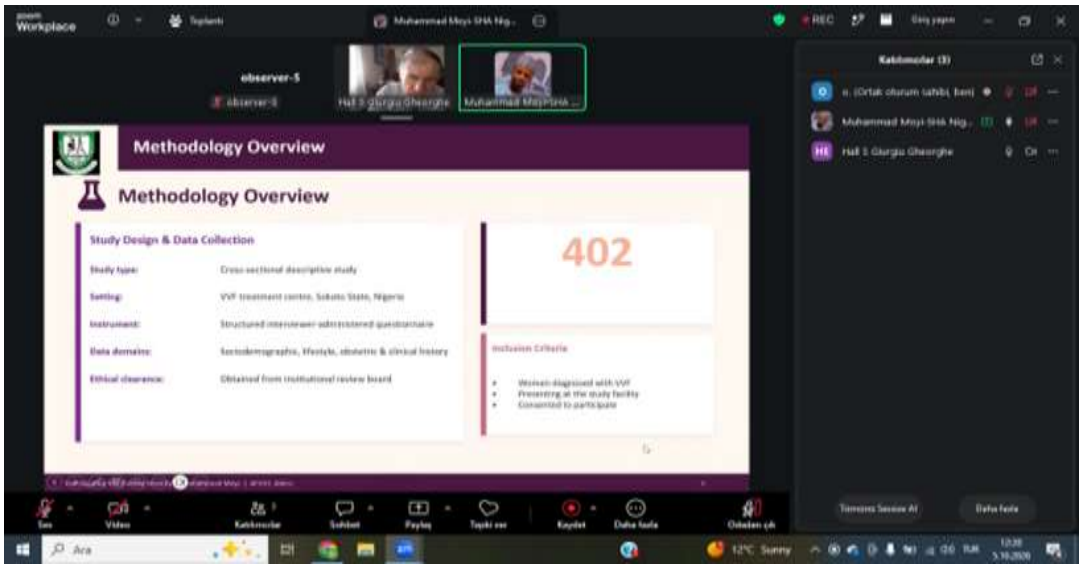

Observer Hall 2
HALL 2 Tuba Ay...
• Kalkaneal spur; kalkaneusun alt yüzeyinde, plantar fasyanın kemiğe tutunduğu yerde oluşur. Röntgen filminde topuğun önüne doğru yönelmiş bir kuş gagası veya kanca şeklinde net bir çıkıntı olarak izlenir.
Observer Hall 2
S

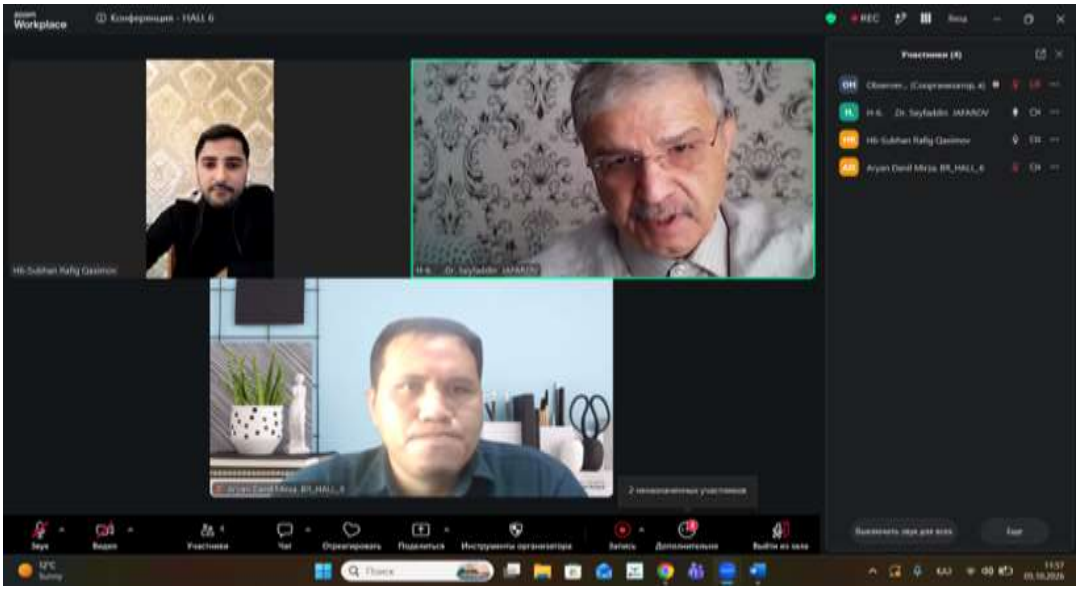

Orman Yangınlarının Karaçam (Pinus Nigra Arnold. (Pinaceae)) Kabuğunun Lif Morfolojisine Etkileri
Effects of Forest Fires on The Fiber Morphology of Black Pine (Pinus Nigra Arnold. (Pinaceae)) Bark
Dr. Öğr. Üyesi Ekrem DURMAZ
Kastamonu Üniversitesi
Orman Fakültesi
Orman Endüstri Mühendisliği Bölümü
Observer Hall 2
S
Esma Aksakal

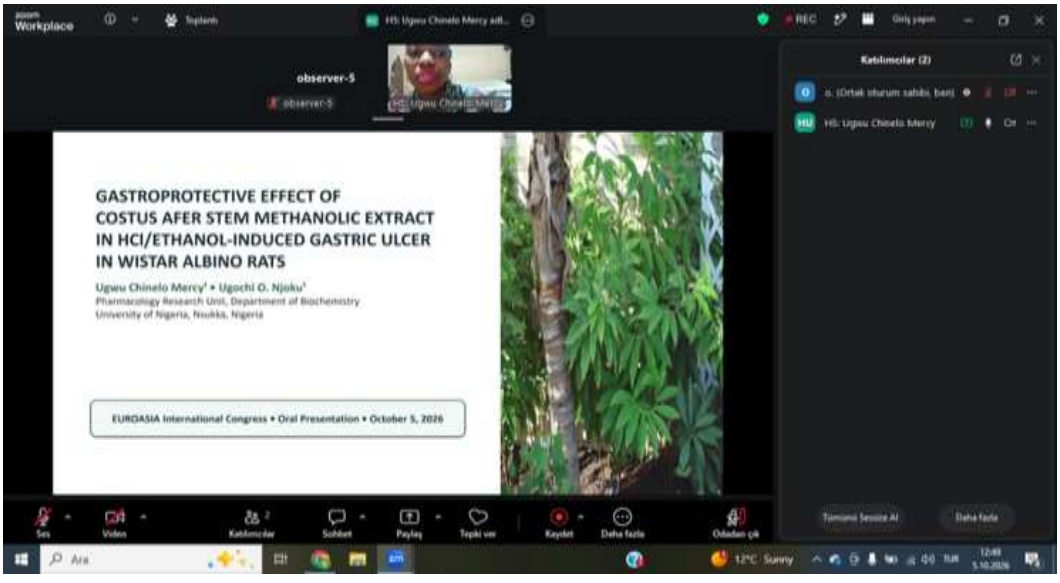

Why Blockchain?
Key Blockchain Capabilities
Immutability
Difficult to modify recorded transactions retrospectively
Transparency & Traceability
Persistent and auditable transaction history
Cryptographic Integrity
Hash-based document verification
Smart Contracts
Observer Hall 3


Raya-Hall 4
Dr. Kavita Singh, H-4, HoS
Hall-4 Komal


Objectives of the Study
•To position HR as a Change Archite
disruptive environments
•To explain the role of HR leadersh
developing workforce agility
•To examine how workforce a
contributes to organizational resilience
•To propose a conceptual frame
grounded in theory
•To provide direction for future empirical
research
Raya-Hall 4
Dr. Kavita Singh, H-4, HoS
Hall-4 Komal


Methodology Overview
Methodology Overview
Study Design & Data Collection
Study type:
Cross-sectional descriptive study
Setting:
VVF treatment centre, Sokoto State, Nigeria
Instrument:
Structured interviewer-administered questionnaire
Data domains:
Sociodemographic, lifestyle, obstetric & clinical history
Ethical clearance:
Obtained from institutional review board
402
Inclusion Criteria
Women diagnosed with VVF
Presenting at the study facility
Consented to participate




observer-5
GASTROPROTECTIVE EFFECT OF
COSTUS AFER STEM METHANOLIC EXTRACT
IN HCl/ETHANOL-INDUCED GASTRIC ULCER
IN WISTAR ALBINO RATS
Ugwu Chinelo Mercy¹ • Ugochi O. Njoku¹
Pharmacology Research Unit, Department of Biochemistry
University of Nigeria, Nsukka, Nigeria
EURASIA International Congress • Oral Presentation • October 5, 2026

15th EUROASIA
Congress on Scientific Researches and Recent Trends-XIV

October 3-10, 2026 - Mecca, Kingdom of Saudi Arabia

CONGRESS PROGRAM

(In-person & Online)

Zoom Meeting ID: 897 0755 8402

Zoom Passcode: 151515

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- or Personal Link Name" and solidify the session.
- The presentation will have **15 minutes** (including questions and answers).
- The Zoom application is free and no need to create an account.
- The Zoom application can be used without registration.
- The application works on tablets, phones and PCs.
- Speakers must be connected to the session **10 minutes before** the presentation time.
- All congress participants can connect live and listen to all sessions.
- During the session, your camera should be turned on at least %70 of session period
- Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.

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- Moderator is responsible for the presentation and scientific discussion (question-answer) section of the session.

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PARTICIPANTS COUNTRY (13): Algeria, Azerbaijan, Hungary, Guinea, India, Indonesia, Iran, Kazakhstan, Libya, Nigeria, Pakistan, Romania, Türkiye

IN-PERSON SESSION - 1

Date: 07.10.2026

Kingdom of Saudi Arabia LOCAL TIME: 14^{00}-16^{00}

Venue: M Hotel Al Dana Makkah

Address: 6724 Prince Majed Ibn Abd Al Aziz, Ar Rawdah, Makkah 24236, Saudi Arabia

Head of the Session: Prof. Dr. Ahmet Faruk LEVENT

Autors	University	Title
Assoc. Prof. Dr. Gülşah ESER	*Harran University, Türkiye*	THE WORK OF SKILLED HANDS: THE TRADITION OF ORGANIZING EXHIBITIONS IN GIRLS' INSTITUTES AND ITS OUTCOMES
Assoc. Prof. Dr. Gülşah ESER	*Harran University, Türkiye*	VICTORY DAY CELEBRATIONS IN GAZİANTEP, 1940-1945
Prof. Dr. Emine FIRAT	*Aksaray University, Türkiye*	THE POSITION AND SIGNIFICANCE OF BIST PARTICIPATION INDICES AS AN ALTERNATIVE INVESTMENT VEHICLE IN TÜRKİYE
Prof. Dr. Orhan GÜNDÜZ Assist. Prof. Dr. Ahmet ASLAN Assoc. Prof. Dr. Çağatay YILDIRIM Res. Asst. Cansu KADAKOĞLU	*Malatya Turgut Özal University, Türkiye* *Ondokuz Mayıs University, Türkiye*	ANNUAL OPERATING RESULTS OF APRICOT-GROWING FARMS: THE CASE OF MALATYA PROVINCE
Prof. Dr. Hatim ELHATIP Assoc. Prof. Dr. Adil AKSOY	*Aksaray University, Türkiye*	INFLUENCES OF DROUGHT AND EXTREME GROUNDWATER OVEREXPLOITATION ON OCCURRENCES OF LAND SUBSIDENCE AND SINKHOLES IN FARMLANDS; CASE STUDY: KONYA KARAPINAR SITE, CENTRAL ANATOLIAN PART OF TURKEY
Asst. Prof. Dr. Aylin ÇELİK TURAN Dilan ATAÇ Dicle YENİLMEZ Şerife TÜRKEN	*Çanakkale Onsekiz Mart University, Türkiye*	INDUSTRIAL POTENTIAL OF GELIBOLU IN A GRID-BASED ANALYSIS MODEL
Prof. Dr. Ahmet Faruk LEVENT Dr. Esengül KANTEKİN Dr. Şule ÇALIŞKAN ELEMAN Prof. Dr. Serhat İREZ Burak ELEMAN	*Marmara University, Türkiye*	A HISTORICAL ANALYSIS OF UNIVERSITY–INDUSTRY COLLABORATION MODELS

IN-PERSON SESSION - 2

Date: 07.10.2026

Kingdom of Saudi Arabia LOCAL TIME: 16^{30}-18^{30}

Venue: M Hotel Al Dana Makkah

Address: 6724 Prince Majed Ibn Abd Al Aziz, Ar Rawdah, Makkah 24236, Saudi Arabia

Head of the Session: Assoc. Prof. Dr. Ahmet KARATAY

Autors	University	Title
Dr. Seyid Mahmud Esad DEMİRCİ	*Sakarya University of Applied Sciences, Türkiye*	OPERATIONAL INTERDEPENDENCIES IN PILOT-ASSISTED SHIP BERTHING: AN ACTOR-BASED ANALYSIS
Lect. Ömer Faruk DEMİROK Assoc. Prof. Dr. Engin KOCAMAN Prof. Dr. Ömer SAVAŞ	*Sakarya University of Applied Sciences, Türkiye* *Yıldız Technical University, Türkiye*	COMPARATIVE INVESTIGATION OF THE TENSILE-ELONGATION BEHAVIOR OF TiB_2 -REINFORCED AL-MATRIX COMPOSITES PRODUCED VIA A HYBRID METHOD
Assoc. Prof. Dr. Ahmet KARATAY	*Ankara University, Türkiye*	ULTRAFAST SPECTROSCOPY AND NONLINEAR OPTICS IN A BROAD RANGE OF MATERIALS: FROM FUNDAMENTAL STUDIES TO BIOLOGICAL APPLICATIONS
Lec. Dr. Sedat KAVAK Prof. Dr. Hasan YILMAZ	*Ardahan University, Türkiye* *Van Yüzüncü Yıl University, Türkiye*	INSUFFICIENCY OF MORPHOMETRIC MEASUREMENTS AND IMPORTANCE OF PCR-RFLP IN DIFFERENTIATING *FASCIOLA HEPATICA* AND INTERMEDIATE-FORM *FASCIOLA*
Lec. Dr. Burcu TEKİN	*Ankara Bilim University, Türkiye*	AN INVESTIGATION INTO THE VISIBILITY STABILITY OF AUTOMOBILE BRANDS ACROSS REPEATED QUERIES IN AI SEARCH ENGINES
Asst. Prof. Dr. Mucize SARIHAN	*Istanbul Okan University, Türkiye*	MANAGEMENT IN NUCLEAR MEDICINE DEPARTMENTS: AN EVALUATION IN TERMS OF QUALITY, PATIENT SAFETY, AND RESOURCE MANAGEMENT
Assoc. Prof. Dr. Tuba TEZER	*Balıkesir University, Türkiye*	LSTM-BASED FORECASTING FRAMEWORK FOR RENEWABLE ENERGY AND LOAD DATA: A CASE STUDY FOR A TEXTILE FACILITY IN İZMİR

ONLINE SESSION |HALL-1

DATE: 05.10.2026

Local Time in Makkah, Saudi Arabia (Mecca): 10^{00}-12^{00}

Local Time in Ankara, Türkiye: 10^{00}-12^{00}

Head of the Session: Prof. Dr. Seyit TAŞER

Autors	University	Title
Yaren Ezgi GÖÇÜLÜ Türkü Deniz MALKOÇ Tolga YILMAZ	*İstanbul Esenyurt Üniversity, Türkiye* *Nevşehir Hacı Bektaş Veli Üniversity, Türkiye* *Eskişehir Teknik Üniversity, Türkiye*	SOCIAL PERCEPTION, CULTURAL TRANSMISSION, AND THE TRANSFORMATION OF PRODUCTION MODES IN GRAFFITI PRACTICE: A PHENOMENOLOGICAL STUDY
Prof. Dr. Seyit TAŞER	*Necmettin Erbakan Unıversty, Türkiye*	AN EVALUATION OF OTTOMAN EDUCATION FROM A THEOCRATIC PERSPECTIVE
Prof. Dr. Seyit TAŞER	*Necmettin Erbakan Unıversty, Türkiye*	ÖMER SIKKIN AND ABOUT HIS TOMB
Prof. Dr. Osman Şimşek	*Ankara Hacı Bayram Veli Üniversity, Türkiye*	THE PROPRIETARY KNOWLEDGE PRODUCTION METHOD CONSTRUCTION OF ISLAMIC CIVILIZATION AGAINST THE POSITIVIST AND HERMENEUTIC KNOWLEDGE PRODUCTION METHODS OF THE MODERN WEST: *THE TEVHIDI THOUGHT METHOD OF KNOWLEDGE PRODUCTION*
Prof. Dr. Aydoğan SOYGÜDEN	*Erciyes University, Türkiye*	CURRENT STATUS OF WRESTLING TRAINING PROGRAMS
Sena MALAY Nagihan SEKİ	*Karabük University, Türkiye*	NEW MONUMENTAL TREE INVENTORY AND DIMENSIONAL ASSESSMENT IN ESKİPAZAR (KARABÜK)

ONLINE SESSION | HALL-2

DATE: 05.10.2026

Local Time in Makkah, Saudi Arabia (Mecca): 10^{00}-12^{00}

Local Time in Ankara, Türkiye: 10^{00}-12^{00}

Head of the Session: Prof. Dr. Mehmet Serdar GÜZEL

Autors	University	Title
Merve GÜLER Prof. Dr. Nuri Murat YAĞMURLU	*İnönü University, Türkiye*	A SEPTIC HERMITE BASIS FUNCTION-BASED COLLOCATION METHOD FOR NUMERICAL APPROXIMATION
Arda GÖNÜL Kardelen PEÇENEK Assoc. Prof. Dr. Fatih EKİNCİ Prof. Dr. Mehmet Serdar GÜZEL	*Çankaya University,, Türkiye* *Burdur Mehmet Akif Ersoy University, Türkiye* *Ankara University, Türkiye*	BREAST CANCER CLASSIFICATION FROM HISTOPATHOLOGICAL IMAGES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE: A PATIENT-WISE EVALUATION OF CNN AND VISION TRANSFORMER ARCHITECTURES
Dr. Tuba Yüksel AYDINER	*Ankara Atatürk Sanatorium Training and Research Hospital, Türkiye*	EVALUATION OF PATIENT DATA FOLLOWING RADIOFREQUENCY THERMAL ABLATION FOR CALCANEAL SPUR
Dr. Ali Niyazi KURTCEBE Dr. Ayşenur GÜR	*Gölbaşı State Hospital, Türkiye* *Etimesgut Şehit Sait Ertürk State Hospital, Türkiye*	PRE-HOSPITAL CHARACTERISTICS OF IN-SCHOOL MUSCULOSKELETAL INJURIES IN PRIMARY SCHOOL-AGED CHILDREN: A RETROSPECTIVE ANALYSIS OF 112 EMERGENCY MEDICAL SERVICES DATA
Asst. Prof. Dr. Ekrem DURMAZ	*Kastamonu University, Türkiye*	EFFECTS OF FOREST FIRES ON THE FIBER MORPHOLOGY OF BLACK PINE (*PINUS NIGRA ARNOLD*. (PINACEAE)) BARK
Dr. Samiratou ABDOULAYE MAMANE Prof. Dr. Üstün ŞAHİN	*Ataturk University, Türkiye*	COW MANURE FERTILIZATION IN DEFICIT IRRIGATION CONDITIONS ENHANCES WHITE CABBAGE YIELD BY REDUCING H2O2, MDA, AND PROLINE

ONLINE SESSION | HALL-3

DATE: 05.10.2026

Local Time in Makkah, Saudi Arabia (Mecca): 10^{00}-12^{00}

Local Time in Ankara, Türkiye: 10^{00}-12^{00}

Head of the Session: Muhammad FAISAL

Autors	University	Title
Hadi Rezaei Omid Sharifi-Tehrani	*Safahan Institute of Higher Education, Iran*	BLOCKCHAIN-BASED DECENTRALIZED APPLICATION FOR PROPERTY REGISTRATION AND OWNERSHIP TRANSFER USING TRON NETWORK TO ENHANCE SECURITY, TRANSPARENCY, AND PREVENT DOCUMENT FORGERY
Aigerim Zhaniyeva Akerke Amanzholova	*Kazakh National Pedagogical University, Kazakhstan*	ADAPTIVE PROGRAMMING LEARNING BASED ON ARTIFICIAL INTELLIGENCE: OPPORTUNITIES, CHALLENGES, AND PROSPECTS
Nour El Houda FETHELLAH	*Université des Sciences et de la Technologie d'Oran- Mohamed Boudiaf, Algeria*	WEATHER-DRIVEN EPILEPTIC SEIZURE RISK: A CRITICAL REVIEW OF EPIDEMIOLOGICAL EVIDENCE AND THE EMERGING ROLE OF ARTIFICIAL INTELLIGENCE IN SEIZURE PREDICTION
OYEWUMI Kassim ADAMU Muhammad	*Federal University, Nigeria*	ASSESSMENT OF ARTIFICIAL INTELLIGENCE INTEGRATION AWARENESS IN BASIC EDUCATION CURRICULUM IN ADAMAWA NORTH EDUCATIONAL ZONE, NIGERIA
Muhammad FAISAL	*Joint Director (AICU) at Ministry of IT & Telecommunication, Pakistan*	ARTIFICIAL INTELLIGENCE-DRIVEN HUMAN RESOURCE RECRUITMENT SYSTEMS TRANSFORMING TALENT ACQUISITION THROUGH INTELLIGENT DECISION SUPPORT

ONLINE SESSION |HALL-4

DATE: 05.10.2026

Local Time in Makkah, Saudi Arabia (Mecca): 10^{00}-12^{00}

Local Time in Ankara, Türkiye: 10^{00}-12^{00}

Head of the Session: Dr. Kavita Singh

Autors	University	Title
Dr. Kavita Singh Komal	*SRM University, India*	TRANSFORMING HR INTO A CHANGE ARCHITECT: LINKING WORKFORCE AGILITY AND ORGANIZATIONAL RESILIENCE IN DISRUPTIVE TIMES
Attila Palancsa		FROM THE STREET TO THE DESTINATION: THE METAMORPHOSIS OF STREET ART IN URBAN TOURISM
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Gábor László VASÁRUS	*Eötvös Loránd University (ELTE), Hungary*	SUBURBANISATION WITHIN THE CITY IN HUNGARY: EXPLORING A PARADOX
Prof. Dr. RAYIHE AMENZADE	*Azerbaijan National Academy of Sciences, Azerbaijan*	EARLY MOSQUES OF AZERBAIJAN (7TH-11TH CENTURIES)

ONLINE SESSION |HALL-5

DATE: 05.10.2026

Local Time in Makkah, Saudi Arabia (Mecca): 10^{00}-12^{00}

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Head of the Session: Gheorghe GIURGIU

Autors	University	Title
SOLTANI Fatiha BENABDELMOUMENE Djilali BENGHARBI Zineb BENAIED Hasna BEGLOUL Amina BENGUENNOUNA Noureddine	*Abdelhamid IbnBadis Mostaganem, Algeria*	COMPARATIVE EVALUATION OF PHYSICOCHEMICAL, NUTRITIONAL, AND SENSORY CHARACTERISTICS OF BROILER AND SPENT LAYING HEN MEAT
Renny Sinaga Hendri PL.Tobing	*Renny Sinaga, Hendri PL.Tobing Midwifery Department, Health Polytechnic of the Ministry, Indonesia*	FACTORS ASSOCIATED WITH BREASTFEEDING SUCCESS AMONG POSTPARTUM MOTHERS IN PEMATANGSIANTAR CITY, INDONESIA
Ugwu Chinelo Mercy Ugochi O. Njokua	*University of Nigeria, Nigeria*	GASTROPROTECTIVE EFFECT OF COSTUS AFER STEM METHANOLIC EXTRACT IN HCL/ETHANOL-INDUCED GASTRIC ULCER IN WISTAR ALBINO RATS
Gerald Ike Unwuka Wasiu Babayemi Muhammad Muhammad Moyi	*Abdullahi Fodiyo University, Nigeria*	INVESTIGATING THE INFLUENCE OF SOCIODEMOGRAPHIC, LIFESTYLE AND CLINICAL FACTORS ON VESICOVAGINAL FISTULA (VVF) SEVERITY IN SOKOTO, NIGERIA
Maimuna Suleiman Naibi Mohammed	*Federal College of Education, Nigeria*	HEAVY METAL CONTAMINATION AND METAL TOLERANCE PROFILES OF GRAM-NEGATIVE BACTERIA FROM WASTEWATER-IRRIGATED FARMS IN KANO STATE, NIGERIA
Eman Derbi	*University of Tripoli, Tripoli, Libya*	PROFESSIONAL KNOWLEDGE, CLINICAL PRACTICES, AND REGULATORY ALIGNMENT REGARDING GLP-1 AND DUAL GIP/GLP-1 THERAPIES AMONG PHARMACISTS AND PHYSICIANS IN TRIPOLI, LIBYA: A CROSS-SECTIONAL STUDY
Gheorghe GIURGIU Prof. Dr. Manole COJOCARU	*Deniplant-Aide Sante Medical Center, Romania* *Titu Maiorescu University, Romania*	THE ASSOCIATION BETWEEN THE CUTANEOUS MICROBIOME AND HIDRADENITIS SUPPURATIVA

ONLINE SESSION |HALL-6

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Local Time in Makkah, Saudi Arabia (Mecca): 10^{00}-12^{00}

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Head of the Session: Dr. Seyfaddin JAFAROV

Autors	University	Title
DAHMANI Yacine Mohamed Prof. Dr. ARKOUB Ouali	*Abdelhamid IbnBadis Mostaganem, Algeria*	THE IMPACT OF ASSET ALLOCATION ON ASSET-LIABILITY BALANCE IN INSURANCE COMPANIES
Joni Putra Ayu Dwiny Octary Ani Maryani Kus Larisa Nathania Zita Muhammad Rizqy Ramadhan Aryan Danil Mirza. BR.	*Universitas Lampung, Indonesia*	THE MORE RELIGIOUS, THE MORE HONEST? AN EXPERIMENTAL STUDY OF SOCIAL PRESSURE AND BUDGETARY SLACK
Ofelya Muzaffar Samadova Subhan Rafig Qasimov	*Mingachevir State University, Azerbaijan*	THE IMPACT OF PMS/ACCA-ORIENTED EDUCATION AND IFRS ADOPTION ON GRADUATE EMPLOYABILITY AND FINANCIAL REPORTING TRANSPARENCY: A LITERATURE REVIEW
Dr. Seyfaddin JAFAROV	*Nakhchivan State University, Azerbaijan*	STUDY OF ELECTRICAL PROPERTIES OF RARE EARTH ELEMENTS-DOPPED GaSe NANOCRYSTAL
Soukaina El Bourachdi Lekbira El mersly Yassine Rakcho Ali Raza Ayub Abdelhay el Amri Mahdi Lechheb Amal Lahkimi	*Sidi Mohamed Ben Abdellah University, Morocco* *Cadi Ayyad University (UCA), Morocco* *Mohammed VI Polytechnic University, Morocco*	ECO-FRIENDLY SYNTHESIS OF CHITOSAN@TIO_2 NANOCOMPOSITE FOR EFFICIENT DYE ADSORPTION AND TEXTILE WASTEWATER TREATMENT: A COMBINED EXPERIMENTAL AND THEORETICAL STUDY
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Aloui Mourad Menana Elhalaoui	*Sidi Mohamed Ben Abdellah University Morocco*	DESIGN OF NOVEL POTENT SELECTIVE SURVIVIN INHIBITORS USING 2D-QSAR MODELING, MOLECULAR DOCKING, MOLECULAR DYNAMICS, AND ADMET PROPERTIES OF NEW MX-106 HYDROXYQUINOLINE SCAFFOLD DERIVATIVES

ONLINE SESSION |HALL-7

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Head of the Session: Ananda Majumdar

Autors	University	Title
HULDA MAXWELL DAVWET MANJI AMOS	*University of Jos, Nigeria*	EFFECTS OF INTEGRATED CURRICULUM TEACHING APPROACH ON LOWER BASIC TWO SOCIAL STUDIES STUDENT'S ACHIEVEMENT AND RETENTION IN PLATEAU STATE, NIGERIA
Ntabayi Solomon Musa	*Federal University of Technology, Nigeria*	INFLUENCE OF LECTURERS' CHARACTERISTICS ON EMOTIONAL INTELLIGENCE SKILLS DEVELOPMENT OF BUILDING TECHNOLOGY EDUCATION STUDENTS IN TERTIARY INSTITUTIONS IN NORTH CENTRAL, NIGERIA
Afshan Naseem Mushba Ishtiaq	*University of Management and TechnologY , Pakistan*	AI-ASSISTED LEARNING TOOLS AND STUDENTS' ACADEMIC WRITING: PERFORMANCE, RESPONSIBLE USE, AND ACADEMIC INTEGRITY
Régis Orens Kobéna Afadzi Johnson Baba Samoura Cécé Kolie	*University of N'zérékoré, Republic of Guinea*	TEACHING OF EFL SPEAKING SKILLS IN SECONDARY SCHOOL IN GUINEA: CHALLENGES AND PERSPECTIVES IN LA GUINÉE FORESTIÈRE
Ananda Majumdar	*Kennedy University of Saint Lucia & QAHE, Saint Lucia*	BRIDGING TRADITION AND MODERNITY: THE ROLE OF INDIAN KNOWLEDGE SYSTEMS IN ETHICAL AND INTERDISCIPLINARY EDUCATION

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THE WORK OF SKILLED HANDS: THE TRADITION OF ORGANIZING EXHIBITIONS IN GIRLS' INSTITUTES AND ITS OUTCOMES

Gülşah ESER
Harran University, Faculty of Science and Literature, History Department, Şanlıurfa, Türkiye.
ORCID ID: 0000-0002-3306-1569

ABSTRACT

Introduction and Purpose: Girls' Institutes were educational institutions established during the Early Republican Period to provide girls with vocational and technical training and thereby enable them to become productive participants in both domestic and professional life. Through courses such as sewing, embroidery, home management, and cookery, these institutes sought, on the one hand, to educate "good housewives and good mothers" and, on the other, to equip girls with the skills necessary to participate in economic life. Particularly committed to the practice and preservation of traditional handicrafts, including embroidery and decorative needlework, these institutions also contributed to the safeguarding of cultural heritage. This study aims to examine how graduates of Girls' Institutes incorporated their training -particularly in traditional handicrafts- into domestic life and how they participated in the public sphere through exhibitions.

Methods: Presenting examples of graduates' work in such areas as clothing and home decoration, the study employs literature review, archival research, and document analysis as its principal methods.

Results: The works produced by students during a term and/or throughout an academic year were presented to the public through exhibitions and fashion shows, a practice that gradually developed into an established tradition. Students educated within this tradition continued to draw upon the knowledge and skills they had acquired after graduation. The findings demonstrate that the education received at Girls' Institutes enabled graduates to shape their everyday lives according to aesthetic, practical, and modern principles. Exhibitions not only provided them with opportunities to display their productive skills but also contributed to the development of self-confidence and the attainment of social visibility. The study further concludes that these graduates contributed to the preservation and transmission of cultural heritage by incorporating traditional handicrafts into domestic life and presenting their work to the wider public through exhibitions that they organized themselves.

Keywords: Girls' Institutes, Traditional Handicrafts, Exhibitions, Educational Outcomes.

EL EMEĞİ GÖZ NURU: KIZ ENSTİTÜLERİNDE SERGİ DÜZENLEME GELENEĞİ VE KAZANIMLARI

ÖZET

Giriş ve Amaç: Kız enstitüleri, Erken Cumhuriyet Dönemi'nde kız çocuklarına mesleki ve teknik eğitim vererek onları hem ev hem de meslek yaşamında üretken kılmak amacıyla açılmış eğitim kurumlarıdır. Bu enstitülerde bir yandan dikiş, nakış, ev idaresi, yemek pişirme vb. derslerle "iyi bir ev kadını ve iyi bir anne" yetiştirmek, diğer yandan da kazandırılan becerilerle kız çocuklarının ekonomik hayata eklemlenmelerini sağlamak hedeflenmiştir. Bilhassa nakış ve işlemeye yönelik geleneksel el sanatlarını uygulayan ve yaşatan bu kurumlar aynı zamanda kültürel mirasın korunmasına da hizmet etmişlerdir. Bu çalışma, kız enstitüsü mezunlarının özellikle geleneksel el sanatlarına yönelik çalışmalarını ev yaşamlarına nasıl aktardıklarını ve sergiler yoluyla toplumsal yaşama nasıl entegre ettiklerini incelemeyi amaçlamaktadır.

Yöntem: Kız enstitüsü mezunlarının giyim-kuşam ve ev dekorasyonu gibi alanlardaki çalışmalarından örnekler sunan bu çalışmada literatür taraması, arşiv taraması, doküman analizi ve sözlü tarih yöntemleri kullanılmıştır.
Bulgular ve Sonuç: Öğrencilerin dönem içinde ve/veya bir ders yılı boyunca gerçekleştirmiş oldukları çalışmalar sergiler ve moda geçitleriyle izleyiciye sunulmuş, bu durum zaman içerisinde ise gelenek haline gelmiştir. Söz konusu geleneğin içerisinde yetişen öğrenciler kazanımlarını mezuniyet sonrası yaşamlarına da aktarmışlardır.
Araştırma sonucunda; aldıkları eğitimle gündelik yaşamlarını estetik, pratik ve modern bir yapıya kavuşturan kız enstitülülerin sergiler yoluyla da üretim becerilerini sergilemenin yanı sıra özgüven kazandıkları ve toplumsal görünürlük elde ettikleri sonucuna ulaşılmıştır. Aynı zamanda geleneksel el sanatlarını ev yaşamına taşıyarak ve kendi açtıkları sergilerle de topluma sunarak kültürel mirasın korunmasına ve aktarılmasına hizmet ettikleri araştırmada ulaşılan bir diğer sonuçtur.
Anahtar Kelimeler: Kız Enstitüleri, Geleneksel El Sanatları, Sergi, Kazanım.

GİRİŞ

Erken Cumhuriyet Dönemi'nde kurulan kız enstitüleri modern ve bilgili ev kadını profilinin yanında gerektiğinde hayatını kazanabilecek, bir başka ifadeyle üretici konumda kadınlar yetiştirmeyi hedeflemiştir. Bu okullar, sundukları mesleki ve teknik eğitim modelinin yanı sıra düzenlemiş olduğu sergilerle de odak noktası haline gelmiştir. Özellikle öğrencilerin bir eğitim-öğretim yılı boyunca yapmış oldukları çalışmaları sunan yıllık sergiler/yıl sonu sergileri oldukça rağbet görmüştür.
Giyim-kuşamdan ev dekorasyonuna kadar öğretmenin rehberliği ve öğrencinin emeği ile oluşturulan ürünler, sergiler ve defileler (moda geçitleri) aracılığıyla halkın beğenisine sunulmuştur. Kız enstitüleri arasında ilk açılan İsmet Paşa Kız Enstitüsü, sergi faaliyetlerinde diğerlerine model oluşturmuştur. Bu enstitünün sergilerinde Türk kültürünü yansıtan motiflere yer verilmiş ve Anadolu'nun muhtelif yerlerinden gönderilen geleneksel el sanatları ürünleri de sergilenmiştir. İsmet Paşa Kız Enstitüsü'nden sonra açılan Bursa Kız Enstitüsü de (daha sonraki adıyla Necatibey Kız Enstitüsü) düzenlediği sergilerle dikkat çekerek ön plana çıkmıştır. Kız enstitülerinin sayılarının arttırılmasıyla birlikte sergi faaliyetleri de yurt genelinde yaygınlaşmıştır.


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Şekil 1. İsmet Paşa Kız Enstitüsü'nün 1942 Yılı Sergisine Dair Bir Gazete Haberi.
Ulus, 12 Temmuz 1942, 1.

Bu çalışma, kız enstitüsü mezunlarının giyim-kuşam ve ev dekorasyonu gibi alanlardaki çalışmalarından örnekler sunarak bilgi ve becerilerini ev yaşamlarına nasıl aktardıklarını ve sergiler yoluyla toplumsal yaşamla nasıl bütünleştirdiklerini ele almayı amaçlamaktadır. Araştırmada literatür taraması, arşiv taraması, doküman analizi ve sözlü tarih yöntemlerinden yararlanılmıştır. Sözlü tarih çalışması bağlamında kız enstitüsü mezunlarından Kamile Kutlar, Edibe Bayram ile F. Bilge Kazaz'ın aktardığı izlenimlerinden ve ayrıca kişisel arşivlerinden istifade edilmiştir. Araştırmaya sundukları değerli katkı ve destekleri için kendilerine teşekkür ederim.
Kız enstitüsü sergileri bu çalışma bağlamında kazanımlar temelinde ele alınmıştır. Kültürel ve sanatsal kazanımlar, ekonomik kazanımlar ve toplumsal kazanımlar olmak üzere üç ayrı başlık üzerinden değerlendirme yapılmıştır.

1. Kız Enstitüsü Sergilerinin Kazanımları

Kız enstitüleri tarafından düzenlenen sergiler, genç kızların "el emeği göz nuru" ürünlerini geniş kitlelerle buluşturmuş ve böylelikle Cumhuriyet'in hedeflediği ideal kadın imajını görsel kültür üzerinden toplumsal hafızaya aktarmıştır. Bu sergilerle bir yandan öğrencilerin teorik bilgileri pratik üretime dönüştürülürken diğer yandan da halkın beğenisine sunulmuş, böylelikle öğrencilerin mesleki beceri ve başarıları görünür kılınmıştır.

1.1. Kültürel ve Sanatsal Kazanımlar

Kız enstitüleri sergilerinde geleneksel Türk el sanatları (bilhassa işleme, nakış vb.) önemli bir yer teşkil etmiştir. Bunların örneklerini daha çok ev tekstili ve giyim konusunda üretilen örneklerde görmek mümkündür. Bu okullarda giyim konusunda her ne kadar Avrupa/Batı tarzı takip edilse de özellikle giysi modellerinde geleneksel unsurlara da yer verilmiştir. Nitekim İsmet Paşa Kız Enstitüsü'nün sergilerinde geleneksel Türk işlemelerinden örnekler sunulmuş olup Türk kültürünü yansıtan motifler vurgulanmıştır. Malatya Kız Sanat Enstitüsü'nün 1953 yılı sergisi de bu konuda önemli bir örnektir. Sergide yer alan modern kıyafetlerde geleneksel Türk el sanatlarına ait motiflerin kullanılmasıyla bir sentez oluşturulmuştur.



Şekil 2. Malatya Kız Enstitüsü'nün Müdiresi Sergide Emeği Geçen Öğrencilerle Birlikte. Ulus, 2 Temmuz 1953, 4.

Gaziantep Kız Enstitüsü mezunlarından Edibe Bayram, enstitüde aldığı eğitimin özellikle giysilere yapılan işlemeler konusunda kendisini önemli ölçüde geliştirdiğini ifade etmektedir. Bayram, Türk motiflerini temel alarak oluşturduğu özgün tasarımları giysilerine uyguladığını dile getirmektedir. Ayrıca enstitü eğitimi süresince özellikle de sergilerle pekiştirdiği bilgi ve becerilerden yaşamının her safhasında yararlandığını aktarmaktadır. Aşağıdaki görselde, Bayram tarafından dikilen ve işlemesi de kendisi tarafından gerçekleştirilen bir etek-bluz takımı yer almaktadır:



Şekil 3. Edibe Bayram Tarafından Dikilen ve İşlenen Etek-Bluz Takımı.
[Edibe Bayram Arşivi]

Gaziantep Kız Enstitüsü mezunlarından Kamile Kutlar da öğrencilik yaşamında aldığı dikiş ve nakış derslerinin ve bu derslerle edindiği becerilerin gündelik yaşamına önemli katkılar sağladığını ifade etmektedir. Kız enstitülülerin bu derslerle yalnızca giyim alanında değil ev dekorasyonu alanında da yetkinleştirildiklerini belirtmektedir. Hatta sıradan bir kumaşı maharetle işleyerek ev dekorasyonunda kullanılabilecek işlevsel bir ürüne dönüştürdüklerini aktarmaktadır. Kutlar'ın ifadelerine göre, enstitü öğretmenlerinden öğrendikleri ince işçilik saç teli ile kırlent yüzü dikmelerine dahi olanak sağlamıştır. Aşağıda yer alan görselde Kutlar'ın işlediği ve kendi saç teli ile diktiği kırlent yer almaktadır:



Şekil 4. Gaziantep Kız Enstitüsü Mezunlarından Kamile Kutlar'ın Diktiği Bir Kırlent Yüzü.
[Kamile Kutlar Arşivi]

Bu örnek, kız enstitülerinde öğrencilere çok yönlü bir teknik yetkinlik kazandırıldığını göstermektedir. Bu kurumlarda teorik bilgi uygulamaya aktarılmış; öğrencilerin kumaşı uygun ölçülerde kesme, yüzeyine desen işleme ve işlenen kumaşı işlevsel bir ürüne dönüştürme becerileri geliştirilmiştir. Kırlent örneği, öğrencilerin yalnızca estetik açıdan nitelikli ürünler ortaya koymalarının değil, aynı zamanda ev ekonomisine katkı sağlayabilecek üretim becerileri edinmelerinin de hedeflendiğini açığa çıkarmaktadır. Öte yandan, söz konusu kırlentin işçilik ve nitelik bakımından sergilenebilecek veya satışa sunulabilecek düzeyde olması, kız enstitülerinde verilen eğitimin öğrencileri üretimin farklı aşamalarında yetkin hâle getirdiğini ortaya koymaktadır.

Gaziantep Kız Enstitüsü mezunlarından F. Bilge Kazaz, mezuniyet sonrası da nakış çalışmalarına devam ettiğini ve özellikle Antep işleriyle ilgilendiğini belirtmektedir. Enstitüden mezun olan bazı arkadaşlarıyla birlikte bir nakış grubu oluşturduklarını ve haftada bir kez toplanarak o toplantıda işleme yaptıklarını ifade etmektedir. Kazaz, 35 yaşlarında iken sehpa örtüsü takımı yapmış olup bu takımı halen evinde muhafaza etmektedir. Orta sehpa örtüsünün ana motifi çiçek saksısıdır. Bu çiçek saksısını renkli Antep işlerinden örümcek yuvasıyla işlemiş ve her yuvada aynı rengin beş farklı tonunu bir arada kullanmıştır. Kazaz'ın aktardığına göre çiçeklerde ise "Türk işi deseni" hakim olup kendisi çiçeklerin sapları ve tomurcuklarını sırma ile işlemiştir. Söz konusu grup toplantılarında işlemeye başladığı bu sehpa takımının tamamlanması iki yıl kadar sürmüştür.



Şekil 5. F. Bilge Kazaz Tarafından İşlenen Orta Sehpa Örtüsü.
[F. Bilge Kazaz Arşivi]

Enstitü yaşamında sergi geleneği içerisinde yetişmiş olması ve ayrıca çok yönlü kişiliğine sahip bulunması F. Bilge Kazaz'ın ilerleyen yıllarda da bu geleneği devam ettirmesinde etkili olmuştur. Kazaz, küçük yaşlardan itibaren biriktirdiği fotoğrafları zaman zaman sergiler aracılığıyla Gaziantep halkına sunmuştur. "Gaziantep'in Yakın Tarihinin Sessiz Tanıkları", "1900'lerden Günümüze Fotoğraflarla Gaziantep" ve "Tarihi Fotoğraflarda Buluşalım" onun sergilerinden bazılarıdır. Ayrıca Kazaz'ın yaşamından bir kesit de sergi konusu olmuştur.



Şekil.6 F. Bilge Kazaz'ın Çeyizinden Bir Hikayeyi Fotoğraflarla Anlatan Serginin Afişi. [F. Bilge Kazaz Arşivi]

Kız enstitüsü sergileri, yurt içinde ve yurt dışında düzenlenen etkinlikler aracılığıyla yeni kurulan Cumhuriyet'in ve geleneksel Türk el sanatlarının uluslararası alanda tanıtılmasına da katkı sağlamıştır. Kız enstitüleri ve akşam kız sanat okullarının İstanbul Beyoğlu Kız Teknik Öğretim Olgunlaşma Enstitüsü ile birlikte hazırladığı Türk nakış ve el işlerinden oluşan ortak sergisinin Londra Halkevi'de açılması, bu konuda önemli bir örnek teşkil etmektedir. Benzer şekilde, İsmet Paşa Kız Enstitüsü'nün düzenlemiş olduğu sergiler de Avrupa ülkeleri tarafından takip edilmiş ve geleneksel Türk el sanatlarının yurt dışında tanıtılmasına katkıda bulunmuştur.

1.2. Ekonomik Kazanımlar

Kız enstitüleri, kadınların ekonomik hayata katılımını destekleyen eğitim kurumları olarak da işlev görmüştür. Bu okullarda verilen eğitimle kadınların üretim yoluyla hem aile bütçesine katkıda bulunmaları hem de ekonomik hayata katılmaları hedeflenmiştir. Böylelikle millî iktisat davasına hizmet edilmiş, ayrıca yerli malı kullanımı da özendirilmiştir. Örneğin, İsmet Paşa Kız Enstitüsü'nün 1935 yılında düzenlediği sergide yalnızca yerli malı kullanılmıştır. *Ulus* gazetesinde yer alan *"Sergide gösterilen her şey yalnızca yerli malından yapılmıştır. Böylece, Türk fabrikalarının kumaşlariyle Türk elemeğinin birleşmesinden doğan, her biri bir sanat eseri kadar değerli ve güzel elbise, tuvalet, çamaşır ve şapkaları seyrederken göğsümüz gururla kabarıyor."* şeklindeki ifadeler bu sergiler aracılığıyla aynı zamanda yerli üretimin teşvik edildiğini gözler önüne sermektedir.

Düzenlenen sergilerle aynı zamanda ev ekonomisinde tasarruf yöntemleri de halka tanıtılmıştır. Bu kapsamda, Edirne Kız Enstitüsü'nün açmış olduğu bir sergide yama örnekleri sunulmuş, ovulmuş bakır ve gümüş gibi madeni eşyalar sergilenmiş, kıyafetler ile ev eşyalarından lekelerin nasıl çıkarılacağı gösterilmiştir. Bütün bunlar, her ne kadar gündelik yaşamın ihtiyaçlarına yönelik küçük ölçekli uygulamalar olarak değerlendirilse de esasen genç Cumhuriyet'in ulusal iktisat politikalarının toplum tabanına yayılması açısından önem arz etmektedir.

Bu sergilerin sağladığı kazanımlardan biri de kadınların istihdam olanaklarının arttırılmasıdır. Vakit gazetesinde yer alan 27 Ağustos 1934 tarihli bir haberde İsmet Paşa Kız Enstitüsü mezunlarından Fahire ve Saadet hanımların Ankara'da terzihanelerini açtığı belirtilerek buranın iyi ve zevkli bir şekilde giyinmenin adresi olduğunun reklamı yapılmıştır. Kız enstitüsü mezunlarına yönelik iş gücü talebinin sonraki yıllarda da devam ettiği gazete ilanlarından anlaşılmaktadır. Hürriyet gazetesindeki 13 Haziran 1950 tarihli bir ilanda kız enstitüsü mezunu veya terzihanelerde çalışmış bir eleman arandığı belirtilirken , Demokrat İzmir gazetesindeki 10 Ekim 1950 tarihli bir ilanda Aliye Bilget Atölyesi'nde çalışmak üzere iyi dikiş bilen iki kız enstitüsü mezunu arandığı ifade edilmiştir. Milliyet gazetesindeki 15 Kasım 1971 tarihli başka bir ilanda ise Singer Sanayi Anonim Şirketi'ne bağlı fabrikanın kalite kontrol kısmında çalışmak üzere kız enstitüsü mezunu birinin arandığının belirtilmesi ilerleyen süreçte de enstitülülerin istihdamının revaçta olduğunu ortaya koymaktadır.



ELEMAN ALINACAKTIR

Fabrikamız Kalite Kontrol Kısmında çalıştırılmak üzere kız enstitüsü mezunu, dikiş makinasında dikiş ve nakış yapmasını çok iyi bilen bir GENÇ BAYAN alınacaktır. Anadolu yakasında oturmak tercih sebebidir. İlgilenenlerin yazı ile

SİNGER SANAYİ A.Ş.

Tugay Yolu No: 92 Cevizli, Maltepe İstanbul adresine müracaatları rica olunur.

Milliyet: 15873

Şekil 7. Milliyet, 15 Kasım 1971, 5.

Kız enstitüleri sergilerinin ekonomik kazanımları ele alınırken Tasarruf ve Yerli Malı Haftası sergilerine de değinmek gerekmektedir. Cumhuriyet'in kuruluş sürecinde Türkiye'de yerli malı kullanımı teşvik etmek ve yaygınlaştırmak, aynı zamanda ekonomik tasarruf bilincini sağlamak amacıyla 1929 yılında Millî İktisat ve Tasarruf Cemiyeti kurulmuştur. Bu Cemiyet tarafından 12-19 Aralık tarihleri arasında Tasarruf ve Yerli Malı Haftası düzenlenmiş, hem halkı tasarruf konusunda bilinçlendirmek hem de yerli ürünleri tanıtmak amacıyla çeşitli sergiler açılmıştır. Kız enstitüleri de bu kapsamda gerçekleştirilen sergilere katılarak yerli üretim ve tasarruf politikalarının toplumsal düzeyde görünürlük kazanmasına katkıda bulunmuştur. Örneğin, 1942 yılında Gaziantep'te düzenlenen sergide fabrika ve kooperatiflerin yanı sıra Gaziantep Kız Enstitüsü de yer almıştır. 1943 yılında düzenlenen sergide ise enstitünün hazırladığı bölüm, en dikkat çeken köşelerden biri olmuştur.

1.3. Toplumsal Kazanımlar

Kız enstitüleri, bir yandan modern ev kadınları yetiştirmeyi hedeflerken diğer yandan da uzmanlaşmaya ve sipariş üretimine yönelik atölyeler (sipariş atölyeleri) aracılığıyla kadınların toplumsal hayata katılımını desteklemiş ve kamusal görünürlüklerini arttırmıştır. Düzenlenen sergiler de bu sürecin önemli araçlarından biri olmuş, enstitü öğrencilerinin bilgi ve becerilerini kamuoyuna sunarak toplumsal görünürlük kazanmalarına olanak sağlamıştır.

Enstitülülerin estetik anlayışı ve özgüvenli duruşları, halkın da bu sergilere rağbet göstermesi onları adeta birer rol model haline getirmiştir. Böylece kız çocuklarının bilgi ve becerileriyle başarılı işler ortaya koyduklarını gören pek çok aile kendi çocuklarını da bu kuruma göndermek istemiştir. Bir başka ifadeyle, bu sergiler adeta ikna edici bir güç haline dönüşmüştür.



Şekil 8. İzmir Kız Enstitüsü'nün Sergi Açılışından Bir Kare.
Akşam, 19 Haziran 1935, 7.

Kız enstitüleri sergileri çağdaş yaşam tarzının yayılmasına da katkıda bulunmuştur. Öğrenciler modern çocuk bakımı, hijyen, batılı tarzda sofra düzeni ve giyim-kuşam gibi konularda örnek teşkil etmişler, rehberlik yapmışlardır. Bunların uygulanmasıyla birlikte geleneksel yapının dönüşümüne de etki edilmiştir. Böylelikle kız enstitülüler Cumhuriyet'in idealize ettiği yeni kadın imajının adeta canlı birer modeli olmuşlardır.

SONUÇ

Kız enstitülerinde öğrencilerin dönem içinde ve/veya bir eğitim-öğretim yılı boyunca yapmış oldukları çalışmalar sergiler ve defileler (moda geçitleri) aracılığıyla halkın beğenisine sunulmuştur. İsmet Paşa Kız Enstitüsü'nün kuruluşuyla başlayan bu uygulama zaman içerisinde enstitüler arasında bir gelenek haline gelmiştir. Söz konusu geleneğin içerisinde yetişen öğrenciler edindikleri kazanımları hem okul hem de mezuniyet sonrası yaşamlarına aktarmışlardır. Bununla birlikte bu sergiler, yalnızca öğrencilerin bir eğitim-öğretim yılı boyunca ortaya koydukları ürünlerin sergilendiği etkinlikler olarak değerlendirilmemelidir. Kız enstitülerinde benimsenen eğitim anlayışının, kadınlara kazandırılmak istenen bilgi ve becerilerin, ayrıca dönemin toplumsal ve ekonomik hedeflerinin kamuoyuna aktarıldığı önemli araçlar olmuştur. Öğrencilerin teorik bilgilerini uygulamalı üretime dönüştürmeleri, ortaya koydukları ürünleri geniş bir ziyaretçi kitlesine sunmaları ve bu ürünlerin kimi zaman satışa konu olması, eğitimin üretimle olan doğrudan ilişkisini ortaya koymaktadır.

Sergilerin bir diğer önemli işlevi ekonomik alanda ortaya çıkmıştır. Öğrencilere kazandırılan çeşitli el sanatları becerileri (dikiş, nakış, dokuma vb.), kadınların ev ekonomisine katkıda bulunmalarını sağladığı gibi ücretli üretim ve istihdam olanaklarına yönelmelerine de zemin hazırlamıştır. Gazete ilanlarında kız enstitüsü mezunlarına yönelik iş taleplerinin farklı dönemlerde devam etmesi, bu eğitim kurumlarında edinilen mesleki becerilerin çalışma hayatında karşılık bulduğunu göstermektedir. Bunun yanında Tasarruf ve Yerli Malı Haftası kapsamında düzenlenen sergilere enstitülerin katılımı, kadınların eğitim ve üretim faaliyetlerinin Cumhuriyet'in yerli üretim ve tasarruf politikalarıyla da ilişkilendirildiğini göstermektedir.

Yurt dışında düzenlenen sergiler ise bu işlevi uluslararası bir boyuta taşımıştır. Türk nakışları, el işleri ve geleneksel motiflerden oluşan çalışmaların yurt dışında sergilenmesi, bir yandan geleneksel Türk el sanatlarının tanıtımına katkı sağlarken diğer yandan yeni Cumhuriyet'in modernleşme anlayışının ve kadınlara yönelik eğitim politikalarının görünürlük kazanmasına aracılık etmiştir. Bu sergilerde geleneksel/kültürel unsurların modern tasarımlarla birlikte sunulması, Cumhuriyet'in kültürel miras ile modernleşme arasında kurmaya çalıştığı ilişkinin de somut bir göstergesidir. Bu ilişkinin etraflı bir şekilde değerlendirilmesine yönelik çalışmaların yapılması önerilmektedir.

KAYNAKÇA

Gazeteler

Akşam
Demokrat İzmir
Hakimiyeti Milliye
Hürriyet
Milliyet
Ulus
Vakit
Yeni Gaziantep

Araştırma Eserler

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F. Bilge Kazaz ile kişisel görüşme, 27 Eylül 2026.
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VICTORY DAY CELEBRATIONS IN GAZİANTEP, 1940-1945

Gülşah ESER
Harran University, Faculty of Science and Literature, History Department, Şanlıurfa, Türkiye.
ORCID ID: 0000-0002-3306-1569

ABSTRACT

Introduction and Purpose: Under the command of Gazi Mustafa Kemal Pasha, the Turkish army achieved a decisive and lasting victory at Dumlupınar on 30 August 1922. Constituting a turning point in the military phase of the Turkish National Struggle, the victory was greeted with great enthusiasm by the public and received extensive coverage in the press. Although no official celebrations were held on its anniversary, newspapers such as *Hâkimiyet-i Milliye*, *Tevhid-i Efkâr*, and *Vakit* presented the occasion in an atmosphere of festivity. On 30 August 1924, the first official commemorative ceremony was held at Dumlupınar, near the village of Çal, with the participation of Gazi Mustafa Kemal Pasha. In 1926, 30 August was officially designated as Victory Day by law, and celebrations subsequently began to be held throughout the country. Gaziantep was among the cities in which these celebrations took place.

During the Turkish National Struggle, Gaziantep was situated within the Southern Front and distinguished itself through its defence and resistance. Consequently, Victory Day celebrations held particular significance for the city's inhabitants. This study aims to examine the Victory Day celebrations in Gaziantep through the lens of the local press.

Methods: The study covers the period from 1940 to 1945. This chronological framework was determined by taking as its starting point the first celebration held after the outbreak of the Second World War and as its endpoint the final celebration held in the year in which the war ended. The research primarily employs literature review and archival research, with particular attention given to the local newspapers *Gaziantep* and *Yeni Gaziantep*.

Results: In addition, memories and impressions of the celebrations during this period, gathered through oral history interviews, were also included in the study. The findings show that the people of Gaziantep attach great importance to Victory Day celebrations. The study shows that these celebrations are both.

Keywords: Gaziantep, 30 August, Victory Day, Celebrations, Second World War.

GAZİANTEP'TE 30 AĞUSTOS ZAFER BAYRAMI KUTLAMALARI (1940-1945)

ÖZET

Giriş ve Amaç: Gazi Mustafa Kemal Paşa komutasındaki Türk ordusu 30 Ağustos 1922'de Dumlupınar'da kesin ve kalıcı bir zafer elde etmiştir. Milli Mücadele'nin askeri safhası açısından bir dönüm noktası olan bu zafer, halk tarafından coşkuyla karşılanmış ve basında da geniş bir yer bulmuştur. Zaferin yıl dönümü, resmî kutlamalar yapılmasa da *Hakimiyet-i Milliye*, *Tevhid-i Efkâr* ve *Vakit* gibi gazetelere adeta bayram şeklinde yansımıştır. 30 Ağustos 1924'e gelindiğinde Gazi Mustafa Kemal Paşa'nın da katılımıyla Dumlupınar'da (Çal köyü yakınlarında) ilk resmî kutlama töreni gerçekleştirilmiştir. 1926 yılında çıkarılan bir kanunla ise 30 Ağustos günü bayram olarak ilan edilmiş ve yurt çapında kutlamalar yapılmaya başlanmıştır. Bu kutlamaların yapıldığı yerlerden biri de Gaziantep'tir.

Gaziantep, Milli Mücadele döneminde Güney Cephesi sınırları içerisinde yer almış olup savunma ve direnişiyle öne çıkmıştır.

Dolayısıyla 30 Ağustos kutlamaları şehir halkı için ayrı bir öneme sahiptir. Bu çalışma, Gaziantep'teki 30 Ağustos kutlamalarını yerel basın ekseninde ele almayı amaçlamaktadır.

Yöntem: Çalışmanın zaman aralığı 1940 ve 1945 yılları arası olup bu aralığın belirlenmesinde II. Dünya Savaşı'nın başlangıcından sonraki ilk kutlama ile savaşın bittiği yıldaki son kutlama temel alınmıştır. Araştırmada öncelikle literatür taraması ve arşiv taraması yöntemleri kullanılmış, yerel basından *Gaziantep* ve *Yeni Gaziantep* gazeteleri taranmıştır. Ardından sözlü tarih yöntemiyle ilgili dönemdeki kutlamalara ilişkin izlenimler çalışmaya dahil edilmiştir.

Bulgular ve Sonuç: Çalışmada, Gaziantep halkının 30 Ağustos kutlamalarına büyük bir önem verdiği görülmüştür. Bu kutlamaların yapılmasının milli bilincin güçlenmesine ve toplumsal bütünleşmenin sağlanmasına katkı sunduğu sonucuna ulaşılmıştır.

Anahtar Kelimeler: Gaziantep, 30 Ağustos, Zafer Bayramı, Kutlamalar, II. Dünya Savaşı.

GİRİŞ

30 Ağustos 1922'de Türk ordusunun kazandığı zafer, askerî bir başarı olmanın ötesine geçerek Cumhuriyet'in ve dolayısıyla modern Türkiye'nin kuruluşuna zemin hazırlamıştır. Tarihsel ve stratejik önemine rağmen, zaferin birinci yıl dönümünü kutlamak amacıyla herhangi bir resmî tören yapılmamıştır. Bununla birlikte basında zaferin yıl dönümüne ilişkin haberler yer almış, Harbiye Nezareti'nin Beyazıt Meydanı'na bakan kapısı bayraklarla donatılmış ve İstanbul Muhafız Ordusu tarafından şenlikler düzenlenmiştir. Bu durum, 1923 yılından başlanarak 30 Ağustos'un bilhassa Türk ordusu tarafından bir bayram havasında kutlanmaya başlandığını göstermektedir. İlk resmî kutlama töreni ise zaferden iki yıl sonra Gazi Mustafa Kemal Paşa'nın iştirakiyle Dumlupınar'da (Çal köyü yakınlarında) yapılmıştır. 1926 yılına gelindiğinde 30 Ağustos günü Türk ordusunun bayramı olarak ilan edilmiş, yayımlanan genelgeyle de kutlama ve anma programlarının usul ve esasları belirlenmiştir.

Tayyare Cemiyeti de Millî Mücadele'yi kesin zafere ulaştıran 30 Ağustos gününü "Tayyare Bayramı" olarak kabul etmiştir. İcra Vekilleri Heyeti'nin 25 Ağustos 1926 tarihli kararnamesiyle 30 Ağustos kutlamalarında Cemiyet ile birlikte hareket edilmesi gerektiğini bildirmesi bu bayramın basında "Zafer ve Tayyare Bayramı" olarak anılmaya başlamasında etkili olmuştur. 27 Mayıs 1935 tarihli Ulusal Bayram ve Genel Tatiller Hakkında Kanun'da ise "Tayyare Bayramı" ifadesine yer verilmemiş, 30 Ağustos yalnızca "Zafer Bayramı" olarak tanımlanmıştır.

30 Ağustos kutlamaları, yurt genelinde ve söz konusu genelgede yer alan usul ve esaslara göre yapılmıştır. Bu kutlamaların coşkuyla gerçekleştirildiği vilayetlerden biri de Milli Mücadele döneminde Güney Cephesi'nde Fransız işgal güçlerine karşı sergilediği direniş ve kazandığı başarılarla öne çıkan Gaziantep'tir. Bu araştırma II. Dünya Savaşı sürecinde Gaziantep'te yapılan 30 Ağustos kutlamalarını ele almaktadır.

Araştırmada literatür taraması, arşiv taraması ve sözlü tarih yöntemleri kullanılmıştır. Öncelikle literatür taraması gerçekleştirilmiş, ardından basın arşivi taraması yapılarak yerel basından Gaziantep ve Yeni Gaziantep gazetelerindeki konuyla ilgili haberler/yazılar derlenmiştir. Sözlü tarih çalışmasında ise Gaziantep Kız Enstitüsü mezunlarından Kamile Kutlar, Meral Dai, F. Bilge Kazaz ve ayrıca eğitimci-yazar Orhan Yalkın ile kişisel görüşme yapılarak görüş ve izlenimlerinden istifade edilmiştir.

Çalışmadaki destek ve katkılarından dolayı Gaziantep Kent Arşivi ve Araştırma Merkezi yöneticisi Ecem Tan ile aynı kurumdan uzman tarihçi-editör Ahmet Şahin'e, Gaziantep Kız Enstitüsü mezunlarından Kamile Kutlar, Meral Dai ve F. Bilge Kazaz'a, eğitimci-yazar Orhan Yalkın'a teşekkür ederim.

1.Gaziantep'te Yapılan Kutlamalar

II. Dünya Savaşı başlamadan henüz birkaç gün önce yurdun dört bir yanında olduğu gibi Gaziantep'te de Zafer Bayramı kutlamaları coşkuyla gerçekleştirilmiştir. Bu coşku ilçelerde yapılan kutlamalara da yansımıştır. Islahiye'de Türk bayraklarıyla donatılan tören alanında kadın ve çocuklar ön safta yer almış, geçit töreni büyük bir heyecanla seyredilmiştir.



Şekil 1. Islahiye'deki 30 Ağustos Töreninden Bir Kare.
[Gaziantep Kent Arşivi ve Araştırma Merkezi Arşivi]

Islahiye'deki törene katılan askerî personel günün anlam ve önemine binaen bir hatıra fotoğrafı çektirmiştir. Aşağıda yer alan bu fotoğraf silah arkadaşlığı bağını gözler önüne serdiği gibi, 30 Ağustos'ta yaşanan gururu adeta simgelemektedir. Ancak bu kutlamadan birkaç gün sonra II. Dünya Savaşı başlamıştır.



Şekil 2. Islahiye'deki 30 Ağustos Töreninde Askeri Erkân.
[Gaziantep Kent Arşivi ve Araştırma Merkezi Arşivi]

Gaziantep'te millî bayramlar II. Dünya Savaşı sürecinde de coşkuyla kutlanmıştır. 30 Ağustos Zafer Bayramı dolayısıyla yapılan ilk kutlama 1940'ta Cumhuriyet Meydanı'nda, son kutlama

ise 1945'te Düztepe'dedir. Dolayısıyla çalışmada 1940-1945 döneminde kutlamalar kronolojik olarak ele alınmıştır.

1.1. 1940 Yılı Kutlamaları

Belirtildiği üzere, ilgili dönemde Gaziantep'teki ilk zafer bayramı kutlaması Cumhuriyet Meydanı'nda gerçekleştirilmiştir. Kutlamadan bir hafta önce, bayramın geçmiş yıllara kıyasla daha canlı ve coşkulu bir şekilde idrak edilmesi için gerekli hazırlıkların yapıldığı basın aracılığıyla halka duyurulmuştur. Nitekim 29 Ağustos'ta da şehir bayraklarla süslenmiş ve askerî tören için hazırlıklar koordine edilmiştir. Ayrıca Gaziantep Halkevi Temsil Şubesi tarafından bayram dolayısıyla millî bir piyes hazırlanmıştır. Sinema gösterimi yapılması da planlanmıştır.

Hazırlanan resmî kutlama programına göre; vali ve garnizon komutanının tebrikleri kabulü, Cumhuriyet Meydanı'ndaki askerî kıtaların ve polis müfrezelerinin teftişi, bir subayın konuşması, Gaziantep Halkevi ve maarif adına Doğan Aytaç'ın hitabı ile geçit resmi planlanmıştır. Saat 21.00'de ise bayram şerefine Gaziantep Halkevi'nde bir garden party (bahçe partisi) verilmesi kararlaştırılmıştır.

Söz konusu tarihte, saat 17.00'de spor sahasında Gençlik Kulübü'nün açılış törenine de yer verilmiş ve törene sivil ve askerî erkân katılmıştır. Vali ile garnizon komutanının kulübü teftişini müteakip İstiklal Marşı okunmuş ve geçit töreni icra edilmiştir. Gaziantep Kız Enstitüsü mezunlarından Kamile Kutlar'ın *"Şehir halkı bayramı coşkuyla kutlardı. Özellikle de bakırcılar ve yemeniciler gibi zanaatkârlar üstü açık kamyonlar kiralayarak kamyonlara kendi çalışmalarını koyar ve geçit resmine katılırdı."* şeklindeki ifadeleri bu törenlerde aynı zamanda yerel kimliğin ve kent kültürünün muhafaza edildiğini gözler önüne sermektedir. Ordu ile milletin bütünleşmesini de adeta sembolize etmektedir. Gaziantep Kız Enstitüsü'nün diğer mezunlarından Meral Dai'nin *"II. Dünya Savaşı sürecinde Dayı Ahmet Ağa İlkokulu'nda okuyordum. Evimiz de şehrin tam göbeğindeydi. Şehirde şenlikler olurdu. Askerler geçerdi, geçit töreni yapılırdı."* şeklindeki ifadeleri de 30 Ağustos'un sadece askerî bir başarı olarak kalmadığını, şenlikler aracılığıyla halk tarafından da benimsenerek coşkuyla kutlandığını ortaya koymaktadır.

kavuşacağını müjdelemiştir. Müsabakalarda derece alanlara madalyalarının verilmesinin ardından atletizm gösterileri ile sürat ve mukavemet koşuları yapılmıştır. Düzenlenen futbol maçının sonrasında tören sona ermiştir.

30 Ağustos ile ilgili etkinlikler ertesi gün de devam etmiştir. Halkevi'nde bir toplantı tertip edilmiş ve Kurmay Albay Seyfi Çalbatur tarafından Başkomutanlık Meydan Muharebesi'ni konu alan bir konferans verilmiştir. Çalbatur, harekâtı paftalar üzerinden anlatmış ve katılımcıların gözünde adeta canlandırmıştır. Konferansın ardından Maarif Müdürü Turgut Tarhan da günün anlam ve önemine dair bir konuşma yapmıştır.

1.2. 1941 Yılı Kutlamaları

1941'deki kutlamalar şehrin güneyindeki Düztepe'de (koşu meydanında) gerçekleştirilmiştir. Kutlama programına göre, saat 08.00 itibarıyla askerî kıtalar, jandarma ve polis müfrezeleri ile gençlik gruplarının meydanda toplanarak yerlerini almaları planlanmıştır. Daire başkanları, memurlar, parti teşkilatının yanı sıra bankalar, iktisadî teşekküller ve hayır cemiyetlerinin temsilcilerinin lise binasında hazır bulunarak tebrik törenine iştirak etmeleri öngörülmüştür.

Saat 08.20'de garnizon komutanının tugay karargâhında tebrikleri kabul edeceği ve ardından tören alanına geçileceği duyurulmuştur. Program kapsamında ordu adına kıdemsiz bir subay, Türk Hava Kurumu adına da bir hatibin konuşmasından sonra garnizon komutanı tarafından günün anlam ve önemini belirten bir konuşmanın gerçekleştirileceği ve akabinde geçit törenine başlanacağı belirtilmiştir. Saat 21.00'de ise Gaziantep Halkevi'nde bayram şerefine bir garden party düzenlenmesi planlanmıştır.

Bayram dolayısıyla şehir baştan başa bayraklarla süslenmiş ve ampullerle aydınlatılmıştır. Kutlama programında belirtildiği üzere, lise binasında toplanılmış ve Vali Burhanettin Teker saat 08.10 itibarıyla toplanan kalabalığa iştirak etmiştir. Birlikte garnizon komutanlığına gidilerek tebrikte bulunulmuştur. Ardından Düztepe'deki tören alanına geçilmiştir. Saat 09.00'da vali ve garnizon komutanı alana gelerek yerlerini almış piyade, süvari, topçu ve istihkam kıtaları ile polis ve jandarma müfrezelerini, ayrıca gençlik teşkilâtını teftiş ederek bayramlarını kutlamıştır. Valinin ve garnizon komutanının şeref tribününde yerlerini almalarını müteakip en genç süvari subayı Üsteğmen Rifat tarafından meydanda hazırlanan top üzerinde 30 Ağustos'un kıymet ve önemini, bağımsızlığa giden yoldaki rolünü anlatan bir konuşma gerçekleştirilmiştir. Türk Hava Kurumu adına ise Yasin Kutluğ bir konuşma yapmıştır. Garnizon komutanı Tuğbay Abdülkadir Seven ise 30 Ağustos'un Türk ve dünya tarihindeki anlam ve önemini anlatan konuşmasında Gaziantep müdafaasına da değinerek Gazianteplilerin kahramanlık ve fedakârlıklarından bahsetmiştir. Seven'in konuşmasını müteakip geçit töreni başlamış ve törenin bitişinin ardından askerî kıtalar önlerinde belediye bandosu ile birlikte şehirde bir tur atmıştır. 30 Ağustos günü Gaziantep halkı askerle birlikte bayramı coşkuyla kutlamış, davullar eşliğinde millî oyunlar oynamıştır. Saat 21.00'de fener alayı yapılmış ve şehir kulübünde bir garden party verilmiştir. Gaziantep Kız Enstitüsü mezunlarından Kamile Kutlar, 30 Ağustos kutlamaları ve özellikle fener alayları hakkında şunları nakletmektedir:

> *"Benim çocukluğumda Gaziantep'te yedi ilkokul ve bir ortaokul vardı. 1930 yılı gibi ilkokula başladım ve o yıldan itibaren tüm bayram kutlamalarına katıldım. Biz ilkokulda iken önce öğretmenlerimiz konuşma yapardı ve biz onları dinlerdik. Kıyafetlerimizi giyinir ve alanlara çıkardık, geçit resmine katılırdık. Vali, komutan, belediye reisi ve üst kademe memurlar onlar da arabalara binerek geçit resmine katılırdı. Bunlar içerisinde 30 Ağustos ayrı bir öneme sahipti. 30 Ağustos kutlamalarında şehirdeki tüm komutanlar ve askerler vardı. Marşlar söylenirdi. II. Dünya Savaşı sürecinde ben Gaziantep Kız Enstitüsü'nde okuyordum. O dönemde de bayram kutlamaları aynıydı. Geceleri muhakkak fener alayı yapılırdı ve 30 Ağustos'taki fener alayları çok büyük olurdu. Biz de enstitü öğrencileri olarak formamızı giyer, okul şapkalarımızı takar ve onlara iştirak ederdik."*

Gaziantep Kız Enstitüsü mezunlarından F. Bilge Kazaz da 1950'li yıllarda da fener alaylarının devam ettiğini nakletmektedir. Okullar kapalı olduğu için öğrencilerin gündüz yapılan törene iştirak edemediğini ifade etmektedir. Kendilerinin küçükken gece yapılan fener alayını ilgiyle izlediklerini ayrıca ifadelerine eklemektedir. Eğitimci ve yazar Orhan Yalkın ise 30 Ağustoslarda fener alaylarına askerlerin de katıldığını, bir kısmının askeri araç üzerinde ve diğer bir kısmının da elinde meşalelerle geçtiğini dile getirmektedir.

1.3 1942 Yılı Kutlamaları

Gaziantep'te Zafer Bayramı kutlamaları sonraki yıllarda da devam etmiştir. Bu kapsamda 1942 yılı kutlamaları için sabahın erken saatlerinde halk sokağa çıkmış ve bayram şehrin dört bir yanında coşkuyla kutlanmıştır. Aynı gün vali tarafından saat 15.00'te aygır deposunun açılışı gerçekleştirilmiştir. Benzer şekilde Memleket Hastanesi'nin röntgen bölümü açılmış ve Kilis yolu üzerindeki kışlanın temeli atılmıştır. Ayrıca kutlama etkinlikleri çerçevesinde akşam verilen garden partyde Türk Hava Kurumu küçük eşya piyangosu düzenlemiştir. Bu piyango sonucunda kuruma 50 lira kazandırılmıştır. Zafer bayramında dağıtılan rozetlerden de 65 lira gelir elde edilmiştir.

1.4 1943 Yılı Kutlamaları

1943 yılındaki kutlamalar Nizip yolu üzerindeki yeni stadyumda gerçekleştirilmiştir. Kutlama programı kapsamında sırasıyla askerî kıtalar, polis müfrezeleri ve gençlik teşkilâtının tören alanındaki yerlerini almaları, Kilis yolu üzerindeki tugay karargâhında tebriklerin kabul edilmesi planlanmıştır. Program devamında garnizon komutanının tören alanındaki kıtaları teftişi, ordu adına bir subayın ve garnizon komutanının konuşmaları, ayrıca Türk Hava Kurumu adına günün anlam ve önemi ile havacılığın ehemmiyetine değinen bir konuşma gerçekleştirilmesi ve ardından geçit törenine başlanması öngörülmüştür.

30 Ağustos Pazartesi günü saat 08.00'de başta vali olmak üzere sivil erkân lise binasında toplanmış ve 08.30'da garnizon komutanlığına gidilerek tebrik ziyaretinde bulunulmuştur. Piyade, süvari ve motorlu birliklerin yerini aldığı tören alanında tribünler tamamen dolmuş, halkın bir kısmı da geçit törenini izlemek için stadyum dışındaki bostanlarda yerini almıştır. Saat 09.30'da vali, milletvekili, garnizon komutanı ve parti reisi tören alanına gelmiştir. Vali ve garnizon komutanı askerleri teftiş ederek bayramlarını kutlamış, ardından şeref tribününde yerlerini almıştır. Belediye bandosu İstiklal Marşı'nı çalarken sahaya Türk bayrağı çekilmiştir. Bir süvari teğmeni top arabası üzerinde 30 Ağustos'un Türk tarihindeki anlam ve değerini dile getiren bir konuşma yapmıştır. Bunu Albay Kazım Akıncı'nın ve Türk Hava Kurumu adına da vilayet maiyet memuru Abdülkadir Uras'ın günün ve havacılığın önemini belirten konuşması takip etmiştir. Sonrasında geçit töreni başlamıştır. Gün boyunca kışlalarda davullar çalmış ve millî oyunlar oynanarak eğlenilmiştir. Saat 21.00'de ise kutlama programında belirtildiği üzere garnizon komutanlığı tarafından Gaziantep Halkevi bahçesinde bir garden party verilmiştir. Baloda Vali Burhanettin Teker başta olmak üzere Gaziantep milletvekili şehrin ileri gelenleri ve çok sayıda kişi hazır bulunmuştur.



Şekil 3. 1943 Yılı 30 Ağustos Töreninde Vali Burhanettin Teker (Sağda), Milletvekili Cemil Alevli (Solda) ve Komutanlar.
[F. Bilge Kazaz Arşivi]

1.5 1944 Yılı Kutlamaları

30 Ağustos 1944 Çarşamba günü başta vali olmak üzere sivil erkân, saat 08.30'da garnizon komutanlığına tebrik ziyaretinde bulunmuş ve komutanlık binasının önünde bir askeri kıta tarafından selamlanmıştır. Saat 15.00'te vali, garnizon komutanı, diğer sivil erkân ve şehrin sağlık personelinin katıldığı törenle Doğum ve Çocuk Bakımevi'nin açılışı gerçekleştirilmiştir. Saat 21.00'de Kırkayak bahçesinde bir garden party verilmiş, valinin de katıldığı eğlence geç vakitlere kadar devam etmiştir. Gece ise fener alayı yapılmıştır.

30 Ağustos etkinlikleri ilerleyen günlerde de devam etmiş, 2 Eylül 1944 Cumartesi saat 20.00'de Gaziantep Halkevi salonunda bir tören düzenlenerek Üsteğmen Muzaffer Atasü tarafından bir konferans verilmiştir. Üsteğmen, Başkomutanlık Meydan Muharebesi'ni harita üzerinde detaylı bir şekilde anlatmış ve konferans dinleyiciler tarafından ilgiyle takip edilmiştir. Konferansın ardından Halkevi korosu tarafından yöresel türküler seslendirilmiştir.

1.6 1945 Yılı Kutlamaları

1945 yılında bayram dolayısıyla Gaziantep şehri kırmızı-beyaz renklerle süslenmiş ve tören Düztepe'de icra edilmiştir. Kutlama programı gereğince vali muaviniyle birlikte sivil erkân saat 08.30'da tugay komutanlığına giderek tebrik ziyaretinde bulunmuştur. Aynı saatte askeri kıtalar tören alanında yerlerini almıştır. Tören alanının şehre uzaklığı nedeniyle katılımcıları alana taşımak üzere Keyvanpark önünde bir belediye otobüsü hazır bulundurulmuştur. Saat 09.00'da vali muavini ve tugay komutanı askerî kıtaları teftiş edip bayramlarını kutlamış ve ardından şeref tribününde yerlerini almıştır. Bandonun İstiklal Marşı'nı çalmasıyla birlikte tören başlamıştır. Ordu adına genç bir subayın 30 Ağustos'un Türk tarihindeki anlam ve değerini anlatan konuşmasını müteakip Tuğgeneral Sıtkı Okan ve Türk Hava Kurumu adına da öğretmen Nurettin Altuğ birer konuşma yapmıştır. Sonrasında geçit töreni başlamış; piyade ve süvari birliklerinin yanı sıra motorlu ve zırhlı birlikler, jandarma ve polis müfrezeleri alkışlar eşliğinde selamlamada bulunmuştur. Bütün gün kışlalarda davullar ve zurnalar çalmıştır. Akşam saat 21.00'de garnizon komutanlığı tarafından Kırkayak bahçesinde bir garden party düzenlenmiştir. Kalabalık ve seçkin bir kitlenin katıldığı balo büyük ilgi uyandırmıştır.

30 Ağustosların gelenekselleşen törenlerinden biri de Atatürk heykeline çelenk koyma olmuştur. Orhan Yalkın'ın *"Şimdiki öğretmenevinin bulunduğu yerin bahçesinde o zamanlar yaz akşamları Gaziantep halkı çay kahve içer, dondurma yerdi. Kapalı alan ise Şehir Kulübü idi. Buraya yakın bir yerde Atatürk heykeli vardı ve 30 Ağustoslarda buraya çelenk konurdu."* şeklindeki ifadeleri de bu törenin Gaziantep'te nerede gerçekleştirildiğine ışık tutmaktadır.

SONUÇ

30 Ağustos Zafer Bayramı kutlamaları, yalnızca askerî bir başarının ya da tarihi bir günün anılması değil, aynı zamanda Türk milletinin ortak değerler etrafında kenetlenmesinin bir sembolüdür. Millî Mücadele'nin öncü şehirlerinden biri olan Gaziantep'te yapılan kutlamalar da bu minvalde şekillenmiştir. Halk, yapılan törenlere büyük ilgi göstermiş ve kutlamalar coşkuyla gerçekleştirilmiştir. Özellikle fener alayları, zafer coşkusunu modern şehir hayatına entegre ederek kutlamalara canlı ve dinamik bir boyut kazandırmıştır.

Halkın törenlere yoğun bir katılım sağlaması ve bu durumun süreklilik kazanması, toplumsal hafızanın oluştuğunu ortaya koymaktadır. Kutlama programı kapsamında yapılan konuşmalar, verilen konferanslar ve ayrıca diğer etkinlikler özellikle genç nesillerin tarih bilincinin arttırılmasında etkili olmuştur. Araştırmaya konu olan dönemde Gaziantep'teki çeşitli okullarda öğrenim görmüş kişilerle yapılan sözlü tarih görüşmeleri ve dolayısıyla onların bayram kutlamalarına ilişkin izlenimleri de bu savı desteklemektedir.

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THE POSITION AND SIGNIFICANCE OF BIST PARTICIPATION INDICES AS AN ALTERNATIVE INVESTMENT VEHICLE IN TÜRKİYE

Prof. Dr. Emine FIRAT
Department of Economics
Faculty of Economics and Administrative Sciences
Aksaray University, Türkiye
ORCID ID: 0000-0003-4586-1632

ABSTRACT
The globalization of financial markets and the diversifying expectations of individual savers have heightened interest in alternative capital market instruments. Reports from the Central Bank of the Republic of Türkiye (CBRT) indicate that a significant portion of household savings remains outside the formal financial system as "under-the-mattress" assets, influenced by behavioral biases and trust factors. While domestic savings traditionally concentrated in bank deposits, real estate, foreign exchange, and gold, recent macroeconomic pressures, high inflation, and digital transformation have prompted a transition toward capital markets. Consequently, Borsa Istanbul (BIST) has emerged as an essential hedge against inflation and a strategic platform for portfolio diversification. Crucially, for faith-based investors seeking compliance with Islamic finance principles, BIST Participation Indices (e.g., Katılım 30, Katılım 50, Katılım Tüm) offer a vital mechanism to integrate idle savings into the formal economy. Utilizing a qualitative synthesis of Turkish investment instruments, this study analyzes the historical evolution of BIST Participation Indices, the governance mechanics of index inclusion criteria, and their role in mobilizing individual capital. The findings indicate that religious beliefs significantly influence financial decision-making, driving robust demand for interest-free assets. Although BIST Participation Indices present a compelling alternative to unregistered holdings, persistent challenges such as financial distrust, inflation concerns, information asymmetry regarding Islamic instruments, and low financial literacy continue to hinder full integration. Ultimately, this paper outlines strategic policy recommendations to fortify the participation finance ecosystem, promote Islamic capital market instruments, and seamlessly convert idle household assets into productive economic capacity in Türkiye.
Keywords: Investment Instruments, Borsa Istanbul, Islamic Finance, BIST Participation Indices, Under-the-Mattress Savings, Türkiye

TÜRKİYE'DE ALTERNATİF YATIRIM ARACI OLARAK BIST KATILIM ENDEKSLERİ'NİN YERİ VE ÖNEMİ

ÖZET
Finansal piyasaların küreselleşmesi ve bireysel tasarruf sahiplerinin çeşitlenen finansal beklentileri, sermaye piyasalarında alternatif yatırım araçlarına olan ilgiyi her geçen gün artırmaktadır. Tüm yatırımcılar finansal bilgiyi işleme biçimlerindeki sistematik hataları, duygusal tepkileri ve sosyal etkileşimleri analiz ederek, gerçek dünya finansal kararlarının neden rasyonel modellerden sıklıkla saptığını açıklamayı hedeflemektedir.
Türkiye Cumhuriyet Merkez Bankası (TCMB) tarafından yayımlanan çeşitli analitik raporlar, Türkiye'de hane halkı tasarruflarının önemli bir bölümünün geleneksel ve finansal sistemin resmi yapısı dışında kalan yöntemlerle, yaygın olarak "yastık altı" olarak tabir edilen fiziksel biçimde tutulmaya devam ettiğini ortaya koymaktadır. Türkiye'de geleneksel olarak mevduat, gayrimenkul, döviz ve altın gibi araçlarda yoğunlaşan bireysel tasarruflar, son dönemde yaşanan makroekonomik dinamikler, yüksek enflasyon ortamı ve dijitalleşmenin getirdiği kolaylıklar neticesinde sermaye piyasalarına doğru kayma eğilimi göstermektedir. Bu süreçte

Borsa İstanbul (BIST), yatırımcılar için yalnızca enflasyondan korunma mekanizması değil, aynı zamanda portföy çeşitlemesinde stratejik bir alternatif yatırım mecrası konumuna gelmiştir. Türkiye'deki İslami hassasiyeti olan yatırımcılar için yastık altında tutulan âtıl birikimlere karşı Borsa İstanbul Katılım Endeksleri aracılığıyla hisse senedi yatırımı da alternatif olarak güçlü bir konuma gelmiştir. Özellikle faiz hassasiyeti bulunan ve Katılım Finans ilkelerine uygun yatırım yapmayı hedefleyen geniş bir yatırımcı kitlesi için BIST Katılım Endeksleri (Katılım 30, Katılım 50, Katılım Tüm vb.) kritik bir rol üstlenmektedir. Çalışmada Türkiye'deki yatırım araçları nitel çalışmalar şeklinde harmanlanarak, BIST Katılım Endekslerinin tarihsel gelişimi, endekse giriş-çıkış kriterlerinin kurumsal yönetişim ve katılım finans esasları açısından işleyişi ve bu endekslerin bireysel tasarrufların sermaye piyasalarına kazandırılmasındaki rolü incelenmektedir.

Çalışma sonucu bulgular, İslami yatırımcıların dini inançlarının finansal kararlarında merkezi bir rol oynadığını ve faizsiz yatırım araçlarına yönelik önemli bir talep olduğunu göstermiştir. BIST Katılım Endeksleri, İslami finans prensiplerine uygun yapısı ve potansiyel faydaları ile yastık altı birikimlere karşı cazip bir alternatif sunmaktadır. Ancak, finansal sisteme güvensizlik, enflasyon endişesi, İslami yatırım araçlarına dair bilgi eksikliği ve düşük finansal okuryazarlık gibi nedenlerle önemli bir tasarruf kesiminin hala yastık altında tutulduğu tespit edilmiştir.

Sonuç olarak bu bildiri, Türkiye'de katılım finans ekosisteminin geliştirilmesi ve alternatif yatırım aracı olarak Katılım Endekslerinin yaygınlaştırılmasına yönelik stratejik öneriler sunmaktadır. İslami finans piyasalarının geliştirilmesi ve âtıl birikimlerin ekonomiye kazandırılması hedeflenmektedir.

Anahtar Kelimeler : Yatırım araçları, Borsa İstanbul, İslami Finans, BIST Katılım Endeksleri, Yastık Altı Birikimler, Türkiye

ANNUAL OPERATING RESULTS OF APRICOT-GROWING FARMS: THE CASE OF MALATYA PROVINCE

Prof. Dr. Orhan GÜNDÜZ
Department of Agricultural Economics, Faculty of Agriculture, Malatya Turgut Özal University, Malatya, Türkiye
ORCID ID: 0000-0002-2357-0802

Assist. Prof. Dr. Ahmet ASLAN
Department of Agricultural Economics, Faculty of Agriculture, Malatya Turgut Özal University, Malatya, Türkiye
ORCID ID: 0000-0002-0003-2358

Assoc. Prof. Dr. Çağatay YILDIRIM
Department of Agricultural Economics, Faculty of Agriculture, Ondokuz Mayıs University, Samsun, Türkiye
ORCID ID: 0000-0002-4121-5564

Res. Assist. Cansu KADAKOĞLU
[1]Department of Agricultural Economics, Faculty of Agriculture, Malatya Turgut Özal University, Malatya, Türkiye
ORCID ID: 0009-0009-0195-7350

ABSTRACT
This study aims to analyze the socioeconomic characteristics and annual operating results of apricot-growing farms in Malatya Province according to farm size groups. The target population consisted of 5,273 farms with at least 5 decares of apricot orchards located in 30 purposively selected villages across 10 districts where apricot production is concentrated. The farms were classified into three groups according to land size, and survey data were collected from 268 farms selected using the Proportional Allocation Method at a 95% confidence level and a 5% margin of error.

The average age of farm managers was 53.64 years, their average duration of education was 8.60 years, and their average farming experience was 29.66 years. The average household size was 4.27 persons per farm, while family labor availability was 2.88 Man Labor Units (MLU). Apricot orchards accounted for 94.81% of the total fruit-growing area, and apricot production contributed 60.91% of the total gross production value. Average gross farm income was calculated as TRY 104,870.44, farm operating expenses as TRY 110,502.31, gross margin as TRY 43,575.15, and agricultural income as TRY 21,917.41. Although net farm income was negative on average, it was positive in the large-farm group. However, when the opportunity cost of total farm capital was taken into account, net profit and profitability ratios were negative across all farm size groups. The findings indicate that farm size positively affects economic performance; nevertheless, increasing farm size alone is insufficient to ensure the economic sustainability of apricot-growing farms.

Keywords: Apricot, farm businesses, farm size, economic performance, profitability, Malatya

KAYISI YETİŞTİREN TARIM İŞLETMELERİNİN YILLIK FAALİYET SONUÇLARI: MALATYA İLİ ÖRNEĞİ

ÖZET

Bu çalışmanın amacı, Malatya ilinde kayısı yetiştiren tarım işletmelerinin sosyoekonomik özelliklerini ve yıllık faaliyet sonuçlarını işletme büyüklük grupları itibarıyla analiz etmektir. Araştırmanın ana kitlesini, kayısı yetiştiriciliğinin yoğun olarak yapıldığı 10 ilçede gayeli olarak seçilen 30 köyde, en az 5 dekar kayısı alanına sahip 5.273 işletme oluşturmuştur. İşletmeler arazi büyüklüklerine göre üç gruba ayrılmış ve %95 güven düzeyi ile %5 hata payı esas alınarak Oransal Dağılım Yöntemiyle belirlenen 268 işletmeden anket yoluyla veri toplanmıştır. İşletme yöneticilerinin ortalama yaşı 53,64 yıl, eğitim süresi 8,60 yıl ve tarımsal deneyimi 29,66 yıl olarak belirlenmiştir. İşletme başına ortalama nüfus 4,27 kişi, aile işgücü varlığı 2,88 Erkek İş Birimidir. Meyve alanlarının %94,81'ini kayısı bahçeleri oluşturmakta, toplam gayrisafi üretim değerinin %60,91'i kayısı üretiminden sağlanmaktadır. Ortalama gayrisafi hasıla 104.870,44 TL, işletme masrafları 110.502,31 TL, brüt kâr 43.575,15 TL ve tarımsal gelir 21.917,41 TL olarak hesaplanmıştır. Saf hasıla işletmeler ortalamasında negatif olmakla birlikte büyük işletme grubunda pozitif gerçekleşmiştir. Buna karşılık aktif sermayenin fırsat maliyeti dikkate alındığında bütün işletme gruplarında net kâr ve rantabilite oranları negatif bulunmuştur. Bulgular, işletme büyüklüğünün ekonomik performansı olumlu etkilediğini, ancak ölçek büyümesinin tek başına ekonomik sürdürülebilirlik için yeterli olmadığını göstermektedir.

Anahtar kelimeler: Kayısı, tarım işletmeleri, işletme büyüklüğü, ekonomik performans, rantabilite, Malatya

1. GİRİŞ

Türkiye, dünya kuru kayısı üretimi ve dış ticaretinde belirleyici bir konuma sahiptir. Uzun yıllar ortalamalarına göre dünya kuru kayısı üretiminin %57,3'ü Türkiye tarafından gerçekleştirilmekte, dünya ihracat miktarının yaklaşık %62'si ve ihracat değerinin %75'i Türkiye'ye ait bulunmaktadır (International Nut and Dried Fruit Council, 2021; International Trade Center, 2021). Kuru kayısı ihracatından yıllık 300 milyon doların üzerinde gelir elde edilmesi, ürünün Türkiye açısından tarımsal üretimin yanı sıra dış ticaret bakımından da önemini ortaya koymaktadır.

Türkiye'de kuru kayısı üretimi büyük ölçüde Malatya ili ve çevresinde yoğunlaşmıştır. 2009-2018 dönemi ortalamalarına göre Türkiye kuru kayısı üretiminin yaklaşık %85'i Malatya'da gerçekleştirilmiştir (TÜİK, 2018). Bu nedenle kayısı, Malatya'nın tarımsal üretim yapısının ve kırsal ekonomisinin temel ürünlerinden biridir.

Üretim ve dış ticarette sahip olunan güçlü konuma rağmen, kayısı üreticilerinin ekonomik performansına ilişkin önceki çalışmalar önemli sorunlara işaret etmektedir. Gündüz (2002), Malatya'daki kayısı işletmelerinde saf hasılanın aktif sermayeye oranını %0,74, Aslan (2013) ise %1,04 olarak belirlemiştir. Daha sonraki çalışmalarda da bu oranın düşük seviyelerde kaldığı görülmüştür. Buna karşılık kayısı işletmelerinin teknik etkinlik düzeylerinin yaklaşık %80 civarında belirlenmiş olması (Gündüz, 2011; Gündüz, 2015), işletmelerin ekonomik sorunlarının yalnızca üretim etkinliği ile açıklanamayacağını göstermektedir.

Malatya'da kayısı işletmelerinin büyüklükleri önemli farklılık göstermektedir. Kayısı alanlarının 1-350 dekar arasında değişebilmesi, işgücü kullanımı, üretim maliyetleri, gelir ve kârlılık bakımından farklı işletme yapılarının ortaya çıkmasına neden olmaktadır. Bu çalışmanın amacı, Malatya ilinde kayısı yetiştiren tarım işletmelerinin sosyoekonomik yapılarını belirlemek ve yıllık faaliyet sonuçlarını işletme büyüklükleri itibarıyla karşılaştırmalı olarak analiz etmektir.

2. MATERYAL VE YÖNTEM

Araştırma Malatya ilinde yürütülmüştür. Kayısı yetiştiriciliğinin yoğun olduğu 10 ilçe araştırma kapsamına alınmıştır. Her ilçeden kayısı üretiminin yoğunluğu ve temsil kabiliyeti dikkate alınarak üçer köy gayeli olarak seçilmiş ve toplam 30 köy araştırma alanını oluşturmuştur.
Araştırmanın ana kitlesini bu köylerde en az 5 dekar kayısı alanına sahip 5.273 işletme oluşturmuştur. İşletmelerin arazi genişlikleri bakımından heterojen olması ve varyasyon katsayısının %90'ın üzerinde bulunması nedeniyle işletmeler kümeleme analiziyle üç büyüklük grubuna ayrılmıştır. Örnek hacmi, %95 güven düzeyi ve ortalamadan %5 sapma esas alınarak Oransal Dağılım Yöntemi ile 268 işletme olarak belirlenmiş ve örnek işletmeler gruplara oransal olarak dağıtılmıştır (Yamane, 1967; Çiçek ve Erkan, 1996).
İşletmelerin sosyoekonomik özelliklerinin değerlendirilmesinde işletmeci yaşı, eğitim süresi, tarımsal deneyim, hanehalkı büyüklüğü, işgücü varlığı ve arazi kullanımına ilişkin tanımlayıcı istatistiklerden yararlanılmıştır. Aile işgücü potansiyelinin belirlenmesinde Erkek İş Birimi (EİB) kullanılmıştır. Ekonomik performansın belirlenmesinde gayrisafi üretim değeri (GSÜD), gayrisafi hasıla (GSH), değişen ve sabit masraflar, işletme masrafları, brüt kâr, saf hasıla, tarımsal gelir, net kâr ile mali ve ekonomik rantabilite oranları hesaplanmıştır. GSH, GSÜD'ye işletme dışı tarımsal gelir ile konut kira karşılığının eklenmesiyle; saf hasıla GSH'den işletme masraflarının çıkarılmasıyla; net kâr ise aktif sermayenin faiz karşılığını da içeren toplam üretim masraflarının GSH'den çıkarılmasıyla hesaplanmıştır.

3. ARAŞTIRMA BULGULARI

İncelenen işletmelerde işletme yöneticilerinin ortalama yaşı 53,64 yıl, eğitim süresi 8,60 yıl ve tarımsal deneyimi 29,66 yıldır. Ortalama hanehalkı büyüklüğü 4,27 kişi, aile işgücü varlığı ise 2,88 EİB olarak hesaplanmıştır. Nüfusun %78,94'ü 15-64 yaş grubunda bulunmasına karşılık 50 yaş ve üzerindeki nüfus oranının %34,04'e ulaşması, kırsal nüfusta yaşlanma eğilimine işaret etmektedir. Önceki çalışmalarla karşılaştırıldığında işletme yöneticilerinin yaş ve deneyimlerinde önemli bir değişme görülmezken eğitim düzeyinde artış olduğu anlaşılmaktadır. Nitekim Gündüz (2002) ortalama eğitim süresini 4,75 yıl, Aslan (2013) ise 6,15 yıl olarak belirlemiştir.
İşletmelerde tarım arazisinin %66,06'sı meyve, %33,86'sı tarla bitkileri ve %0,07'si sebze üretimine ayrılmıştır. Meyve arazilerinin %94,81'ini kayısı bahçeleri oluşturmaktadır. Ortalama meyve alanı yaklaşık 30 dekar olup kayısı alanı birinci işletme grubunda 13,19 dekardan üçüncü grupta 69,79 dekara yükselmektedir. Gündüz (2002) kayısı alanlarının toplam meyve alanları içindeki payını %98 olarak belirlemiştir. Mevcut sonuç, kayısının işletme üretim desenindeki belirleyici konumunu sürdürdüğünü, ancak diğer meyve türlerinin payında sınırlı da olsa artış bulunduğunu göstermektedir.

Tablo 1. İşletmelerin temel sosyoekonomik ve üretim özellikleri

Gösterge	İşletmeler ortalaması
İşletmeci yaşı (yıl)	53,64
Eğitim süresi (yıl)	8,60
Tarımsal deneyim (yıl)	29,66
Hanehalkı büyüklüğü (kişi)	4,27
Aile işgücü (EİB)	2,88
Meyve alanlarının toplam arazi içindeki payı (%)	66,06
Kayısının meyve alanları içindeki payı (%)	94,81
Kayısının toplam GSÜD içindeki payı (%)	60,91

İşletme başına ortalama GSÜD 102.307,75 TL olarak belirlenmiştir. Bunun %76,14'ünü bitkisel, %23,86'sını hayvansal üretim oluşturmaktadır. Toplam GSÜD'nin %60,91'i kayısı ve kayısı çekirdeğinden sağlanmaktadır.

Kayısının GSÜD içindeki payı Gündüz (2002) tarafından %48, Aslan (2013) tarafından %79 ve Gündüz vd. (2017) tarafından %66,34 olarak belirlenmiştir. Mevcut çalışmadaki %60,91'lik oran, kayısının işletme gelirlerinin temel kaynağı olmayı sürdürdüğünü, ancak hayvancılık ve diğer bitkisel faaliyetlerin de gelir çeşitlendirmesinde önemli olduğunu göstermektedir.
İşletme ölçeği büyüdükçe toplam GSÜD 63.586,03 TL'den 236.764,34 TL'ye yükselirken dekara GSÜD aynı yönde artmamış; en yüksek değer 2.787,64 TL/da ile birinci işletme grubunda gerçekleşmiştir. Bu durum büyük işletmelerin toplam üretim değeri bakımından avantajlı olmakla birlikte birim alan performansında aynı üstünlüğü göstermediğini ortaya koymaktadır.
Ortalama GSH 104.870,44 TL olup bunun %97,56'sı GSÜD'den oluşmaktadır. İşletme başına ortalama işletme masrafı 110.502,31 TL olarak hesaplanmış; bunun %53,15'ini değişen ve %46,85'ini sabit masraflar oluşturmuştur. Değişen masrafların %74,06'sı bitkisel üretime aittir. Sabit masraflar içerisinde aile işgücü ücret karşılığı %49,13 ve amortismanlar %44,28 ile en yüksek paya sahiptir.

Tablo 2. İşletme büyüklüklerine göre yıllık faaliyet sonuçları

Göstergeler	1. Grup	2. Grup	3. Grup	Ortalama
GSÜD (TL/işletme)	63.586,03	104.299,14	236.764,34	102.307,75
GSH (TL/işletme)	66.280,46	106.338,24	240.048,95	104.870,44
İşletme masrafları (TL)	76.753,30	112.086,87	228.036,55	110.502,31
Brüt kâr (TL)	25.475,14	46.328,16	102.267,03	43.575,15
Brüt kâr (TL/da)	1.116,84	876,10	914,40	952,25
Saf hasıla (TL)	-10.472,84	-5.748,63	12.012,40	-5.631,87
Saf hasıla (TL/da)	-459,13	-108,71	107,41	-123,07
Tarımsal gelir (TL)	13.200,91	25.689,16	44.600,09	21.917,41
Tarımsal gelir (TL/da)	578,73	485,80	398,78	478,96
Net kâr (TL)	-140.653,12	-265.406,74	-573.205,71	-245.028,58
Mali rantabilite (%)	-15,93	-15,05	-14,47	-15,09
Ekonomik rantabilite (%)	-15,54	-14,65	-14,11	-14,71

İşletme başına ortalama brüt kâr 43.575,15 TL olup bütün işletme gruplarında pozitiftir. Buna karşılık dekara brüt kâr birinci grupta 1.116,84 TL ile en yüksek düzeydedir. Toplam brüt kârın ölçekle birlikte artmasına karşılık dekara brüt kârın aynı yönde artmaması, büyük işletmelerde toplam gelir avantajının esas olarak daha geniş arazi varlığından kaynaklandığını düşündürmektedir.
Saf hasıla işletmeler ortalamasında -5.631,87 TL olarak gerçekleşmiştir. Birinci ve ikinci işletme gruplarında saf hasıla negatif iken üçüncü grupta 12.012,40 TL'ye yükselerek pozitif değer almıştır. Saf hasılanın aktif sermayeye oranı da birinci gruptaki %-1,17'den üçüncü grupta %0,30'a yükselmiştir. Gündüz (2002) bu oranı %0,74, Gündüz vd. (2017) ise %0,40 olarak belirlemiştir. Dolayısıyla büyük işletmelerde ölçek avantajı görülmekle birlikte sermaye getirisinin oldukça düşük kaldığı ve uzun dönemli kârlılık sorununun devam ettiği anlaşılmaktadır.

Ortalama tarımsal gelir 21.917,41 TL olup birinci grupta 13.200,91 TL'den üçüncü grupta 44.600,09 TL'ye yükselmiştir. Buna karşılık dekara tarımsal gelir işletme büyüklüğü arttıkça 578,73 TL'den 398,78 TL'ye gerilemiştir. Ayrıca işletme başına ortalama tarım dışı gelir 22.850,42 TL olup toplam aile gelirinin %51,04'ünü oluşturmaktadır. Bu sonuç, kayısı üretiminin temel tarımsal faaliyet olmasına rağmen hane gelirinin önemli bölümünün tarım dışı kaynaklardan sağlandığını göstermektedir.

Aktif sermayenin fırsat maliyeti üretim masraflarına dahil edildiğinde işletme başına ortalama net kâr -245.028,58 TL olarak hesaplanmış ve bütün işletme büyüklük gruplarında negatif gerçekleşmiştir. Buna bağlı olarak mali rantabilite ortalama %-15,09, ekonomik rantabilite ise %-14,71 olarak bulunmuştur. Brüt kâr ve tarımsal gelirin pozitif olmasına karşılık net kâr ve rantabilitenin negatif gerçekleşmesi, işletmelerin cari üretim faaliyetlerinden gelir sağlamakla birlikte üretimde kullanılan sermayenin alternatif maliyetini karşılamakta yetersiz kaldığını ortaya koymaktadır. Bu bulgu, kayısı işletmelerinin ekonomik sürdürülebilirliğinin yalnızca üretim miktarı veya işletme ölçeğiyle değil, sermaye yapısı, maliyetler, verimlilik ve ürün fiyatlarıyla birlikte değerlendirilmesi gerektiğini göstermektedir.

4. SONUÇ

Malatya ilinde kayısı yetiştiren işletmelerin üretim yapısında kayısı temel faaliyet olma özelliğini korumaktadır. Meyve alanlarının %94,81'inin kayısı bahçelerinden oluşması ve toplam GSÜD'nin %60,91'inin kayısıdan sağlanması, işletmelerin ekonomik performansının büyük ölçüde bu ürüne bağlı olduğunu göstermektedir. Bununla birlikte Türkiye'nin kuru kayısı üretimi ve dış ticaretindeki güçlü konumunun işletme düzeyinde aynı ölçüde yüksek kârlılığa dönüşmediği görülmektedir.

İşletme ölçeği arttıkça işletme başına üretim değeri, brüt kâr, tarımsal gelir ve saf hasıla artmaktadır. Saf hasılanın yalnızca büyük işletme grubunda pozitif olması belirli ölçüde ölçek avantajına işaret etmektedir. Buna karşılık dekara gelir göstergelerinin işletme büyüklüğüyle birlikte yükselmemesi, ekonomik performansın yalnızca işletme ölçeğinin büyütülmesiyle iyileştirilemeyeceğini göstermektedir.

Aktif sermayenin fırsat maliyeti dikkate alındığında bütün işletme gruplarında net kâr ile mali ve ekonomik rantabilitenin negatif olması, sektörün uzun dönemli ekonomik sürdürülebilirliği açısından temel sorundur. Bu nedenle politikaların yalnızca üretim artışına değil, birim üretim maliyetlerinin düşürülmesine, işgücü ve sermaye kullanım etkinliğinin artırılmasına, üretici örgütlenmesinin güçlendirilmesine, ortak makine kullanımının yaygınlaştırılmasına, pazarlama maliyetlerinin azaltılmasına ve üründen yaratılan katma değerin üreticiye daha yüksek oranda aktarılmasına odaklanması gerekmektedir.

Teşekkür

Bu çalışma, TÜBİTAK tarafından 120K147 numaralı proje kapsamında desteklenen araştırmadan üretilmiştir. Araştırmaya sağladığı desteklerden dolayı Türkiye Bilimsel ve Teknolojik Araştırma Kurumuna (TÜBİTAK) teşekkür ederiz.

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INFLUENCES OF DROUGHT AND EXTREME GROUNDWATER OVEREXPLOITATION ON OCCURRENCES OF LAND SUBSIDENCE AND SINKHOLES IN FARMLANDS; CASE STUDY: KONYA KARAPINAR SITE, CENTRAL ANATOLIAN PART OF TURKEY.

Hatim ELHATIP
"Prof.Dr."Head, Department of Environmental Engineering, Aksaray University, Aksaray City, T ürkiye
ORCID ID NO: 0000-0001-6147-77676147-7767

Adil AKSOY
Assoc.Prof.Dr." Department of Civil Engineering, Aksaray University, Aksaray, Türkiye

ABSTRACT

Climate change poses uncertainties to the supply and management of water resources. Consequently, these changes can influence precipitation amounts, timings and intensity rates, and indirectly impact the flux and storage of water in surface and subsurface reservoirs. The effects of global warming and climatic change require multi-disciplinary research, especially when considering hydrology and global water resources "the Groundwater Resources". The Overdrawn of due to extreme pumping/exploitation is one among several serious causes capable to cause many serious problems in earth systems. The overpumping of large quantities of groundwater (e.g. for irrigation and water draining purposes) is very possible to produce ground subsidence, as the phenomenon which usually gets worse as groundwater pumping continues. The consequences of such phenomena may be dangerous, especially in the farmland when the ground subsidence becomes not smoothly distributed in the problematic area. The increase in the use of groundwater for agricultural and industrial expansion accompanied with successive droughts has greatly lowered the groundwater level in this area. This has resulted in farmland subsidence and increase sinkhole occurrence.

The main targets of this research are;

- to investigate the drought and climate change and its impact on the high declination of the groundwater level, and
- to evaluate the occurrences of land subsidences and sinkhole collapses in different depths, due to overpumping of groundwater in Konya Karapınar plain site, the Central Anatolian part of Turkey.
- to investigate the formation of different karstic structures in the reseach area, and identify the mechanism of these structures
- and finally, to explain the occurrence of these geological hazards and the main triggering factors, that play an important role in the development of land subsidence and sinkhole formation in these farmlands.

Thus, to realize these objectives; detail hydrogeological, geotechnical and Geoelectric field studies were carried out during the field researches. Konya plain in Central Anatolia features various unique karstic formations from different ages. The most peculiar of these formations are the sinkholes/obruks, which are mainly found in the lacustrine limestone of Neogene age. The unconfined groundwater in the region outcrops in the form of sinkhole/obruk lakes. The Neogene formation is more porous because of cavities, and the nature of the basement is due to karst conduits. The main factors included the presence of fine-grained materials (for land subsidence) and karstic limestone bedrock (for sinkhole formation), the increase of effective stress, and generation of turbulent groundwater flow in the soil-bedrock interface.

Keywords: Drought, Climate changes, Groundwater overpumping, Geohazards, Sinkholes

INTRODUCTION

The most serious problems related to the drought, climate changes (global warming) that may cause changes in the landscape in earth system as result of excessive groundwater pumping (also called aquifer overdraft) are; Subsidence in farmland, High pumping costs, High depletion of surface and groundwater levels, and Degraded water quality. Ground subsidence can be defined as the vertical downwards-small movements of the ground. Several physical causes (like earthquakes, tectonic movements, underground cavities etc.) and human activities as well, can produce ground subsidence (Hu et al., 2004).

Many geologic events that are hazardous to man generally occur suddenly and are restricted to particular (geotectonic) environments in such urban areas (Delle Rosa et al. 2004). Two most contrasting types of ground Subsidence are taken place in the research site, Konya Karapınar region (Ustun et. al, 2010). One is the funnel-shaped solution/subsidence doline, looks like a funnel of depleted groundwater level. Here, a cone depression is produced in the perched water table as downward flow rates in the enlarged fractures exceed that of the surrounding area.

These type of subsidences (dolines/collapses) are surface forms in nonsoluble rocks, caused by overpumping rates in farmlands and/or the solution of buried karst near the surface (Bloom, 1998). The other type of ground subsidence is the steep or cliffed doline collapses. Most of these sinkholes are a combination of the solutional and collapse types. Collapse sinkholes are depressions, that are initiated by the solution of occurs at great depths beneath the surface. The expansion of caverns, caused by corrosion and reduction of support may lead to collapse by decreasing the support of the overlying rock material (Kochel and others, 1995).

The present paper illustrates a case study for the formation of subsidence/sinkholes in the farmlands due to excessive groundwater pumping and deep karstification in Konya Karapınar region, Central Anatolian Part of Turkey. Konya plain in Central Anatolia features various unique karstic formations from different ages (Ustun et. al, 2010). The most peculiar of these formations are the obruks, which are mainly found in the lacustrine limestone of Neogene age.

The unconfined groundwater in the region outcrops in the form of obruk lakes. The Neogene formations at the upper part and the basement limestones are hydraulically linked. The Neogene formation is more porous because of cavities, and the nature of the basement is due to karst conduits. The obruks have been formed by the combined effects of the carbonates, structures, karstification, and the tectonic history of the area (Hung et. Al., 2002).

However, these type of sinkholes so far may be defined as relict karstic landforms. Therefore, during the present research, detail hydrogeological (geological, stratigraphical, groundwater levels) and remote sensing GIS-based analysis geophysical studies were carried out to identify the mechanism and the development steps of the above-mentioned land subsidences.

The geoelectric and remote sensing based analysis-GIS methods, that were applied for investigating such karstic structures, showed that there is a fine-grained, clay-density and low-resistivity unit up to 20-40 m deep from the surface. The impedance of this unit is less than 15ohm m. The anomalies of about 5-10m in diameter, which may be important in terms of karstic cavern formations, that were found at about 200 and 350 meters depths.

1. BACKGROUND / PRINCIPLES OF COLLAPSES FORMATION

In this research, two types of ground subsidences has been illustrated. The mechanism of the first formation, doline collapse is entirely occurred due to the extreme groundwater, overpumping in farmlands, where the hydrostatic pressures are reduced, resulting in sedimentation due to load losses in the upper strata. Whereas, the second type of these ground subsidences is the collapse sinkholes, which are karstic depressions initiated by solution occurs at great depths beneath the surface. The relation between changes in pore fluid pressure and compression of the aquifer system is based on the principle of effective stress as (Ralph, 1983),

$$d\sigma T = dP + d\sigma_E \qquad (1)$$

where dσT is the change in total stress, dσT is the effective or intergranular stress, and dP is the change in pore fluid pressure (Figure 1).

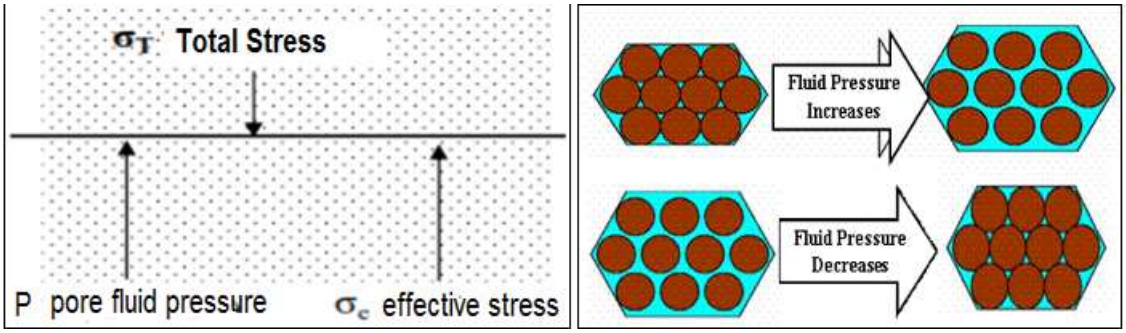


Figure 1. Balance of ground Pressure (Ralph, 1983)

Under this principle, when the total stress remains constant, a change in pore fluid pressure causes an equivalent change in effective stress within the aquifer system, which causes the aquifer system skeleton to compress or expand under the new load. When the effective stress is decreased by an increase in pore fluid pressure, the aquifer system expands elastically, especially in the cone depression zone.

When the effective stress is increased by a reduction in pore fluid pressure and the effective stress does not exceed the maximum past effective stress, the aquifer system compresses elastically. When a reduction in pore fluid pressure causes an increase in effective stress to values greater than the previous maximum effective stress, the pore structure of the fine-grained aquitards in the system undergoes significant rearrangement, resulting in a permanent reduction of pore volume and compaction of the aquitards. This process can be quantified in terms of two compressibilities, one elastic and one inelastic, each of which can be applied to the aquifer system if the stratigraphy is well defined.

This type of groundwater depletion may cause shallow (25meters to 30meters) type of doline subsidence or a cone depression. The impacts of groundwater depletion are many and varied. The first and most direct impact is the loss of baseflow. Shallow groundwaters flow nearly horizontally, in the direction of the closest depression in the Earth's crust, usually towards a stream or river draining a valley. Any shallow groundwater extracted through pumping is water that does not reach the surface waters in the vicinity (Figure 2).

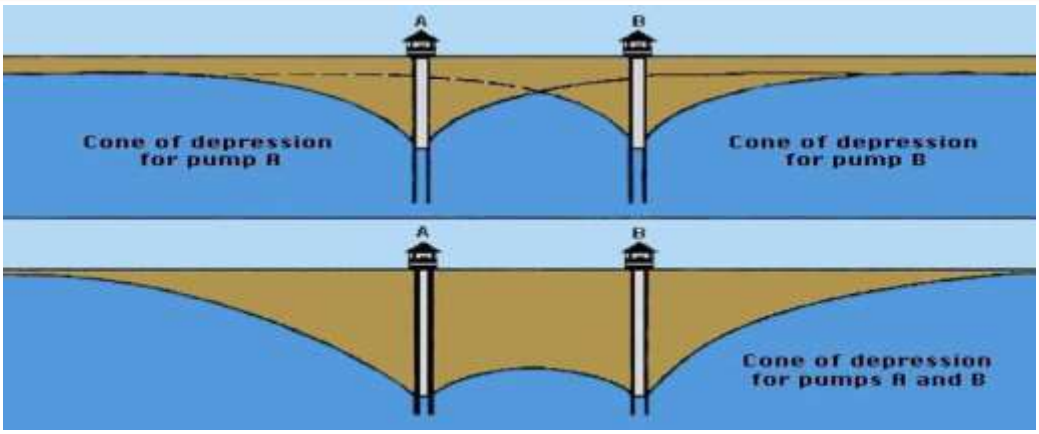


Figure 2. Cone of depression, area of influence, and well interference.

The other type of ground subsidence is the steep or cliffed dissolution sinkholes/collapses. Here, most of these types of sinkholes are a combination of the solutional and collapse types. It causes the collapse of the ground due to the solution of soluble rocks at great depths beneath the surface. They are natural depressions (or holes) in the Earth's surface, usually caused by karst processes. Karst processes occur when the bedrocks are soluble, in other words, in 99% of all cases, in carbonate rocks (like limestone or dolomite) or evaporitic rocks (like gypsum or anhydrite). So, while they can occur in other environments.

The expansion of caverns, caused by corrosion and reduction of support may lead to collapse by decreasing the support of the overlying rock material (Kochel and others, 1995). This type of ground subsidence can range from gentle Cylinder-shaped depressions forming over a period of time (dolines) to sudden and catastrophic collapses (deep sinkholes) that may occur without warning. Dissolution of soluble rocks can cause subsidence of ground, buildings and roads plus damage to services such as water, gas and drainage (Figure 3).

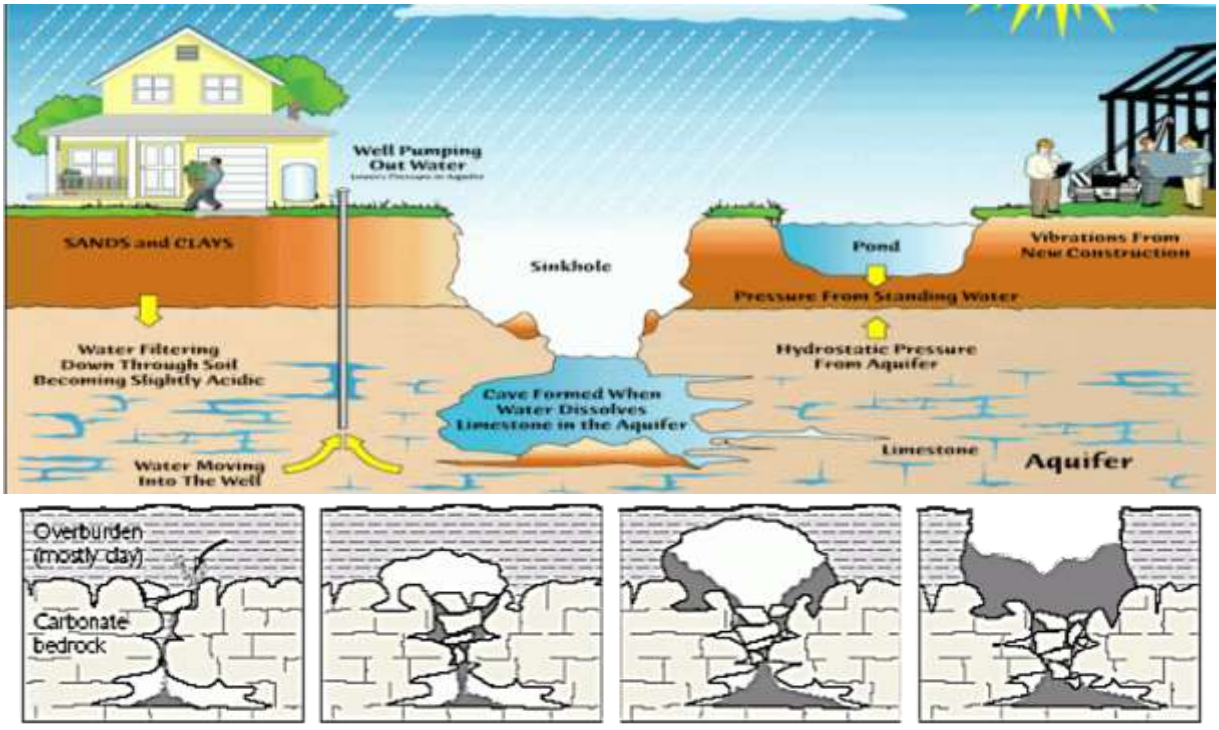


Figure 3. Possible mechanism for sinkhole formation
(http://ga.water.usgs.gov/edu/sinkholes.html

Thus, hazards associated with such karstic ground collapses have a great influence on the planning, development and construction. Planning in these areas requires an understanding of the characteristics of the karst and the likelihood of subsidence, which limits the land that can be developed or requires the use of appropriate designs. Therefore, knowledge of the mechanism of formation of these geological hazards and their likely evolution is necessary for planners and also decision makers to inform the most appropriate land-use and development. Consequently, prior to development and construction, a geohazard assessment including land subsidence and sinkholes occurrence is necessary to determine its overall suitability for development.

2. CASE STUDY: FORMATION OF SINKHOLES IN KONYA KARAPINAR AREA, CENTER ANATOLIAN PART OF TURKEY

2.1. Definition of The Study Area

The study area is located at Konya Karapınar region, in the central Anatolian part of Turkey. Konya Closed Basin, that covers about 55.000 km2 has an important position in view of the agricultural and industrial production of Turkey. The basin is on the threshold of a great hazard ecologically and environmentally because of the decline of its groundwater. The decline resulted by global warming, rising of the population, the over and misuse of and other environmental factors directly affect the future of people and other species living in the region. Konya plain in Central Anatolia features various unique karstic formations from different ages. The most peculiar of these formations are the sinkholes/obruks, which are mainly found in the lacustrine limestone of Neogene age. The unconfined groundwater in the region outcrops in the form of obruk lakes. The Neogene formations, which are located at the upper part of the basement limestones are hydraulically linked. The Neogene formation is more porous because of cavities, and the nature of the basement is due to karst conduits. The obruks have been formed by the combined effects of the carbonates, structures, karstification, and the tectonic history of the area. The northwestern part of Karapınar plain site has wide spread distribution of many shallow and deep ground subsidences. This region is called as “Obruk/Sinkhole Plateau” (Figure 4).

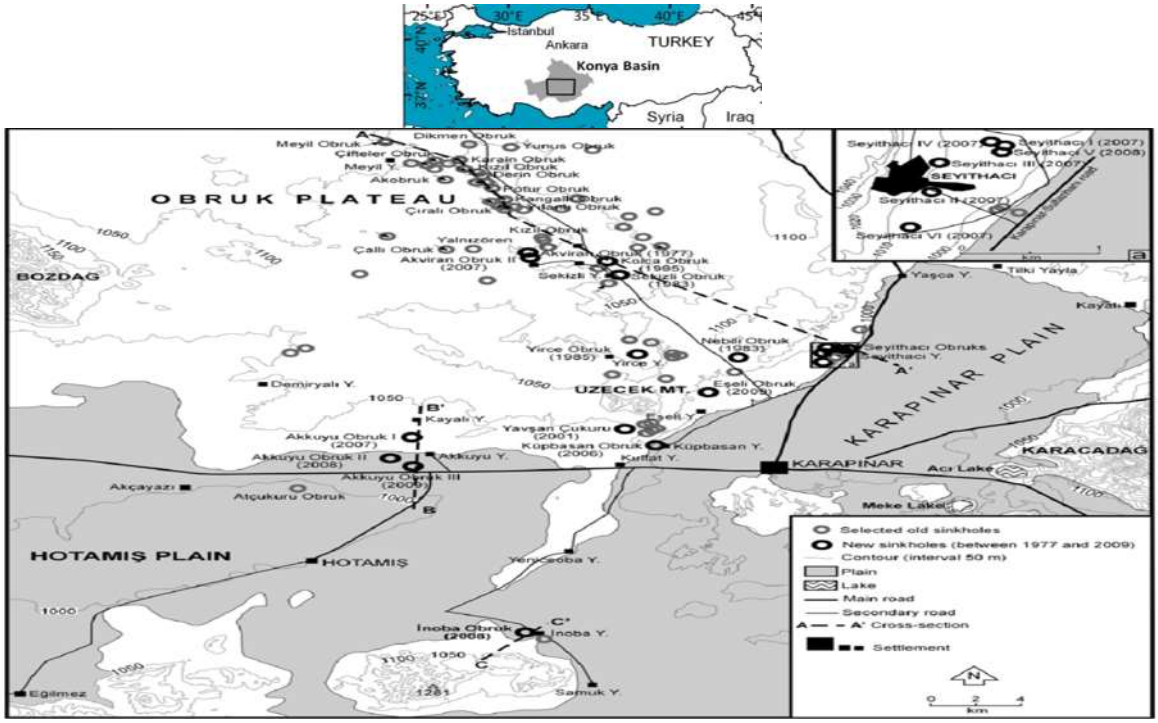


Figure 4. Location map of the study area.

"Obruk" as a term is the name that is used to refer to the cylindrical sinkholes in Konya plain in Central Anatolia. Some of these are larger formations and are therefore referred to as "Obruk Lakes," such as those in Kızoren, Cıralı and Meyil Obruks. Kızoren Obruk is located at Kızoren village. The main formations are Paleozoic limestone Neogene aged lake deposits (Photo 1).



Photo 1. Kızören Obruk in different periods.

Çıralı Obruk is located at the Karapınar province, Northwestern part of Yenikent village (Photo 2).



Photo 2. Çıralı Obruk in different periods.

2.2. Types of Sinkholes/Obruks in Karapınar Plain

According to field measurements that were carried out in 2017, there are two groups of obruks; the "Old Obruks-Wide Dolines", characterized by large dimensions (approximately up to 500 m wide), and here the groundwater depletion may cause shallow (35-50m) type of doline subsidence or a cone depression (Photo 3A). Whereas, the "Young-Recent" obruks that have been formed during the recent decades, with diameters of less than 50meters to 60 meters (Photo 3B). These type of ground collapses are caused by the dissolution of soluble rocks at great depths beneath the surface. Then, natural cylinder-shaped depressions (or holes) may take place on the Earth surface. Usually, they may be caused by heavy karstification processes at great depths.

The "old" obruks are concentrated in the Obruk Plateau, a horst slightly higher than the surrounding grabens formed by the Konya plain and the Tuz Lake basin. These "old" obruks can be classified as bedrock collapse sinkholes (Photo 3). On the other hand, most of the "Young-Recent" obruks can be classified as cover collapse sinkholes and their formation is associated with the human-induced groundwater withdrawal during overpumping from farmlands.



Photo 3. (**A**) Old Obruk and (**B**) Young – Recent Obruk/Sinkholes (Yarımoğlu Obruk)

The "Young-Recent" obruks have caused social alarm in the Karapınar Obruk Plateau. Indeed, 30 collapse sinkholes with 35meters to 50meters in diameter and 35meters to 85meters in depth, occurred during the period between 2010 and 2017. These sinkoles are especially concentrated in and around the Seyithacı Village. According to the occurrence of these sinkholes, we can expect future sudden collapses if the water lowering trend will continue. Future sinkholes could damage buildings and infrastructures in the study area and represent a hazard for the local population (Photo 4).



Photo 4. Young Obruk/sinkholes near the Seyithaci and Kizoren Village.

3. METHODOLOGY

The analysis of geological, geophysical, hydrogeological data and the groundwater chemical and isotopic compositions indicate a hypogenic origin for these large recent/young sinkholes/obruks, where, there were no previous evidence of this sudden subsidence activity. However, these type of sinkholes so far may be defined as relict karstic landforms. Therefore, detail hydrogeological (geological, stratigraphical, groundwater levels) and geophysical studies were investigated to find out the mechanism and the development steps of the above-mentioned land subsidences.

3.1. Geological, Stratigraphical, Hydrogeological, and Groundwater Level Data

3.1.1. Geological, Stratigraphical and Hydrogeological Settings

The local basement of the mountains, which surround the Konya plain, consists of schists, phyllites, quartzites, crystallized limestones, as well as of penecontemporaneous volcanic with fresh physiographic features and magmatic rocks. On top of these layers, basal conglomerate and the partly recrystallized and noticeably fractured Bozdağ limestone with colors ranging from light to dark gray overlie the plain, respectively.

The limestone formation was dated to the Permian age with the help of some fossils. The Bozdağ limestone overlaps a thick sequence of light-colored, compact, solid and Jurassic-Cretaceous-aged limestone, which can also be seen along the Taurus mountain range in the South (Dogan, et. al, 2011). This plain also features an extensively-exposed Cretaceous ophiolitic system and thick Tertiary formations. In the east, there are distinguishable sedimentary basins of the Paleocene, Eocene and Oligocene ages, as well as lacustrine deposits of the Miocene and Pliocene ages, which cover large areas in the plain.

From the geomorphological point of view, the land scape of the study area is conditioned by several active processes: volcanism, water and wind erosion, and rock dissolution. Among these, water erosion and dissolution-induced subsidence are the most widespread phenomena in the study area, while aeolian processes are effective in relatively local sectors of the Konya basin. The dissolution-induced subsidence is represented by the karst depressions called ‘sinkholes’. Sinkholes are common geomorphologic features in the study area (Figure 5).

This Figure shows the formation and spatial distribution of sinkholes, which are closely related to the lacustrine Insuyu Formation and the aquifer in this formation. According to this stratigraphic column, the Insuyu Formation was formed as a result of an extension regime during Upper Miocene–Pliocene ages (Koçyigit, 2005). This formation consists of thick limestone in the upper section, limestone, marl, clay, tuff and silt intercalations in the lower section.

The thickness of fractured lacustrine limestone, suitable for karstification has been documented by boreholes to be over 200m. Limestone, marl and clay intercalations are commonly observed in the boreholes in the Obruk Plateau.

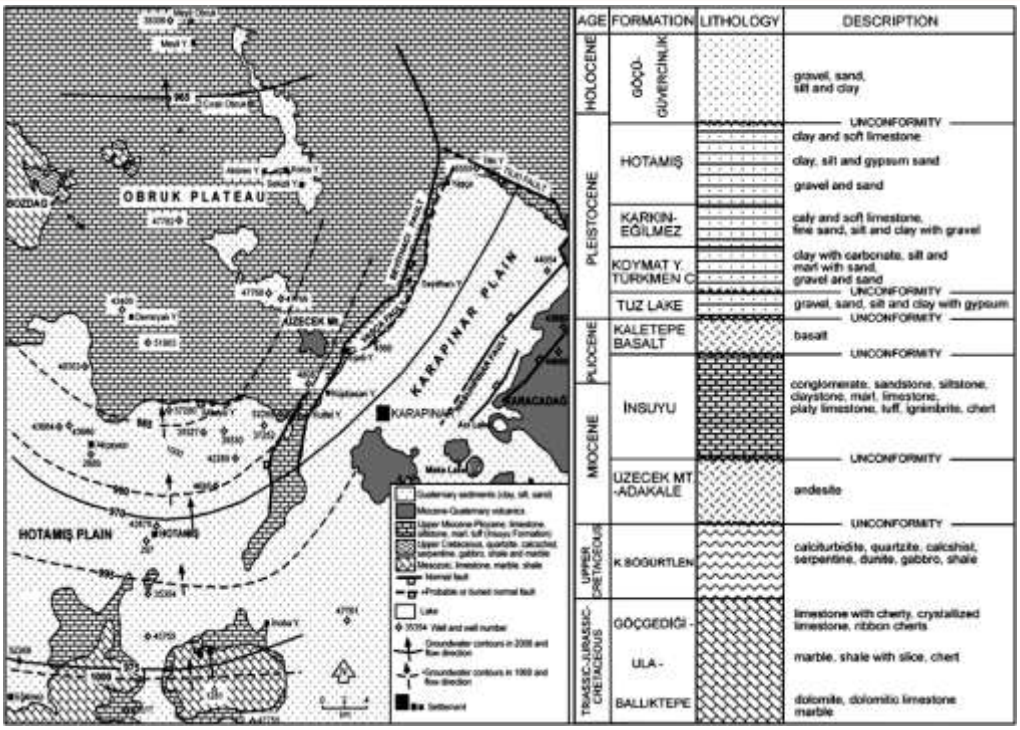


Figure. 5. Simplified Geological and Geomorphological Map and of Stratigraphic Column of The Study Area (Dogan, et. al, 2011)

At the base of the Insuyu Formation, there is the Upper Cretaceous Karaböğürtlen Formation consisting of calciturbidite, quartzite, serpentine, dunite, gabbro, shale and marble. The Karaböğürtlen Formation overlies Mesozoic formations. These Mesozoic formations consist of limestone, dolomite, marble and shale which are exposed in the study area. Sedimentation in the Insuyu Formation came to end with the last compression that caused sediments deformation.

The western side of the Karapinar Graben, forming a part of Konya Graben, is bordered by the Seyithaci Fault, extending in an NE–SW direction. Here, the main groundwater flow direction (recharge) is from the southeastern part of the basin to the northwest, where most of the discharge points are located at the northern part of the study area. This is also confirmed by the groundwater contours around Karapinar in the periods 1968–2008 (see Figure 5). In particular, Seyithaci fault system in the Seyithaci Village is a dynamic process delimiting the Obruk plateau from the plain at the north of Karapinar district.

The fault has a vertical component character and follows a highly linear form between the floors of plateau and plain. The fault system is defined as active and is known to establish a surface rupture during Holocene, and has an important effect in the devolvement of Karapınar plain and in the formation of sinkholes because the karstification of the bedrock may be developed through fault structures. Using the Geographical Information System (GIS), the locations of the borehole and old and young current sinkholes, which are located on different fault systems and ongoing karstification zone in the Karapınar region, were evaluated in Figure 6.

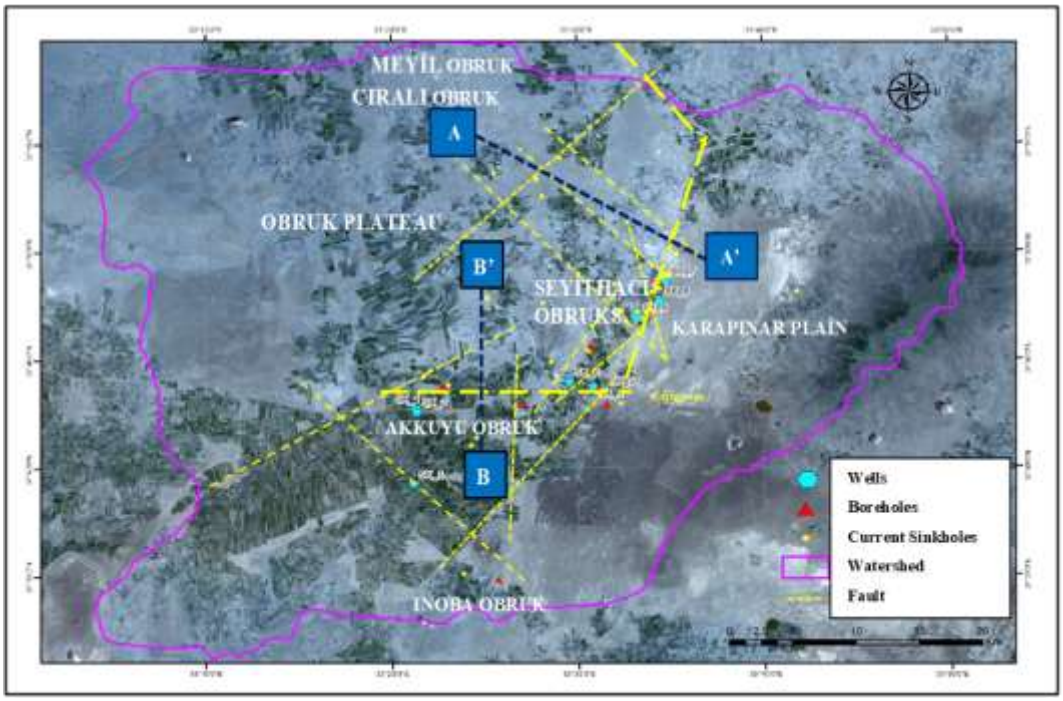


Figure. 6. The locations of borehole, the old and young sinkholes, and the fault systems.

The borehole data indicate that the Quaternary sediments are 30–40 m thick near the edges of Karapinar-Hotamis Plain, increasing to be more than 100 m thick in the central areas of the plain in accordance with tectonic subsidence. The Karapinar Hotamis Plain is one of the sub-sections of the Konya Plain. Insuyu Formation remains high between the Quaternary sediments in the south and north because of the above-mentioned tectonic movement. Most of the wells existed in the study area located nearby the Young/Current deep Obruk region (see Figure 5).

The field measurement, well log data and lineament map of the study area showed that most of the boreholes, which were drilled in the Hotamış and Karapınar plains (just cutting limestone unit) represent points of Old/Shallow obruks, which are characterized by large dimensions (approximately up to 500 meters wide), and here the groundwater depletion caused the formation of old/shallow types of doline subsidences or a cone depressions with depths change between 30meters and 50meters (see Photo 3A).

The field measurements showed that all of these old and shallow sinkholes were formed in the surfaced and consolidated limestone units. Whereas, the boreholes (wells), which are located at the extension of Seyithacı and Akkuyu fault systems within the Obruk Plateau (North and Northeastern Part) represent points of deep Young/Recent Obruks series with 35 meters to 50 meters in diameters and 30 to 85m in depth (see Photo 3B).

The obruks were formed recently due to the dissolution of carbonate, marl and evaporite units beneath the siltsone, claystone and sandstone units in the surface. These natural cylinder-shaped depressions (or holes) may take place on the Earth surface due to the heavy karstification processes and caverns formation at great depths.

3.1.2. Groundwater Level Data

According to Bayari et al. (2009b), there are two main, largely independent, aquifers within the Konya Closed Basin (KCB), which are separated by a Paleogene aquitard. The lower aquifer consists of Paleozoic– Mesozoic rocks.

The upper aquifer is part of the Insuyu Formation, in which limestone controls the formation and the areal distribution of sinkholes. The Insuyu Formation aquifer contains CaHCO3 groundwater, and 10–70 lt/s water could be pumped from deep wells of 50 meters to 250 meters in depth opened to this aquifer. In recent years, a significant decline (45meters to 50meters) has occurred in the groundwater table throughout the KCB because of increasing aridity and excessive pumping from deep wells (Bayari et al, 2009b). The locations of the boreholes, the old and young sinkholes, the fault systems and the hydrogeological cross-sections were given Figure 6.

Comparison of the changes groundwater levels from 1970 to 2008 showed that the groundwater table declined about 25-30m in the last 38 years. The data set obtained from the Eğilmez well (well No. 52268) in the Hotamis Plain, in the southeast part of the study area indicates that the groundwater table fell 15-35m during the 38 years between 1970 and 2008. In fact, long-term data for groundwater level obtained from wells show that this water table decline occurred over a much shorter time (last 10 years). According to this data, no significant change occurred in groundwater level between 1970 and 1994, with the exception of minor climatic fluctuations of a few meters (4-5m maximum). However, from 1994 onwards, a declining trend started to be seen in the groundwater table, which level is -17.4 meters in 1994 and dropped to -33,5 meters in 2008 (Figure 7A).

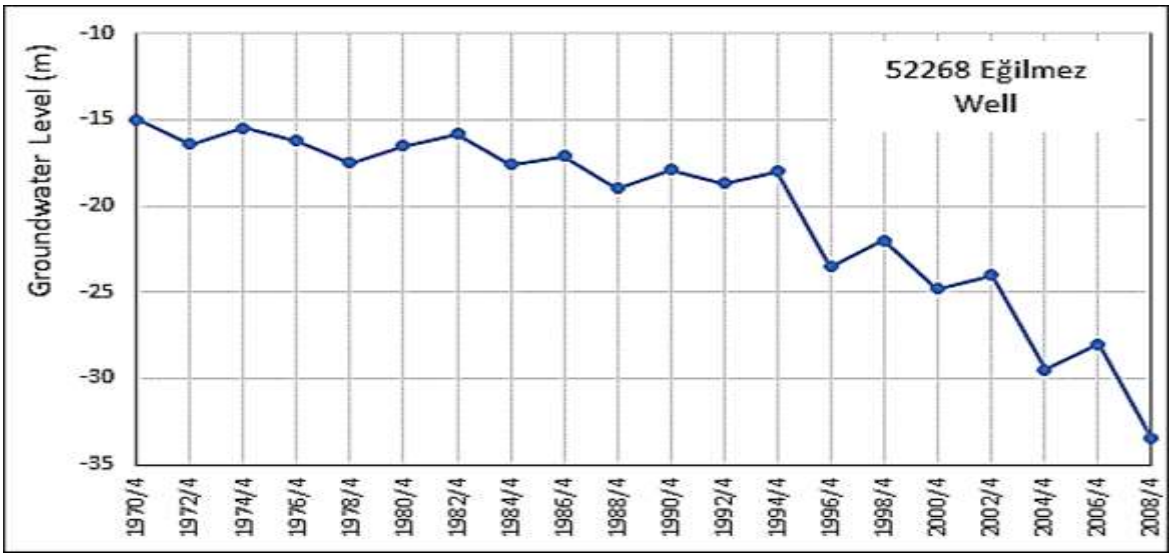


Figure. 7A. Long-term groundwater level changes around Karapinar: Eğilmez well (No. 52268). Well location is given in Figure 5.

This period coincided with the intensive formation of many "Old Obruks", characterized by large dimensions (approximately 500m wide), where the groundwater depletion caused shallow (30-35m) types of doline subsidences or cone-shaped depressions (See Photo 3A). In the study area, there are many irrigation wells are concentrated in Karapınar and Hotamış plains.
Therefore, it was possible to observe the stress in the groundwater level in the Obruk Plateau (Doğdu, 2007; Göçmez, 2008a, 2008b). Especially, in Yenikent (well no 38036), there is a measurement value between 2008 and 2016. The measuring well is located nearby the Meyil Obruk, in the northern part of the study area (see Figure 5). Here, the groundwater level measurement showed that, at the beginning of 2008, the groundwater level was -33,5 meters, whereas, it decreased to -55,6m in April 2014. During the last 3 years, the groundwater level decreased to 82,6m (Figure 7B).

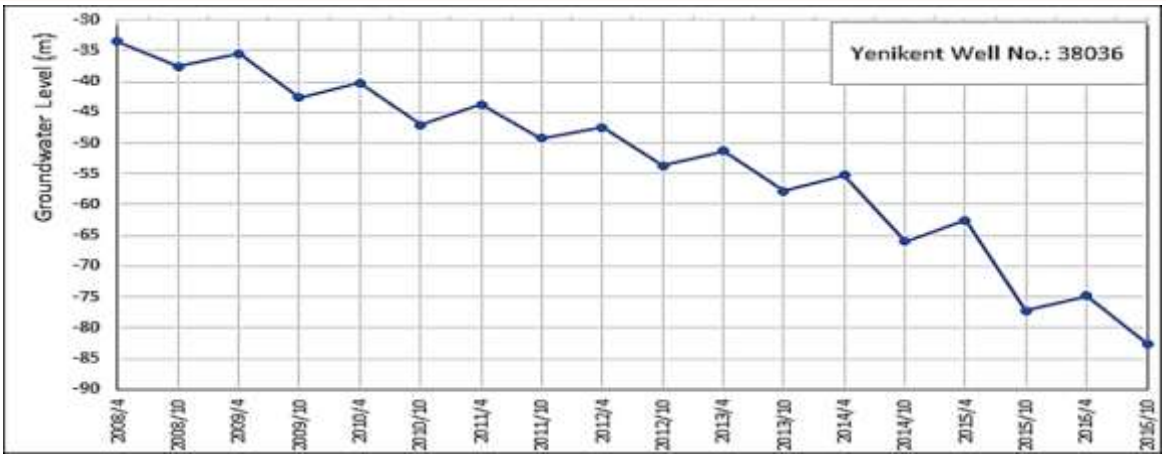


Figure. 7B. Long-term groundwater level changes around Karapinar: Yenikent well (No. 38036). Well location is given in Figure 5.

The groundwater levels were similar in both, the Karapınar plain as well as the Obruk Plateau, where the groundwater is dramatically decreased more than 50 meters. The last 10 years period coincided with the intensive formation of many "Young/Recent Obruks" with diameters changes between 30 meters and 60 meters (see Photo 3B). These type of ground collapses are caused by dissolution of soluble rocks during the groundwater flows at great depths beneath the surface through out the Insuyu formation, which consists of limestone, conglomerate, sandstone, marl, tuff, gypsum, and evaporitic sediments. Thus, natural cylinder-shaped depressions (or sinkholes) occurred during the deformation of the Earth's surface (Figure 8).

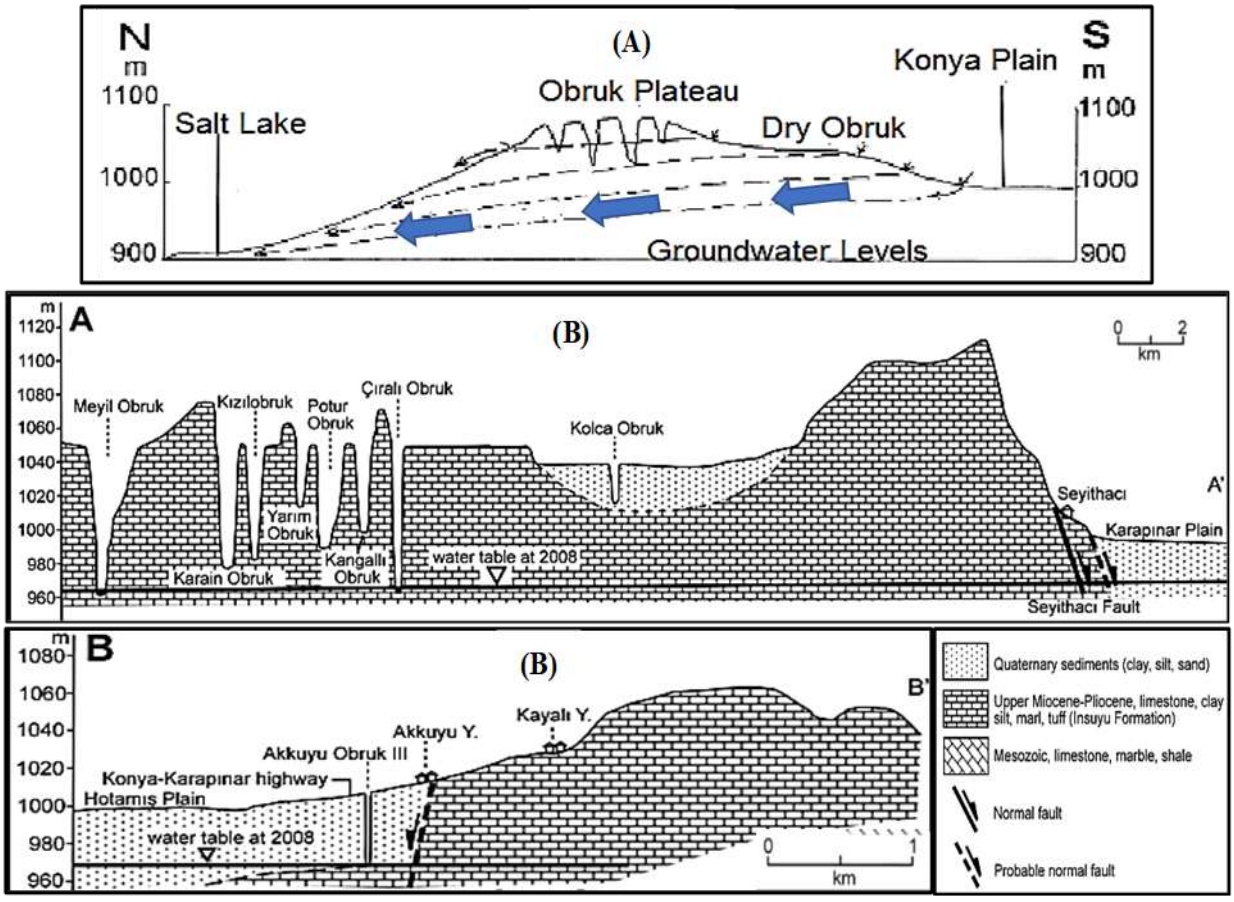


Figure 8. (A) General deep groundwater flow system from Konya plain to the Salt Lake, (B) Cross-section A-A' and B-B' (Dogan, et. al, 2011) (see Fig.6).

Moreover, the Seyithaci Fault (see Figure 6), which extends in the NE–SW direction controls the main groundwater flow direction in this part of the study area. Here, the main groundwater flow direction (recharge) is from southwest to the northeastern part of the basin, where most of the discharge points are located at the northern part of the study area (Figure 9).

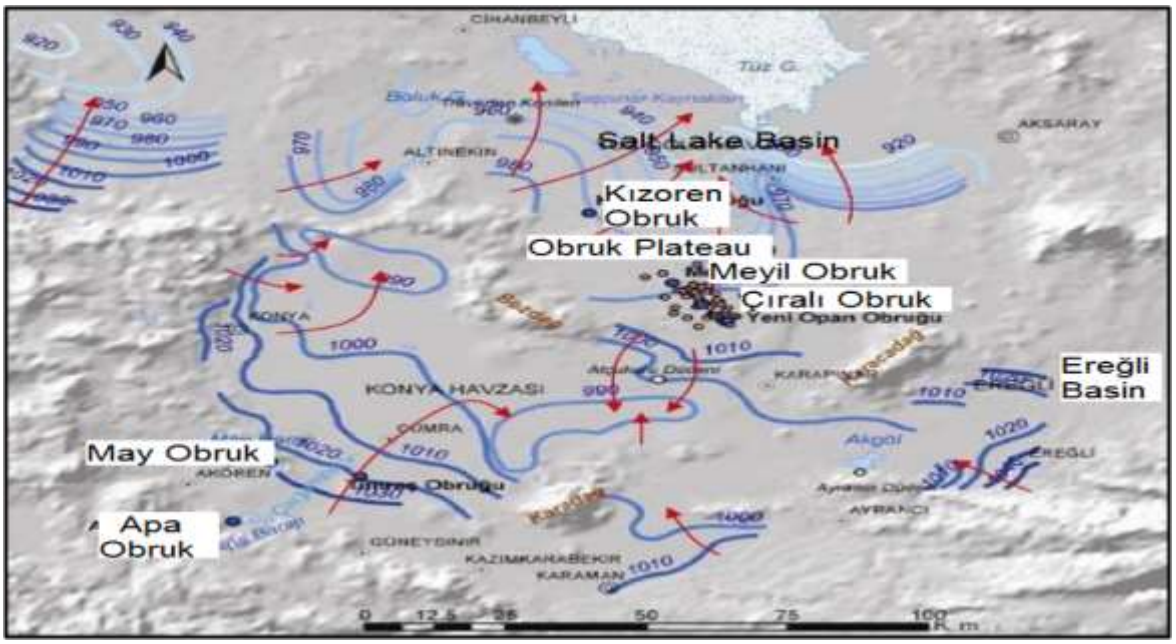


Figure. 9. Groundwater flow direction in Konya-Karapınar Basin
(Adapted from Pekkan, 2004)

3.1.3. Geophysical/Geoelectric Methods

The geoelectric method was applied in the field during geophysical field studies. Geoelectric and Remote sensing based analysis-GIS methods are the most commonly used methods for investigating the karstic structures (Hung, et. al, 2002). Direct current resistivity method was applied in geoelectric methods. The resistivity method is a method to determine the electrical resistivities of the geological units and to illuminate the physical properties of the ground. In this study, 11 different potential electrons were used to obtain measurements with the pol-dipole array at 20 levels with two different current electrons (Tork et. al, 2017).

By using the Res2dinv program of the generated profiles, the two-dimensional (2D) solution. As an inverse solution, the anomalies, which are thought to be related to the development of karstic structures have been identified. The dimensions and depths of the Anomalies change nearby the sinkhole area. It should be taken into consideration that the anomaly areas may be dangerous.

- ***Seyitacı Region:***The geoelectric method was carried out in Seyithacı plateau, approximately 10 km north of the Karapınar district. The tests were carried out and the measurements were made in new different profiles crossing the Seyithacı Fault zone. The plateau is quite an active area in terms of karstic formations. The main idea of the tests is to determine the places where there may be a risk in terms of subsidence/sinkhole formations. Thus, a total of 30km profile scrolling measurements were carried out on 10 areas with a profile length of 500 meters in an area of approximately 2 km² (Figure 10).

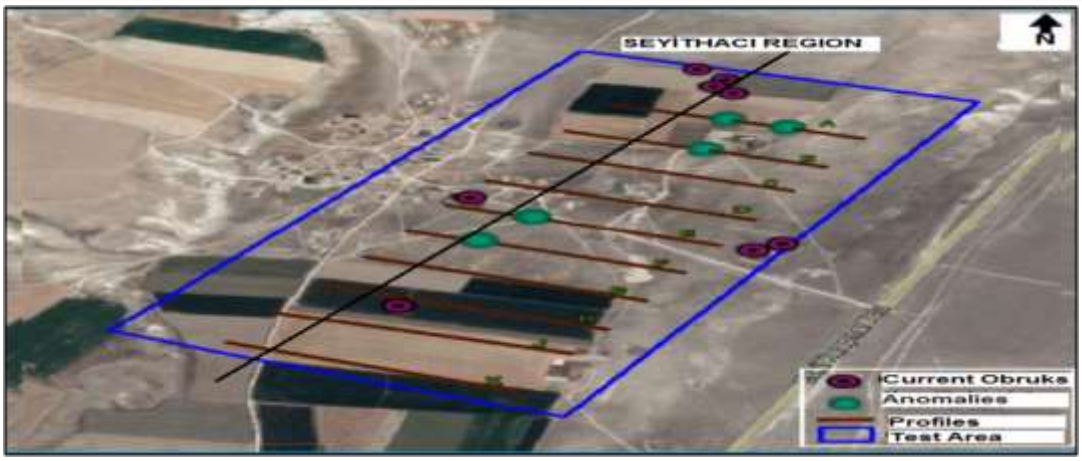


Figure. 10. The geoelectric Profile and Anomalies in Seyithacı region.

A profile: Generally, there is a fine-grained, clay-density and low-resistivity unit up to 20 m deep from the surface. The impedance of this unit is less than 15-ohm m. There are coarse grained units up to 90 m deep from this level. Anomalies of about 5meters to 10meters in diameter, which may be important in terms of karstic cavern formations, were found at about 200meters and 350 meters (Figure 11A).

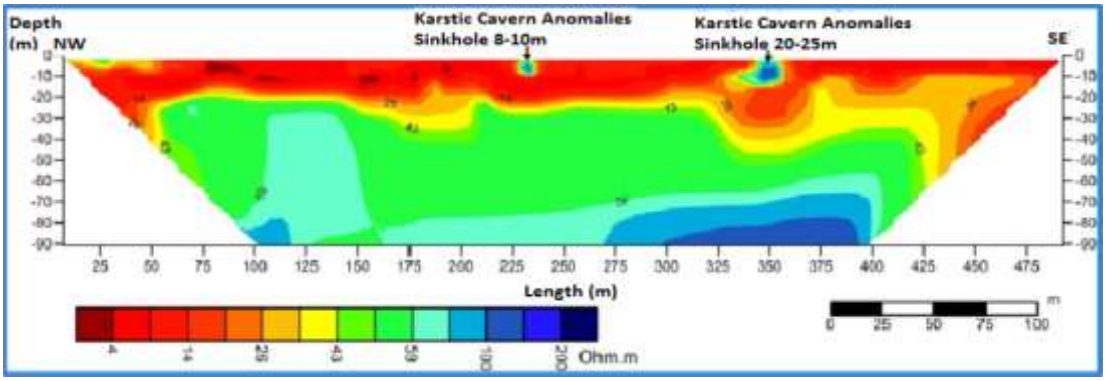


Figure. 11A. A profile 2D cross section

B profile: Karstic cavern anomaly was detected at about at about 15meters and 20meters in depth, where the deep karstification is taken place at 250meters to 270meters in depth (Figure 11B).

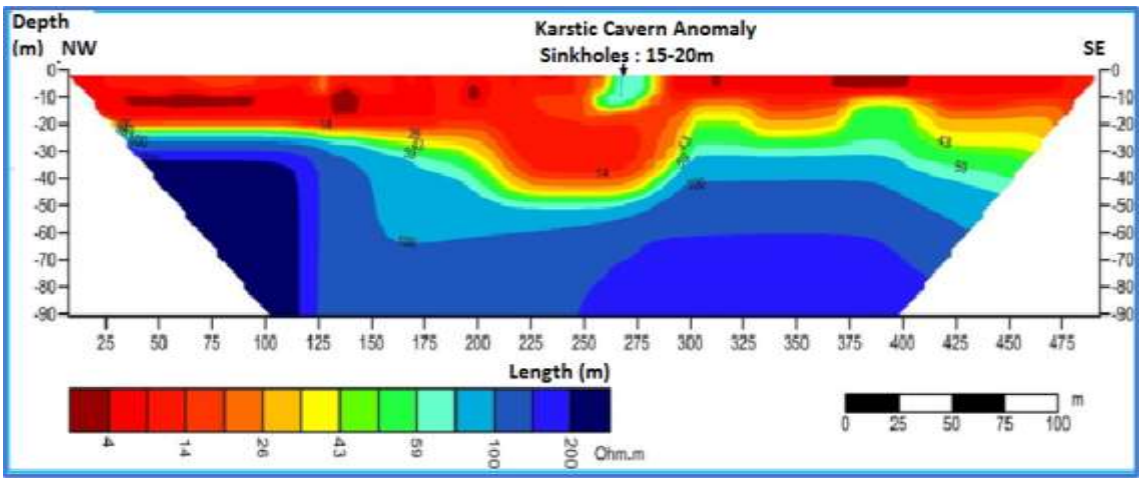


Figure. 11B. B profile 2D cross section

E profile: There is karstic cavern anomaly at 155m. This anomaly is located about 10m depth with 10m in diameter (Figure 11C).

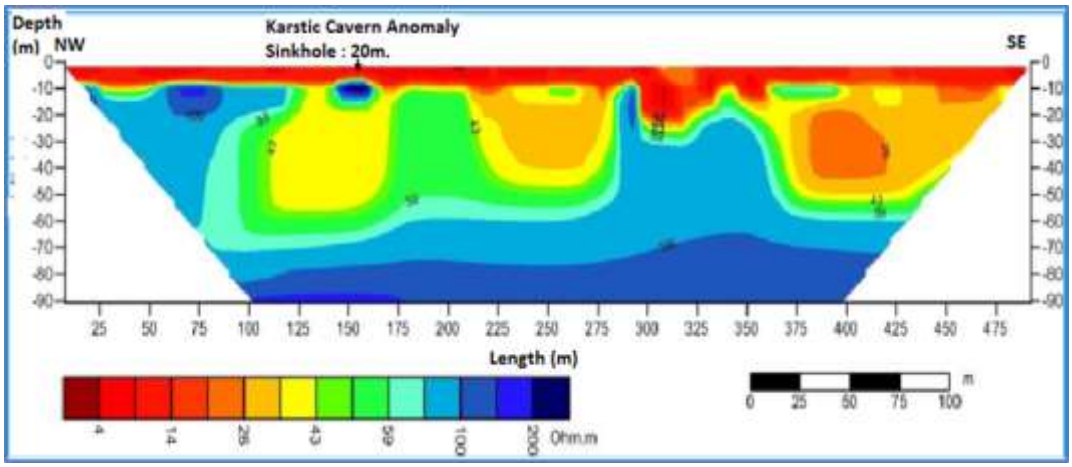


Figure. 11C. E profile 2D cross section

4. RESULTS AND CONCLUSIONS

Konya Closed Basin that covers about 55 000 km2 has an important position in view of the agricultural and industrial production of Turkey. The basin is on the threshold of a great hazard ecologically and environmentally because of the decline of its groundwater. The decline resulted by global warming, rising of the population, the over and misuse of groundwater and other environmental factors directly affect the future of people and other species living in the region. Hence, it needs an urgent cooperation of all disciplines concerning the earth sciences in sense putting the studies rapidly on the management of surface and ground waters and reducing the negative consequences. Thus, during the last decades, land subsidences and a number of cover-collapse and subsidence sinkholes have been recognized in Konya/Karapınar central plain.

In this study, the variability of groundwater levels using the observed time series in the wells scattered into Konya Closed Basin is presented and the unfavorable outcomes in the future are estimated by means of hydrogeological findings and other parameters. According to the borehole data, the study area is characterized by the differences of thickness of alluvial and soil deposits varying from 20 to 100m that overlie karstic bedrock.

The Insuyu Formation, which was formed as a result of an extension regime during Upper Miocene–Pliocene ages consists of thick limestone unit in the upper section, and limestone, marl, clay, tuff and silt intercalations in the lower section. The thickness of fractured in this lacustrine limestones was suitable for cavern formation and karstification process, that has been documented by boreholes to be over 200 meters.

Limestone, marl, and clay intercalations are commonly observed in the boreholes in the Obruk Plateau. Thus, the Insuyu Formation is a limestone prone to karstification as shown by sinkholes and caves. Typically it has high porosity, high purity with a high specific solution rate constant for a limestone. Cover-collapse sinkholes generally formed suddenly after penetration of deep wells into karstified limestone bedrock. Depending on the consequences of the data, it is expected that a surface deformation in Konya Karapınar plain site took place/occurred as two different land subsidences.

The first type is the land subsidence“Old Obruks-Wide Dolines”, which characterized by large dimensions (approximately up to 500m wide), where the groundwater depletion may cause shallow (35meters to 50meters in depth) type of doline subsidence or a cone depression. Whereas, the second type is the “Young-Recent” obruks, that have been formed during the recent decades, with diameters of about 50-60m and 50-85m in depth. These type of ground collapses are caused by continuous dissolution of soluble rocks at great depths beneath the surface. Then, natural cylinder-shaped depressions (or holes) may take place on the Earth’s surface. Usually, they may be caused by heavy karstification processes at great depths.

The interpretation of the hydrogeological and geotechnical studies identified three triggering factors that control the development of sinkholes. These factors are the presence of karstic bedrock, lowering of ground water table and generation of turbulent flow at the soil-bedrock interface. The geoelectric methods, that were carried out in Seyithacı plateau in Konya Karapınar plain showed that the anomalies of the sinkholes/karstic cavern regions were detected at about 15-20m in depth. These cavern areas cause deep karstification at 250meters to 270meters in depth, which latter may cause sudden and deep land subsidences/Obruks in the near future.

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INDUSTRIAL POTENTIAL OF GELIBOLU IN A GRID-BASED ANALYSIS MODEL

Aylin ÇELİK TURAN
Çanakkale Onsekiz Mart University, Faculty of Architecture and Design, Departmant of Landscape Architecture, Çanakkale, Turkey
ORCID ID: 0000-0002-1672-1254

Dilan ATAÇ
Çanakkale Onsekiz Mart University, Faculty of Architecture and Design, Departmant of Landscape Architecture, Çanakkale, Turkey

Dicle YENİLMEZ
Çanakkale Onsekiz Mart University, Faculty of Architecture and Design, Departmant of Landscape Architecture, Çanakkale, Turkey

Şerife TÜRKEN
Çanakkale Onsekiz Mart University, Faculty of Architecture and Design, Departmant of Landscape Architecture, Çanakkale, Turkey

ABSTRACT

Due to its strategic location on the Dardanelles Strait, Gelibolu has historically been an important transportation, trade, and settlement center. With a population of approximately 44,000, the district is situated on a crucial transit corridor connecting the Marmara and Aegean regions. This geographical advantage is a decisive factor in Gelibolu's economic development. Its economy traditionally relies on agriculture, livestock farming, fishing, and tourism. Wheat, sunflower, canola, and rice production, along with vegetable farming, form the core components of the regional economic structure. Furthermore, Gelibolu's coastal settlement offers significant economic advantages in terms of aquaculture and fishing potential.

Although the industrial sector has a limited share in the district's economy, the nature of existing economic activities offers significant opportunities for value-added production based on industry. Fish canning facilities, shipbuilding and maintenance activities, timber processing businesses, and small-scale industrial establishments for agricultural products constitute the basic elements of the existing industrial infrastructure. There is particular potential for development in the fields of agriculture-based industry, food processing industry, seafood processing industry, and logistics services. Investments in transportation infrastructure and increased regional accessibility are among the important factors strengthening Gelibolu's investment attractiveness. The development of transportation networks around the Dardanelles Strait contributes to the district gaining a competitive advantage in terms of both raw material supply and the delivery of manufactured goods to markets. This situation creates an environment that can support the development of industries related to logistics, warehousing, food processing, and maritime activities.

Considering the historical, cultural, and natural heritage values of Gelibolu within the TR22 region, it is crucial that industrial development is planned in accordance with the principles of sustainable development. Using a Grid-Based Analysis Model in QGIS software, a Gelibolu Industrial Potential Map has been created, which can serve as a basis for Environmental Master Plan, taking into account factors such as slope, aspect, elevation, settlement, and transportation levels, as well as a compatibility conflict scoring matrix.

Keywords: Grid-based analysis, QGIS, Gallipoli, Sustainable Planning

GRİD TABANLI ANALİZ MODELİNDE GELİBOLU SANAYİ POTANSİYELİ

ÖZET

Gelibolu Çanakkale Boğazı üzerindeki stratejik konumu nedeniyle tarih boyunca önemli bir ulaşım, ticaret ve yerleşim merkezi olmuştur. Yaklaşık 44 bin nüfusa sahip olan ilçe, Marmara ve Ege bölgeleri arasında bağlantı sağlayan önemli bir geçiş koridoru üzerinde bulunmaktadır. Bu coğrafi avantaj, Gelibolu'nun ekonomik gelişiminde belirleyici bir unsur olarak öne çıkmaktadır. Ekonomisi geleneksel olarak tarım, hayvancılık, balıkçılık ve turizm faaliyetlerine dayanır. Özellikle buğday, ayçiçeği, kanola ve çeltik üretimiyle birlikte sebzecilik faaliyetleri bölgesel ekonomik yapının temel bileşenlerini oluşturur. Ayrıca Gelibolu'nun kıyı yerleşimi su ürünleri üretimi ve balıkçılık faaliyetleri potansiyeli ekonomik avantajlar sağlamaktadır.

Sanayi sektörü ilçe ekonomisinde sınırlı bir paya sahip olmakla birlikte, mevcut ekonomik faaliyetlerin niteliği sanayiye dayalı katma değer üretimi açısından önemli fırsatlar sunmaktadır. Balık konserve tesisleri, gemi yapım ve bakım faaliyetleri, kereste işleme işletmeleri ile tarımsal ürünlere yönelik küçük ölçekli sanayi kuruluşları, mevcut sanayi altyapısının temel unsurlarını oluşturur. Özellikle tarıma dayalı sanayi, gıda işleme sanayi, su ürünleri işleme sanayi ve lojistik hizmetleri alanlarında gelişim potansiyeline vardır. Bölgedeki ulaşım altyapısında gerçekleştirilen yatırımlar ve bölgesel ulaşılabilirliğin artması, Gelibolu'nun yatırım çekiciliğini güçlendiren önemli faktörler arasında yer alır. Çanakkale Boğazı çevresindeki ulaşım ağlarının gelişmesi, ilçenin hem hammadde temini hem de üretilen malların pazarlara ulaştırılması açısından rekabet avantajı elde etmesine katkı sağlamaktadır. Bu durum, özellikle lojistik, depolama, gıda işleme ve denizcilik faaliyetleriyle ilişkili sanayi kollarının gelişimini destekleyebilecek bir ortam oluşturmaktadır.

TR22 bölgesi kapsamında Gelibolu'nun sahip olduğu tarihi, kültürel ve doğal miras değerleri dikkate alındığında, sanayi gelişiminin sürdürülebilir kalkınma ilkeleri doğrultusunda planlanması önem arz eder. Eğim, bakı, yükseklik, yerleşim, ulaşım kademelenmeleri uygunluk çatışma puanlama matrisi QGIS programında Grid Tabanlı Analiz Modeli kullanılarak Çevre Düzeni Planlarına altlık oluşturabilecek Gelibolu Sanayi Potansiyeli Haritası oluşturulmuştur.

Anahtar Kelimeler: Grid tabanlı analiz, QGIS, Gelibolu, Sürdürülebilir Planlama

A HISTORICAL ANALYSIS OF UNIVERSITY–INDUSTRY COLLABORATION MODELS

Ahmet Faruk LEVENT
Marmara University, Ataturk Faculty of Education, Istanbul, TÜRKİYE
ORCID ID: 0000-0003-3429-6666

Esengül KANTEKİN
Marmara University, İstanbul, TÜRKİYE
ORCID ID: 0000-0003-2553-0502

Şule ÇALIŞKAN ELEMAN
Marmara University, İstanbul, TÜRKİYE
ORCID ID: 0000-0002-7467-0264

Serhat İREZ
Marmara University, İstanbul, TÜRKİYE
ORCID ID: 0000-0003-3294-4666

Burak ELEMAN
Marmara University, İstanbul, TÜRKİYE
ORCID ID: 0000-0001-5605-7901

ABSTRACT
University–industry collaboration has evolved from a relatively limited exchange of knowledge into a multidimensional system involving universities, firms, governments, intermediary organizations, communities, and, increasingly, the natural environment and digital technologies. This paper provides a historical and comparative analysis of the principal conceptual approaches and models that have shaped this field from the early conceptual foundations of the 1980s to emerging frameworks published between 2022 and 2026. Drawing on the literature reviewed in the source document, the paper organizes developments into five overlapping periods: systemic and process-oriented models (1996–2003); intermediary structures and the expansion of helix models (2007–2013); matching and behavioral approaches (2013–2019); integrative and implementation-oriented frameworks (2018–2021); and context-sensitive and technology-driven models (2022–2026). The analysis indicates that the field has not developed through a single, linear theoretical progression. Instead, the unit of analysis has shifted between innovation systems, organizational processes, intermediary actors, interpersonal relationships, partner selection, institutional implementation, and context-specific or AI-enabled ecosystems. The Triple Helix model established a systemic account of university–industry–government relations, while open innovation and technology-transfer research highlighted the organizational mechanisms needed to move knowledge across institutional boundaries. Later models emphasized trust, prior experience, partner complementarity, coordination, and the importance of context. Recent work adds artificial intelligence, local institutional conditions, and sustainability-related concerns to the discussion. The paper concludes that no universal model can adequately explain or guide every collaboration. Effective partnerships require adaptable governance, clearly shared objectives, sustained communication, appropriate incentives, capable intermediaries, and evaluation practices that consider scientific, educational, economic, social, and environmental outcomes.
Keywords: university–industry collaboration; innovation models; Triple Helix; knowledge transfer; artificial intelligence

INTRODUCTION

Universities and industry have increasingly been expected to work together to address complex scientific, technological, economic, and social challenges. Such collaboration can support the production and application of knowledge, improve the relevance of research and education, and facilitate innovation. Yet collaboration is not a single activity. It may include joint research, contract research, consultancy, staff and student mobility, curriculum development, informal professional networks, technology licensing, spin-off formation, and long-term institutional partnerships (Ankrah & AL-Tabbaa, 2015; Perkmann et al., 2013).

The changing role of universities in innovation is connected to broader transformations in how knowledge is produced and used. Rosenberg (1982) conceptualized technology as involving both tacit and general knowledge and as having a social dimension. National innovation systems approaches subsequently emphasized interactions among firms, universities, and public institutions, while the concept of Mode 2 knowledge production highlighted contextual, application-oriented, interdisciplinary knowledge created through the participation of heterogeneous actors (Freeman, 1987; Gibbons et al., 1994; Lundvall, 1992; Nelson, 1993; Nowotny et al., 2003). These approaches helped establish the conceptual conditions for understanding university–industry collaboration as a systematic and negotiated process rather than a simple transfer from one institution to another.

This paper examines how models of university–industry collaboration have changed over time and compares their central analytical emphases. It synthesizes the literature across five partly overlapping periods, tracing the movement from system-level explanations to process management, intermediary structures, behavioral and matching mechanisms, integrated implementation frameworks, and recent context-sensitive and AI-enabled approaches. The central argument is that the field has developed through shifts in analytical focus rather than through the replacement of one definitive model by another. Consequently, models should be understood as complementary lenses whose usefulness depends on the purpose, partners, discipline, institutional environment, and intended outcomes of collaboration.

1. CONCEPTUAL FOUNDATIONS

The conceptual foundations of university–industry collaboration rest on the increasingly porous boundary between knowledge production and knowledge application. National innovation systems theory treats innovation as an outcome of interactions among organizations operating within institutional, legal, and cultural environments (Freeman, 1987; Lundvall, 1992; Nelson, 1993). From this perspective, collaboration cannot be understood solely as a bilateral agreement between a university and a company; it is also influenced by public policy, funding arrangements, institutional rules, and the broader innovation system.

Mode 2 provides a complementary perspective. In contrast to discipline-based and university-centered knowledge production, Mode 2 emphasizes context-sensitive, application-oriented, interdisciplinary work involving different kinds of participants (Gibbons et al., 1994). Its later development also brought social accountability and quality considerations into the discussion (Nowotny et al., 2003). These ideas challenge the assumption that universities alone produce knowledge that industry subsequently receives. Instead, knowledge may be co-produced through interaction among researchers, firms, public bodies, and other stakeholders.

The Triple Helix model brought these developments into a recognizable systemic framework. Etzkowitz and Leydesdorff (2000) distinguished among arrangements in which the state dominates university and industry, arrangements in which the three institutional spheres remain largely separate, and a more interactive configuration in which their boundaries partially overlap. In the latter configuration, hybrid organizations and activities—including technology-transfer offices, spin-off firms, and joint initiatives—can emerge at institutional interfaces.

This model assigns universities an active role in innovation while recognizing that the relationship among academia, industry, and government is continually negotiated rather than fixed.

These foundations establish three continuing questions for the field: which actors should participate, how should their interactions be organized, and what kinds of outcomes should count as evidence of successful collaboration? The historical development of models can be read as a series of attempts to answer these questions at different analytical levels.

2. HISTORICAL DEVELOPMENT OF COLLABORATION MODELS

2.1. Systemic Models and Process Approaches (1996–2003)

During this period, models addressed both the overall architecture of innovation and the practical management of collaborative projects. Cyert and Goodman (1997) approached university–industry alliances through organizational learning, emphasizing problem selection, teamwork, process management, and knowledge dissemination. Etzkowitz and Leydesdorff's (2000) Triple Helix model, by contrast, offered a system-level account of the changing relationships among universities, industry, and government.

Alongside these systemic perspectives, research examined how collaboration operates in practice. Mattessich et al. (2004) synthesized evidence on collaboration across sectors and identified factors involving the environment, membership, process and structure, communication, purpose, and resources. Barnes et al. (2002) studied collaborative research and development projects and emphasized partner selection, environmental stability, perceived equity, and project management. Schartinger et al. (2002) showed that knowledge interactions extend beyond patents and licensing to include joint research and publications, staff and student mobility, education, informal networks, and personal contact. These studies suggest that the channels and determinants of collaboration vary by discipline and industry.

Open innovation added a strategic business perspective. Chesbrough (2003) challenged the closed innovation model in which firms rely primarily on internal research and development, arguing that organizations can benefit from both inward and outward knowledge flows. Universities consequently became strategic external partners in firms' innovation processes. Research on technology-transfer offices further demonstrated that collaboration outcomes are shaped by organizational design, including royalty arrangements, staff expertise, academic involvement in commercialization, and the level of bureaucracy (Siegel et al., 2003). Overall, this period established collaboration as both a systemic relationship and a process requiring active management.

2.2. Intermediary Structures and the Expansion of Helix Models (2007–2013)

From 2007 onward, attention increasingly moved toward the mechanisms that connect institutions and sustain collaboration. Perkmann and Walsh (2007) described university–industry relationships as diverse organizational connections, including joint and contract research, consultancy, research centers, informal relationships, and academic entrepreneurship. Thune (2007) highlighted the importance of pre-existing networks and social ties, while Calder (2007) emphasized boundary agents—people able to understand the priorities and working languages of both university researchers and company representatives. Such actors can reduce communication barriers and help align project goals.

Philbin (2008) proposed a process model that moves through opportunity mapping, proposal development, initiation, execution, and evaluation. The model underscores the need to align technical and commercial objectives and identifies trust, reciprocity, communication, and brokerage as resources supporting coordination.

Acworth's (2008) Knowledge Integration Community model moved beyond one-off projects toward a continuing platform for multidirectional knowledge exchange among universities, industry, government, and education. It also incorporated systematic evaluation and learning.
During the same period, the helix approach expanded beyond the university–industry–government relationship. Carayannis and Campbell (2009) added the public, media, and cultural dimension in the Quadruple Helix model; Carayannis et al. (2012) added the natural environment in the Quintuple Helix model. Innovation was thereby framed as a process influenced not only by institutional collaboration but also by social legitimacy, public engagement, and ecological sustainability. European research on university–business cooperation likewise considered research, education, knowledge valorization, and management as interconnected activity areas (Davey et al., 2018). Finally, Ankrah and AL-Tabbaa (2015) synthesized the fragmented literature through themes covering forms, motivations, formation and operationalization, enablers and inhibitors, and outcomes. The period thus broadened the field from direct institutional exchange to a multilevel system of intermediaries, platforms, and societal actors.

2.3. Matching and Behavioral Approaches (2013–2019)

A further shift concerned how partners are selected and how their experiences and attitudes shape collaboration. Research on collaborative know-how argued that prior experience does not automatically produce benefits; organizations must learn how to use that experience effectively (Simonin, 1997). Applying a relational perspective to university–industry partnerships, Plewa and Quester (2007) found that organizational compatibility and personal experience matter, while trust, commitment, and integration are associated with satisfaction and intentions to renew relationships.
Matching models questioned the assumption that partnerships arise randomly. Mindruta (2013) conceptualized academic–firm collaboration as an endogenous selection process in which partners' research capabilities may complement or substitute for one another. Evidence from UK research proposals similarly suggested patterns of matching by partner quality and research orientation (Banal-Estañol et al., 2018). These approaches imply that collaboration outcomes cannot be assessed independently of the process through which partners come together.
Behavioral research also considered whether firms intend to collaborate and what might encourage them to act. Drawing on the Theory of Planned Behavior, Giones (2019) emphasized attitudes, perceived social norms, and perceived behavioral control. Taken together, this period shifted attention toward the relational and behavioral foundations of collaboration. Institutional structures remain important, but their effects are mediated by partner choice, trust, prior experience, perceived compatibility, and the practical capacity to undertake joint work.

2.4. Integrative and Implementation-Oriented Frameworks (2018–2021)

From 2018 to 2021, research increasingly sought to integrate previously dispersed findings into practical frameworks. Arenas and González (2018) reviewed technology-transfer models and their constituent elements. Rybnicek and Königsgruber (2019) organized success factors into institutional, relationship, output, and framework categories, emphasizing that the significance of factors may change across collaboration stages, organizational scales, and scientific disciplines. Their synthesis points to the importance of institutional flexibility, honesty in relationships, clarity about outputs, and awareness of the wider context.
Implementation-oriented models also considered how collaboration could be strengthened through coordinated administrative and policy arrangements (Awasthy et al., 2020). Palaniappan (2021) presented collaboration as a staged process in which student capabilities and contributions may progressively connect to company performance and economic impact.

This emphasis addresses the gap that can exist between educational or research outputs and demonstrable organizational effects.

The central development during this period was not the emergence of a single universal model, but the effort to connect success factors, management practices, and measurable outcomes. Evaluation became more explicitly multidimensional: publications, patents, and commercialization may be relevant, but so too are skills development, organizational learning, relationship quality, and the longer-term impact of collaboration.

2.5. Context-Sensitive and Technology-Driven Models (2022–2026)

Recent work has developed along two related directions. One emphasizes institutional and regional context; the other examines the potential of artificial intelligence (AI) to reshape collaboration. Studies of collaboration in Oman, European university networks, and Nigeria highlight the significance of local institutional arrangements, governance, resources, partner diversity, and the practical conditions under which partnerships operate (Ahmed et al., 2022; Al Harrasi & Al Subhi, 2024; Bugan et al., 2024; Dutse et al., 2026). Such work cautions against transferring models across contexts without considering differences in policy, funding, organizational capacity, and industry structure.

AI-focused frameworks position digital technologies as potential enablers of knowledge sharing, competency transfer, research support, and service innovation. Arya et al. (2025) proposed an AI-enhanced framework for competency-transfer hubs, while Zhao et al. (2025) addressed the redesign of innovation-oriented partnerships. Kriz et al. (2026) considered university–industry collaboration in AI-driven service innovation, including the ways AI can support research and development processes. These approaches suggest that technology may alter both the tools used in collaboration and the capabilities that partners need.

Nevertheless, technological capacity does not remove the need for clear governance, mutual trust, appropriate incentives, or context-sensitive design. The recent literature therefore presents a dual agenda: models must be responsive to local institutional conditions while also accounting for emerging digital capabilities. This period is best understood as an expansion of the field rather than a complete break with earlier approaches.

3. DISCUSSION

The historical review indicates five overlapping analytical emphases. First, systemic models explain the institutional architecture of innovation and establish the roles of universities, firms, and governments. Second, process and intermediary approaches examine how partnerships are initiated, coordinated, and sustained. Third, behavioral and matching models focus on the people and organizations entering partnerships, including trust, compatibility, previous experience, and partner complementarity. Fourth, integrative frameworks combine success factors with implementation and evaluation. Fifth, recent context-sensitive and AI-oriented models bring local conditions and emerging technologies into the analytical picture.

These emphases should not be interpreted as a simple sequence in which each new model makes its predecessors obsolete. System-level conditions continue to shape individual projects, while interpersonal trust can influence whether formal institutional arrangements work in practice. Similarly, AI-enabled tools may accelerate particular tasks, but their value depends on the quality of the partnership, the relevance of the research problem, and the capacity of organizations to adopt results. The literature is therefore multilayered and methodologically diverse, combining conceptual models, systematic reviews, case studies, surveys, econometric analyses, and policy-oriented research.

A key implication is that collaboration success is multidimensional and context-dependent. Patent counts, licensing income, and commercial products may be appropriate indicators for some projects, but they do not capture all benefits of collaboration.

Joint publications, educational development, staff and student mobility, organizational learning, public value, and environmental contributions may also be important, depending on the mission and goals of the partnership (Ankrah & AL-Tabbaa, 2015; Davey et al., 2018; Rybnicek & Königsgruber, 2019). Evaluation should therefore begin with a shared definition of purpose and select indicators that fit the expected outcomes rather than assuming that one metric applies to every collaboration.

A second implication concerns the management of relationships. Formal agreements and intermediary offices can provide structure, but effective cooperation also requires communication, realistic expectations, clarity about roles, fair treatment, and mechanisms for resolving differences. Academic and commercial partners may operate with different timelines, incentives, publication norms, and expectations about intellectual property. Boundary agents and collaboration brokers can help bridge these differences, but they need adequate authority and expertise to do so (Calder, 2007; Philbin, 2008; Siegel et al., 2003).

Third, the models emphasize the importance of contextual adaptation. Institutional resources, government policy, disciplinary norms, firm size, and regional innovation capacity may affect which arrangements are feasible. A model developed in one setting should therefore be treated as a design resource rather than a universal prescription. Finally, AI-related approaches raise questions about capability, governance, and the distribution of benefits. Technology should be integrated in response to clearly identified collaboration needs and assessed against scientific, organizational, social, and economic objectives.

CONCLUSION

This paper has traced the development of university–industry collaboration models from their conceptual foundations to recent context-sensitive and AI-oriented approaches. The review shows that the field has evolved through a series of shifts in analytical focus: from innovation systems and the Triple Helix, to project processes and technology transfer, to intermediary structures and broader helix models, and then to partner matching, behavioral dynamics, integrated success frameworks, and emerging technological ecosystems.

The principal conclusion is that university–industry collaboration cannot be adequately explained or managed through one model alone. Effective collaboration requires a combination of system-level support, capable institutions, clear processes, suitable partners, trust-based relationships, skilled intermediaries, and evaluation aligned with shared objectives. Universities, firms, and policy makers should therefore select and adapt models according to the nature of the research, the participating organizations, the relevant disciplinary and regional context, and the intended outcomes. Future work would benefit from comparative and longitudinal studies that examine how collaboration models perform across different institutional settings and how AI-enabled practices affect governance, knowledge sharing, and the distribution of benefits. Such research can help clarify not only whether collaborations produce outputs, but also under what conditions they generate sustained scientific, educational, economic, social, and environmental value.

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OPERATIONAL INTERDEPENDENCIES IN PILOT-ASSISTED SHIP BERTHING: AN ACTOR-BASED ANALYSIS

Asst. Prof. Dr. Seyid Mahmud Esad DEMİRCİ
Sakarya University of Applied Sciences, Maritime Vocational School

ABSTRACT
Pilot-assisted ship berthing relies on coordinated decisions, information exchange and physical actions involving both shipboard and shore-based personnel. Research on pilotage has provided valuable insights into accident causation and human performance. Building on this knowledge, the present paper examines how operational influence is distributed among the actors involved in the final berthing phase. The analysis covers the period from the commencement of the final approach until the vessel is all fast. Ten actors representing bridge, machinery, tug, traffic-control and mooring functions were included in the assessment. Their pairwise relationships were evaluated through a five-level linguistic scale and represented by triangular fuzzy numbers. Fuzzy DEMATEL was used to account for uncertainty in expert judgement, capture direct and indirect relationships, and separate overall prominence from net causal position. The illustrative analysis placed the pilot, officer of the watch and master at the centre of the interaction structure. The pilot emerged as the most prominent actor and the strongest net influencer, followed by the officer of the watch and master in overall prominence. Tug and VTS actors also occupied influencing positions, while the helmsman, engine-room team and mooring personnel were located mainly within the dependent group. The shipboard mooring team nevertheless retained a relatively high position in the overall ranking, showing that operational dependence does not imply limited importance. The directed network was dominated by reciprocal relationships among the pilot, master and officer of the watch, with further influence pathways extending towards manoeuvre-execution and mooring functions. These results support a broader approach to master–pilot exchange that incorporates active bridge-team participation and systematic feedback from tug, machinery and mooring personnel. The actor-centred framework provides a structured basis for examining coordination during pilot-assisted berthing.
Keywords: Pilotage, Ship berthing, Bridge team coordination, Operational influence, Causal network.

INTRODUCTION
Ship berthing requires the coordinated management of vessel motion within a restricted manoeuvring area. During the final approach, low-speed control, environmental conditions, tug assistance and mooring arrangements must be considered simultaneously. The outcome depends not only on the pilot's manoeuvring decisions but also on the information and actions exchanged among shipboard and shore-based personnel.
The pilot provides local knowledge and supports the vessel's safe navigation. However, the master retains command, while the officer of the watch continues to monitor the vessel's position and movement. Helm and engine commands must also be executed correctly, tug assistance must be coordinated, and mooring teams must act in line with the vessel's approach. Pilot-assisted berthing is thus performed through a network of actors with distinct but interconnected roles. This operational structure is consistent with the cooperation and information-exchange principles defined in IMO Resolution A.960(23).
Previous research has examined human factors, communication and accident causes in pilotage operations (Bahadır et al., 2026; Canımoğlu et al., 2025, 2026a, 2026b; Demirci et al., 2023; Öztürk et al., 2024).

Oraith et al. (2021) evaluated human factors affecting pilotage safety, while Mansson et al. (2017) described port navigation as a joint activity involving several maritime actors. Demirci et al. (2022) analysed causal relationships among accident factors during navigation under pilotage. These studies clarify the conditions affecting pilotage safety, but do not model the directed influence structure among all actors involved in the final berthing phase.

This study analyses the operational interdependencies among ten actors involved in pilot-assisted ship berthing. The assessment covers the period from the commencement of the final approach until the vessel is all fast. Fuzzy DEMATEL is applied to identify direct and indirect relationships, determine actor prominence, and distinguish net influencing actors from net receiving actors. The resulting causal network provides a structured representation of how information, decisions, commands and actions are transmitted throughout the berthing operation.

METHODOLOGY

Research Framework and Actor Selection

Pilot-assisted berthing was modelled as a multi-actor operation. The analysis covered the period from the commencement of the final approach until the vessel was all fast. Ten actors were selected according to their operational involvement in the berthing process. Their codes, titles and functions are given in Table 1. The actors were placed in both the rows and columns. Rows represented influencing actors, while columns represented influenced actors. The analysis concerned operational influence rather than responsibility, fault or error probability.

Table 1. Actors and operational functions

Code	Actor	Operational function
A1	Master	Retains command, monitors the manoeuvre and intervenes when required.
A2	Pilot	Provides local knowledge, directs the manoeuvre and coordinates external assistance.
A3	Officer of the Watch	Monitors navigation, cross-checks the manoeuvre and manages bridge communications.
A4	Helmsman	Acknowledges and executes helm orders and reports their completion.
A5	Lookout	Maintains visual and auditory watch and reports hazards or changes in the surroundings.
A6	Engine-room team	Maintains propulsion and steering readiness and responds to manoeuvring commands.
A7	Tug master/team	Executes tug instructions and reports the tug's operational status.
A8	VTS/Port Control	Provides traffic information, navigational warnings and shore-side coordination.
A9	Shipboard mooring team	Prepares and handles mooring lines and reports distances and line status.
A10	Shore mooring team	Receives, transfers and secures mooring lines, including work performed by line handlers and mooring boats.

Expert Assessment and Fuzzy Scale

The elicitation protocol was prepared for ten maritime experts with experience in pilotage, ship manoeuvring, tug operations, VTS, marine engineering or mooring operations. The following question guided each pairwise assessment:

"During pilot-assisted berthing, to what extent do Actor i's information, decisions, commands or actions influence Actor j's ability to perform its assigned role safely and effectively?"
Each expert completed the direct-influence matrix independently. Diagonal values were fixed at zero because self-influence was excluded. The linguistic scale used in the assessment is presented in Table 2.

Table 2. Linguistic scale and triangular fuzzy numbers

Score	Linguistic assessment	Triangular fuzzy number
0	No influence	(0.00, 0.00, 0.00)
1	Low influence	(0.00, 0.25, 0.50)
2	Medium influence	(0.25, 0.50, 0.75)
3	High influence	(0.50, 0.75, 1.00)
4	Very high influence	(0.75, 1.00, 1.00)

The assessment provided by expert k for the influence of actor i on actor j was converted into the triangular fuzzy number shown in Equation (1).

$$\tilde{z}_{ijk} = (l_{ijk}, m_{ijk}, u_{ijk}) \tag{1}$$

Here, l, m and u denote the lower, modal and upper values. The individual matrices were combined using Equation (2).

$$\tilde{z}_{ij} = \sum_{k=1}^{K} w_k \tilde{z}_{ijk}, \quad \sum_{k=1}^{K} w_k = 1 \tag{2}$$

Fuzzy DEMATEL Calculations
The calculation followed the Fuzzy DEMATEL procedure described by Soner (2021). First, the normalisation coefficient was obtained from the maximum row sum of the upper-bound matrix, as given in Equation (3).

$$s = \max_{1 \le i \le n} \sum_{j=1}^{n} u_{ij} \tag{3}$$

Each fuzzy element was divided by s to construct the normalised direct-relation matrix. This operation is expressed in Equation (4).

$$\tilde{x}_{ij} = \frac{\tilde{z}_{ij}}{s} = \left(\frac{l_{ij}}{s}, \frac{m_{ij}}{s}, \frac{u_{ij}}{s}\right) \tag{4}$$

The total-relation matrices were calculated separately for the lower, modal and upper components using Equation (5).

$$T^q = X^q(I - X^q)^{-1}, \quad q \in \{l, m, u\} \tag{5}$$

The three components of each total-relation value were converted into a crisp value using centroid defuzzification, as shown in Equation (6).

$$t_{ij} = \frac{{t_{ij}}^{l} + {t_{ij}}^{m} + {t_{ij}}^{u}}{3} \quad (6)$$

The outgoing and incoming influence values were obtained from the row and column sums of the defuzzified total-relation matrix. Their calculation is given in Equation (7).

$$D_i = \sum_{j=1}^{n} t_{ij}, \quad R_i = \sum_{j=1}^{n} t_{ji} \quad (7)$$

Actor prominence and causal position were determined using Equation (8).

$$P_i = D_i + R_i, \quad C_i = D_i - R_i \quad (8)$$

A high P_i value indicates strong involvement in the interaction system. A positive C_i value identifies a net influencing actor, while a negative value identifies a net receiving actor. A supplementary normalised actor weight was calculated using Equation (9).

$$V_i = \sqrt{{P_i}^2 + {C_i}^2}, \quad W_i = \frac{V_i}{\sum_{i=1}^{n} V_i} \quad (9)$$

The threshold used to construct the causal network was calculated as the arithmetic mean of all elements in the defuzzified total-relation matrix. Equation (10) presents this calculation.

$$\alpha = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} t_{ij}}{n^2} \quad (10)$$

Relationships with $t_{ij}>\alpha$ were retained for causal interpretation. The full thresholded matrix was preserved, while only the 20 strongest relationships were displayed in the network diagram to maintain visual clarity. Arrow direction represented the direction of influence, and line thickness indicated its magnitude.

RESULTS AND DISCUSSION

Total Relation Matrix

The defuzzified total-relation matrix is presented in Table 3. Each value represents the combined direct and indirect influence of the row actor on the column actor. The analytical threshold was calculated as α, 0.106. Off-diagonal values exceeding this threshold are shown in bold. Diagonal values represent indirect feedback effects and were excluded from the causal network.

Table 3. Defuzzified total-relation matrix

Actor	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
A1	0.121	**0.230**	**0.233**	**0.168**	**0.136**	**0.168**	**0.139**	**0.123**	**0.196**	0.090
A2	**0.231**	0.144	**0.241**	**0.193**	**0.139**	**0.176**	**0.179**	**0.162**	**0.204**	0.097
A3	**0.206**	**0.217**	0.135	**0.169**	**0.162**	**0.167**	**0.109**	**0.151**	**0.194**	0.095
A4	0.075	0.105	0.104	0.037	0.065	0.037	0.035	0.030	0.045	0.023
A5	**0.115**	**0.131**	**0.154**	0.071	0.047	0.052	0.076	0.043	0.087	0.038
A6	**0.126**	0.096	**0.155**	0.079	0.044	0.046	0.039	0.042	0.088	0.038
A7	**0.131**	**0.178**	0.101	0.059	0.074	0.056	0.052	0.073	0.099	0.074

Actor	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
A8	0.091	**0.163**	**0.136**	0.056	0.080	0.048	0.084	0.043	0.094	0.067
A9	**0.175**	**0.158**	**0.174**	0.064	0.084	0.091	0.090	0.059	0.088	**0.154**
A10	0.085	0.088	0.081	0.036	0.040	0.035	0.058	0.029	**0.151**	0.035

The strongest relationship was identified from the pilot to the officer of the watch (A2→A3; 0.241). This was followed by A1→A3 (0.233), A2→A1 (0.231), A1→A2 (0.230), A3→A2 (0.217) and A3→A1 (0.206). These reciprocal relationships place the master, pilot and officer of the watch at the centre of the interaction structure. Strong links from these actors to the shipboard mooring team were also observed, particularly A2→A9 (0.204), A1→A9 (0.196) and A3→A9 (0.194).

Actor Prominence and Causal Position

The outgoing influence D, incoming influence R, prominence $D+R$, causal position $D-R$ and normalised actor weights are reported in Table 4.

Table 4. Fuzzy DEMATEL results for berthing actors

Code	Actor	D	R	D+R	D−R	Group	Weight (%)	Rank
A1	Master	1.606	1.356	2.961	0.250	Influencer	13.92	3
A2	Pilot	1.767	1.511	3.277	0.256	Influencer	15.40	1
A3	Officer of the Watch	1.605	1.512	3.117	0.092	Influencer	14.61	2
A4	Helmsman	0.557	0.931	1.488	−0.374	Dependent	7.19	9
A5	Lookout	0.814	0.872	1.686	−0.058	Dependent	7.90	6
A6	Engine-room team	0.753	0.876	1.629	−0.123	Dependent	7.65	7
A7	Tug master/team	0.896	0.862	1.758	0.034	Influencer	8.24	5
A8	VTS/Port Control	0.862	0.757	1.619	0.105	Influencer	7.60	8
A9	Shipboard mooring team	1.136	1.245	2.381	−0.109	Dependent	11.17	4
A10	Shore mooring team	0.638	0.711	1.349	−0.073	Dependent	6.33	10

The joint distribution of prominence and causal position is shown in Figure 2. The pilot had the highest prominence and normalised weight, followed by the officer of the watch and master. The pilot and master also recorded similar positive $D-R$ values, indicating strong net influence. The officer of the watch had high prominence but a lower positive causal value, reflecting substantial involvement in both receiving and transmitting operational information.

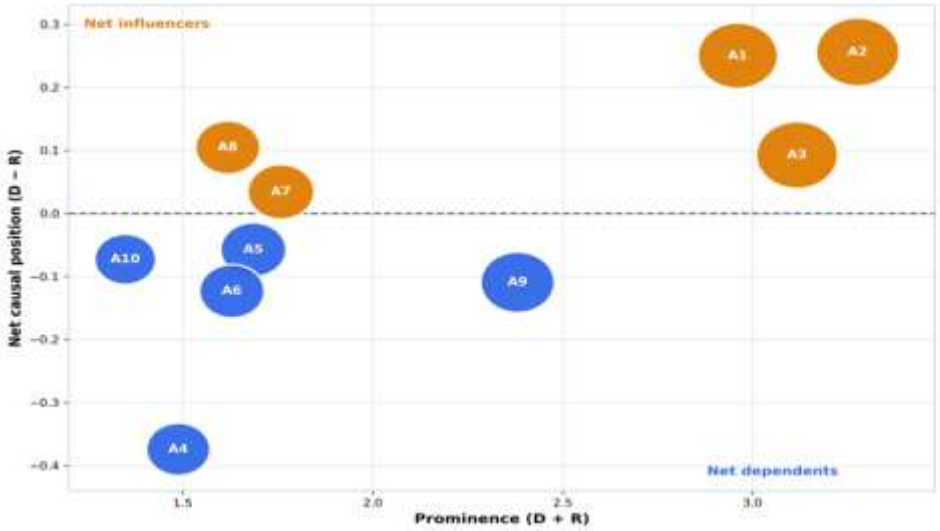


Figure 2. Cause–effect positions of the berthing actors

The placement of A1, A2 and A3 supports an interpretation of berthing as a shared bridge activity rather than a manoeuvre controlled by one actor alone. The result is consistent with IMO Resolution A.960(23), which requires continuous information exchange and close cooperation between the master, pilot and bridge team. It also corresponds with the joint-activity perspective reported by Mansson et al. (2017).

Negative $D-R$ values should not be interpreted as low operational importance. The shipboard mooring team, for example, ranked fourth in overall weight despite belonging to the dependent group. Its position reflects reliance on manoeuvring decisions and vessel movement while also providing distance and line-status feedback. The helmsman recorded the lowest $D-R$ value. This result is compatible with an execution-oriented role in which helm actions are largely shaped by commands originating from the bridge decision structure.

Causal Network and Interpretation

The threshold retained 38 directed, non-self relationships. To preserve readability, the 20 strongest relationships are displayed in Figure 3.

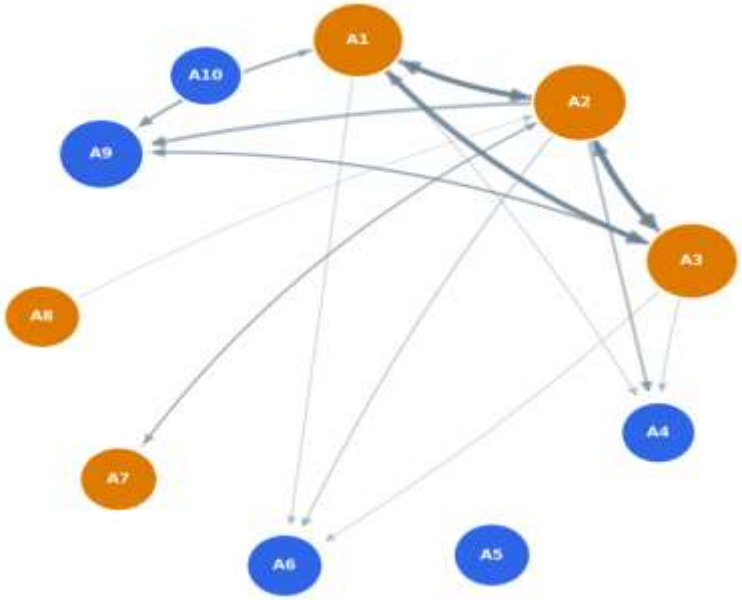


Figure 3. Directed causal network of berthing actors

The network is dominated by reciprocal relationships among the master, pilot and officer of the watch. These actors also form the main pathways toward the helmsman, engine-room team and shipboard mooring team. External support enters the bridge structure primarily through the pilot, as indicated by the reciprocal A2–A7 relationship and the A8→A2 connection. The pattern suggests that tug and VTS inputs become operationally effective after being integrated into the shipboard decision process.

The absence of A5 and A10 from the 20-link visual network does not imply that their roles are unnecessary. Their relationships remain in the complete total-relation matrix but are weaker than the displayed links. This distinction is important because thresholding and visual filtering simplify the network without removing actors from the operational system.

Operationally, the results support a broader approach to master–pilot exchange. The officer of the watch should remain actively involved in monitoring, cross-checking and communication (Lochner et al., 2018). Closed-loop communication is also required for helm and engine orders, tug instructions and mooring status reports (Kuzu et al., 2019; Sezer, 2025). This interpretation agrees with studies linking pilotage performance to communication, teamwork and information exchange (Demirci et al., 2023; Lochner et al., 2018; Oraith et al., 2021).

The actor-based model extends the factor-oriented analysis conducted by Demirci et al. (2023). While the earlier study identified causal accident factors under pilotage, the present framework describes how operational influence is distributed among actors during final berthing. Fuzzy DEMATEL captures perceived structural relationships; it does not establish accident causation or assign legal responsibility.

CONCLUSION

This study developed an actor-based framework for examining operational interdependencies during pilot-assisted ship berthing. Ten actors involved between the commencement of the final approach and the all-fast condition were analysed using Fuzzy DEMATEL. The method represented both direct and indirect influences and distinguished system prominence from net causal position.

The illustrative results placed the pilot, officer of the watch and master at the centre of the interaction structure. The pilot had the highest prominence, while the pilot and master were the strongest net influencers. The officer of the watch occupied a highly connected position by receiving, verifying and transmitting operational information. Tug and VTS actors also belonged to the influencing group, whereas the helmsman, engine-room team and mooring teams were positioned mainly as receivers. These negative causal values do not indicate limited importance. They reflect the dependence of execution-oriented roles on information and commands transmitted through the operational network.

The findings support the inclusion of the officer of the watch in master–pilot coordination and the use of closed-loop communication with tug, engine-room and mooring teams. The framework also extends pilotage research from accident-factor ranking to the analysis of actor-to-actor influence during final berthing. Its results represent perceived operational relationships rather than accident causation, fault or legal responsibility. The defined operational boundary, aggregated actor groups, expert-based assessments and selected network threshold should be considered when interpreting the findings. Future research may compare different ports, vessel types and berthing conditions and test the stability of the causal structure using larger expert panels and sensitivity analysis.

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COMPARATIVE INVESTIGATION OF THE TENSILE-ELONGATION BEHAVIOR OF TiB_2-REINFORCED Al-MATRIX COMPOSITES PRODUCED VIA A HYBRID METHOD

Lect. Ömer Faruk DEMİROK
Maritime Vocational School, Sakarya University of Applied Sciences, Sakarya 54800, Türkiye
Naval Architecture and Marine Engineering, Yıldız Technical University, Istanbul 34349, Türkiye
ORCID ID:0000-0002-8795-5736

Assoc. Prof. Dr. Engin KOCAMAN
Department of Aerospace Engineering, Faculty of Engineering, Zonguldak Bülent Ecevit University, Zonguldak, Türkiye
ORCID ID: 0000-0001-5617-3064

Prof. Dr. Ömer SAVAŞ
Department of Marine Engineering, Faculty of Naval Architecture and Maritime, Yıldız Technical University, Istanbul 34349, Türkiye
ORCID ID: 0000-0001-7454-1457

ABSTRACT
In this study, a novel hybrid production approach was devised by integrating in-situ synthesis, sedimentation and dilution techniques, with the aim of developing high-performance aluminium matrix composites for use in maritime applications. Thanks to the innovative hybrid method employed, the distribution of the reinforcing phase within the matrix was controlled, enabling a systematic investigation of the tensile elongation behaviour of Al-matrix Al/TiB_2 composites with different TiB_2 content (0%, 5%, 10%, 15%). In the first step of the multi-stage hybrid method, a master melt containing 3% TiB_2 was synthesised via an in-situ reaction in an argon atmosphere at 1200 °C; subsequently, it was enriched to 10%-15% TiB_2 at the bottom of the crucible through a 2-hour sedimentation process at 800 °C. In the subsequent step, the resulting enriched block was diluted by adding Al at 800 °C, mechanically homogenised, cast into a mould, and the material was produced. In this way, the multiple performance criteria required for marine structures were targeted.
Analyses of the tensile deformation behavior of the produced Al/TiB_2 composite samples revealed that the elongation at break (EL%) decreased from 35% for pure Al to 23% with 5% TiB_2 reinforcement, 18% with 10% TiB_2 reinforcement, and 10% with 15% TiB_2 reinforcement. It was determined that increasing the TiB_2 volume fraction enhanced the material's rigidity driven by the mechanism wherein hard ceramic phases impede dislocation motion (Orowan strengthening) while simultaneously reducing ductility in a predictable manner. The homogeneous reinforcement distribution and strong interfacial bonding achieved through the developed hybrid production method ensured high stability and reproducibility during the deformation of marine components under tensile loads.
Keywords: Tensile test, Elongation at break, TiB_2-reinforced composites, Al matrix, Hybrid manufacturing method, Marine applications.

INTRODUCTİON
Marine structures and equipment used in the shipbuilding industry are exposed to harsh environmental conditions due to various destructive factors, such as mechanical stresses, wear, saltwater corrosion, vibrations, and electromagnetic effects. It is challenging for materials used under these demanding conditions to function properly and maintain their structural integrity.

Materials utilized in such aggressive operating environments often suffer from performance degradation and may lose their structural integrity over time. Consequently, the maritime sector requires materials that not only possess high mechanical strength but also exhibit corrosion resistance, high strength against dynamic loads, and the necessary electromagnetic properties. In this context, metal matrix composites (MMCs) stand out as advanced engineering materials for applications demanding high-temperature stability, wear resistance, and robust environmental performance (Miracle, 2005; Campbell, 2010). Among these materials, aluminum matrix composites (Al-MMCs) are widely preferred in the aerospace, automotive, and maritime sectors due to their low density, superior mechanical properties, and corrosion resistance (Kainer, 2006).

Although Türkiye possesses a significant portion of the world's boron reserves, the use of boron-based materials in advanced engineering applications remains largely limited, with these materials primarily utilized in the production of low-value-added products. Titanium Diboride (TiB_2), a boron-based ceramic, holds particular importance for enhancing the performance of Aluminum Matrix Composites (Al-MMCs) due to its high hardness, thermodynamic stability, and excellent interfacial compatibility with the aluminum matrix (Mohanavel et al., 2021; Chen et al., 2015). The use of strategic reinforcements such as TiB_2 in lightweight metal matrix composite structures offers significant potential for transforming boron into high-value-added products. The development of such materials will contribute not only to the more effective utilization of boron resources but also to expanding the application of boron in advanced engineering fields.

It has been observed that reinforcing Al-MMCs with TiB_2 yields significant improvements in properties such as hardness, tensile strength, and wear resistance (Ashok Kumar et al., 2020; Ramesh et al., 2011; Li et al., 2018). This performance enhancement is largely attributed to the manufacturing method employed and the microstructural characteristics (Manoj et al., 2022). In ex-situ powder addition and powder metallurgy methods, microstructural defects such as poor particle wetting, heterogeneous distribution, and porosity can negatively affect the mechanical properties of composites. Such defects can lead to stress concentrations and crack initiation at the matrix-reinforcement interface, resulting in a reduction of tensile strength, in particular. While in-situ synthesis methods developed to overcome these issues enable the formation of clean and strong metallurgical bonds within the matrix, the TiB_2 content achievable via this method is generally limited to the 2–3% range due to solubility constraints. While sedimentation techniques that utilize density differences allow for high reinforcement ratios, their use alone can lead to particle aggregation and segregation problems (Hanumanth et al., 1992; Kambakas & Tsakiropoulos, 2006). Although hybrid fabrication approaches combining in-situ synthesis and sedimentation techniques have been addressed in a limited number of studies in recent years, research comparatively investigating the effect of reinforcement content on the tensile strength and elongation behavior of Al-matrix composites containing varying proportions of TiB_2 reinforcement remains limited.

In this study, to address the relevant gap in the literature, Al/TiB_2 composites with varying TiB_2 reinforcement ratios (0–15%) were produced using a hybrid method combining in-situ synthesis and sedimentation techniques, and their tensile and elongation behaviors were comparatively investigated.

Materials and Methods

In this study, the tensile-elongation behavior of aluminum matrix composites produced with varying TiB_2 reinforcement ratios using in-situ synthesis and sedimentation techniques was investigated.

The experimental process utilized commercially pure aluminum, Al–3B and Al–10Ti master alloys, and aluminum as the matrix alloying element; the in-situ synthesis, sedimentation, and semi-solid dilution stages were carried out using a furnace, a mechanical stirrer, and a casting mold system. As part of the characterization, tensile tests were performed to determine the tensile strength performance of the produced composites.

Al–3B and Al–10Ti master alloys were used as the boron and titanium sources, respectively, for the synthesis of TiB_2 particles. These alloys, in stoichiometric proportions calculated to yield approximately 3% TiB_2, were melted with pure aluminum at 1200 °C. During this process, Ti and B elements dissolved in the molten aluminum to form an Al–Ti–B melt, ensuring the complete dissolution of intermetallic phases such as AlB_2, AlB_{12}, and Al_3Ti. The general flowchart of the production process is presented in Figure 1.

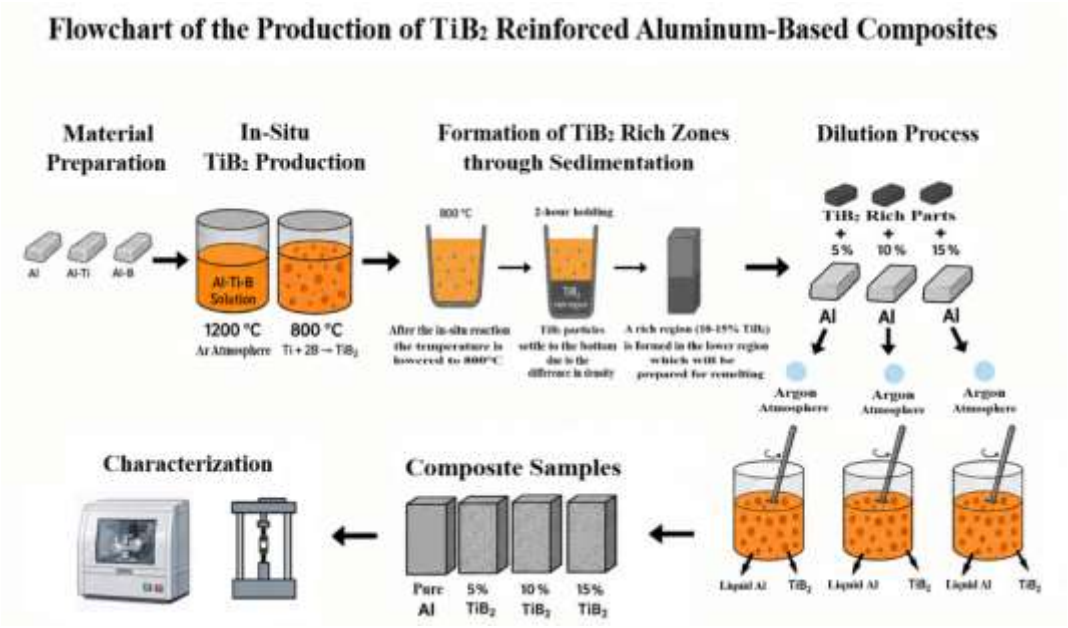


Figure 1. General flowchart of the production process

The primary reason for selecting a 3% TiB_2 target at this stage is that, according to the Al–B phase diagram, the maximum solubility of boron in aluminum at 1200 °C is approximately 1.5% (Okamoto, 2006). Exceeding this limit inevitably leads to the formation of insoluble intermetallic phases. The Al–Ti–B melt obtained at 1200 °C was cooled in a controlled manner to 800 °C, at which temperature the formation of TiB_2 particles within the molten aluminum was induced in accordance with Equation (1) (Suresh & Moorthi, 2012; Chen et al., 2015).

$$Ti + 2B \rightarrow TiB2 \qquad \text{(Equation 1)}$$

An examination of Al–B and Al–Ti phase diagrams reveals that the solubility of boron and titanium in aluminum is quite limited (Okamoto, 2000; Okamoto, 2006). This situation restricts the amount of TiB_2 that can be directly obtained via in-situ synthesis to approximately 3%. To overcome this limitation, a semi-solid Al(liquid)–TiB_2(solid) melt was held at 800 °C, allowing the TiB_2 particles to settle to the bottom due to the significant density difference. A novel two-stage approach was employed in this study. In the first stage, blocks enriched with approximately 15% TiB_2 were obtained through sedimentation; in the second stage, these blocks were melted and diluted with additions of pure Al within the 800 °C semi-solid temperature range. Consequently, Al-matrix Al/TiB_2 composites with varying TiB_2 contents ranging from 0 to 15% were produced.

Tensile specimens with a dog-bone geometry were extracted from Al/TiB_2 composite parts featuring various reinforcement ratios (0%, 5%, 10%, and 15% TiB_2). Axial tensile tests were conducted at room temperature using a constant crosshead speed of 1 mm/min. Throughout the testing process, the specimens were secured vertically between the grips to prevent axial misalignment; progressive deformation and necking occurred under the applied load, and loading continued until the specimen fractured.

Tensile deformation analyses were performed using digital image analysis software. Elongation at break (EL%) was calculated according to the following equation, based on the vertical gauge dimensions of the specimens before testing (L_o) and after fracture (L_f):

$$EL\% = \left(\frac{L_f - L_0}{L_0}\right) \times 100 \qquad \text{(Equation 2)}$$

Results and Discussion

Tensile deformation behavior of the produced Al/TiB2 composite samples at room temperature was examined. During the tensile test, it was observed that the samples fixed vertically between the jaws and with gauge lines marked on them (Figure 2a) exhibited a stable deformation in the gauge section under the applied axial load and the final fracture occurred consistently in the center of the measurement region (Figure 2b).

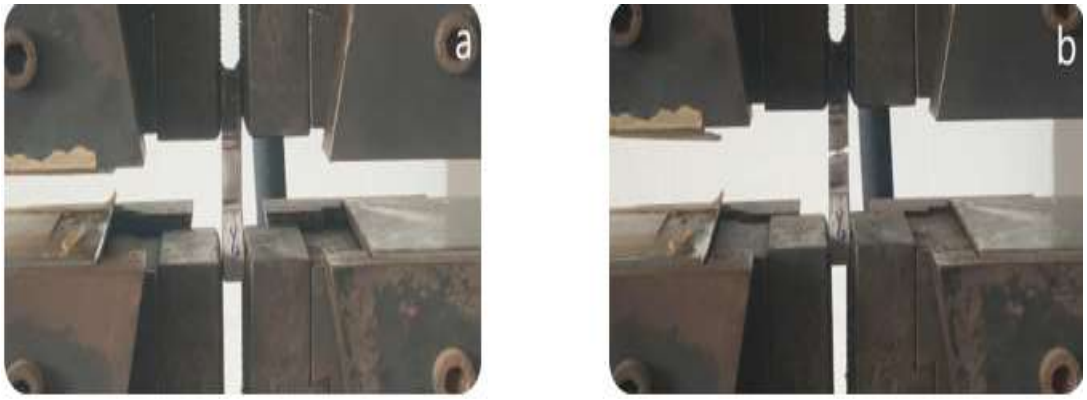


Figure 2. Vertical tensile test setup of the Al/TiB2 composite samples: (a) the sample fixed between the jaws with marked gauge section at the beginning of the test, and (b) the final fracture appearance occurring at the center of the gauge section at the end of the test

In addition, hydrostatic density measurements based on the Archimedes principle revealed that the density of the unreinforced pure Al matrix, which was 2.70 g/cm^3, showed a steady increase with the addition of 15% TiB_2, reaching 2.83 g/cm^3 (Table 1). This consistent increase in density is attributed to the incorporation of the TiB_2 phase (4.52 g/cm^3), which possesses a significantly higher density than the matrix, in accordance with the Rule of Mixtures. This linear trend in the experimental data confirms that the applied hybrid manufacturing methodology minimizes porosity formation during casting and ensures a homogeneous reinforcement distribution within the matrix. Regarding the mechanical properties, the Vickers hardness of the pure Al matrix which was 28.6 HV increased by 41.3% to 40.4 HV with the addition of 5% TiB_2, and reached 43.8 HV and 44.1 HV at 10% and 15% TiB_2 contents, respectively.

Table 1. Physical and mechanical properties of pure Al and Al/TiB_2 composites

Sample	Yield Strength (MPa)	Ultimate Tensile Strength (MPa)	Elongation at Break (%EL)	Vickers Hardness (HV)	Density (g/cm^3)
Pure Al	48.63	59.34	35%	28.6	2.70
Al+5% TiB_2	65.48	80.69	23%	40.4	2.75
Al+10% TiB_2	79.65	95.38	18%	43.8	2.77
Al+15% TiB_2	120.02	130.80	10%	44.1	2.83

As a result of the tensile test analysis, a significant improvement in the load-bearing capacity of the material was achieved with increasing the volume fraction of TiB_2 in the matrix. The yield strength (YS), which was 48.63 MPa for pure Al, increased by 146.8% to 120.02 MPa in the 15% TiB_2-reinforced sample. Similarly, the ultimate tensile strength (UTS) increased by 120.4% from 59.34 MPa to reach 130.80 MPa.

Analysis of the experimental data revealed that the elongation to failure (%EL) values gradually and predictably decreased with increasing the volume fraction of TiB_2 in the matrix. While the unreinforced pure Al matrix sample (0% TiB_2) exhibited the highest plastic deformation capability with an elongation of 35%, this value dropped to 23% in the 5% TiB_2-reinforced sample. With the 10% TiB_2 addition, the elongation further decreased to 18%, accompanied by a noticeable increase in stiffness. Finally, for the 15% TiB_2-reinforced sample, the elongation dropped to 10%, demonstrating the highest tendency toward brittleness.

This observed performance change is attributed to the hindrance of dislocation movement by the hard ceramic TiB_2 particles dispersed within the matrix during plastic deformation (Orowan strengthening). As evident from the micrographs/images, no premature fracture caused by slippage or gripping issues occurred in the jaw regions.

Conclusions

In this study, 0-15% TiB_2-reinforced Al matrix composites with a pore-free and homogeneous microstructure were successfully fabricated using a hybrid approach consisting of in-situ synthesis, sedimentation, and semi-solid dilution methods. Density measurements based on Archimedes' principle (ranging from 2.70 to 2.83 g/cm^3) showed excellent agreement with the Rule of Mixtures. The Vickers hardness increased by 41.3% to 40.4 HV with 5% TiB_2 addition and reached 44.1 HV at 15% TiB_2 content. With increasing reinforcement content, the yield strength increased by 146.8% from 48.63 to 120.02 MPa, and the ultimate tensile strength improved by 120.4% from 59.34 to 130.80 MPa, while the elongation to failure (EL%) decreased from 35% to 10%. The incorporated ceramic TiB_2 particles significantly enhanced the strength and hardness of the material through mechanisms such as load-bearing capacity, Orowan strengthening, and in-situ nucleation-induced grain refinement (Hall-Petch effect). This remarkable improvement in strength and hardness was accompanied by a predictable, gradual decrease in ductility, which is attributed to the restriction of matrix plasticity by the ceramic particles.

Information Note

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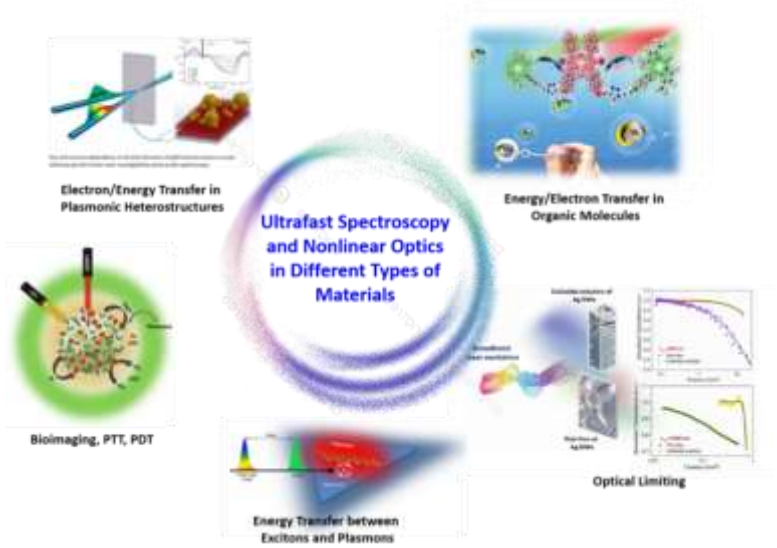
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ULTRAFAST SPECTROSCOPY AND NONLINEAR OPTICS IN A BROAD RANGE OF MATERIALS: FROM FUNDAMENTAL STUDIES TO BIOLOGICAL APPLICATIONS

Assoc. Prof. Dr. Ahmet KARATAY
Department of Engineering Physics, Faculty of Engineering, Ankara University, 06100, Ankara, Turkiye
ORCID ID: 0000-0001-9373-801X

ABSTRACT
Ultrafast spectroscopy provides a powerful platform for elucidating electronic, vibrational, and structural dynamics in matter on femtosecond timescales. When combined with nonlinear optical techniques, it offers a comprehensive approach for probing and manipulating complex light–matter interactions across a broad spectrum of materials, including semiconductors, nanostructures, two-dimensional materials, molecular systems, and strongly correlated solids. In semiconductor crystals, nonlinear absorption processes associated with doping-induced variations in defect density can be quantitatively investigated using open-aperture Z-scan measurements, providing valuable insights into the relationship between structural defects and nonlinear optical response. Similarly, pump–probe spectroscopy enables the direct characterization of ultrafast relaxation and energy-transfer pathways in molecular systems, revealing the influence of molecular substituents and solvent environments on excited-state dynamics. Beyond fundamental materials science, these techniques are particularly valuable for investigating charge-transfer processes, excited-state dynamics, and nonlinear absorption in functional nanocomposites developed for emerging biomedical applications, including bioimaging and photodynamic therapy. Collectively, the integration of ultrafast spectroscopy and nonlinear optics provides a versatile framework that bridges fundamental understanding of transient processes with the design and optimization of advanced functional materials and photonic technologies, including ultrafast optical switches, optical limiters, and light-driven therapeutic platforms.

Keywords: Ultrafast spectroscopy, Nonlinear optics, Bioimaging, Nanomaterials, Z-scan



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INSUFFICIENCY OF MORPHOMETRIC MEASUREMENTS AND IMPORTANCE OF PCR-RFLP IN DIFFERENTIATING *FASCIOLA HEPATICA* AND INTERMEDIATE-FORM *FASCIOLA*

Lec. Dr. Sedat KAVAK
Ardahan University Vocational School of Health Services, 75000, Ardahan, Turkey
ORCID ID: 0009-0006-6912-6383

Prof. Dr. Hasan YILMAZ
Department of Medical Parasitology, Faculty of Medicine, Van Yüzüncü Yıl University, 65080, Van, Turkey
ORCID ID: 0000-0001-6947-4499

ABSTRACT
Objective: This study aimed to thoroughly investigate adult *Fasciola* species obtained from the liver bile ducts of slaughtered cattle, sheep, and goats using morphometric measurements and molecular techniques.
Materials and Methods: A total of 50 adult specimens randomly selected from *Fasciola* isolates obtained from infected cattle, sheep, and goats were included in the study. Morphometric measurements of the parasites were performed under a stereomicroscope at X8 magnification. For molecular species identification, following genomic DNA extraction, the ITS1 region of ribosomal DNA was amplified by PCR. The resulting amplicons were subjected to digestion using the *RsaI* restriction enzyme via the PCR-RFLP method. The diagnostic performance and efficacy of morphometric parameters (body length/width ratio) in species differentiation were evaluated using ROC analysis.
Results: PCR-RFLP analysis identified 45 of the 50 analyzed specimens as *Fasciola hepatica* and 5 as intermediate-form *Fasciola*. The ROC analysis demonstrated that morphometric measurements based on the body length-to-width ratio were insufficient to differentiate F. hepatica from intermediate-form *Fasciola* specimens.
Conclusion: Intermediate-form *Fasciola* was identified for the first time in the Eastern Anatolia Region of Türkiye using the PCR-RFLP method. The findings reveal that classical morphometric analysis alone is inadequate for the definitive identification of *Fasciola* species and morphologically similar forms, highlighting the necessity of molecular methods such as PCR-RFLP.
Keywords: *Fasciola hepatica*, intermediate-form *Fasciola*, PCR-RFLP, Morphometry, Türkiye.

FASCIOLA HEPATICA VE ARA FORM *FASCIOLA*'NIN AYRIMINDA MORFOMETRİK ÖLÇÜMLERİN YETERSİZLİĞİ VE PCR-RFLP'NİN ÖNEMİ

ÖZET
Amaç: Bu çalışmada, mezbahada kesimi yapılan sığır, koyun ve keçilerin karaciğer safra kanallarından elde edilen erişkin *Fasciola* türlerinin morfometrik ölçümler ve moleküler yöntemler kullanılarak ayrıntılı bir şekilde incelenmesi amaçlanmıştır.
Gereç ve Yöntem: Enfekte sığır, koyun ve keçilerden elde edilen *Fasciola* izolatlarından rastgele seçilen 50 erişkin örnek çalışmaya dahil edilmiştir. Parazitlerin temel morfometrik ölçümleri stereo mikroskop altında (X8 büyütmede) gerçekleştirilmiştir. Tür tayinini moleküler düzeyde gerçekleştirmek amacıyla, gDNA izolasyonunu takiben ribosomal DNA'ya ait ITS1 bölgesi PCR yöntemiyle çoğaltılmıştır. Elde edilen PCR amplikonları PCR-RFLP yöntemiyle *RsaI* restriksiyon enzimi kullanılarak kesim işlemine tabi tutulmuştur.

Morfometrik verilerin (vücut uzunluğu/genişliği oranı) tür ayrımındaki başarısı ve tanısal değeri ROC analizi ile değerlendirilmiştir.
Bulgular: PCR-RFLP analizi sonucunda incelenen 50 izolatın 45'inin *Fasciola hepatica*, 5'inin ise ara form *Fasciola* olduğu kesin olarak belirlenmiştir. Yapılan ROC analizi sonuçları, vücut uzunluğu/genişliği oranına dayalı morfometrik ölçümlerin *F. hepatica* ile ara form *Fasciola* örneklerini birbirinden ayırmada yetersiz kaldığını ve bu iki grubu belirgin bir şekilde ayıramadığını göstermiştir.
Sonuç: *Fasciola*'nın ara formu bu çalışma ile PCR-RFLP yöntemi kullanılarak Türkiye'nin Doğu Anadolu Bölgesi'nde ilk defa belirlenmiştir. Elde edilen bulgular, *Fasciola* türlerinin ve fenotipik olarak karışık formların kesin teşhisinde klasik morfometrik analizlerin tek başına yeterli olmadığını ve PCR-RFLP gibi moleküler yöntemlerin kullanımının zorunlu olduğunu ortaya koymaktadır.
Anahtar Kelimeler: *Fasciola hepatica*, Ara form *Fasciola*, PCR-RFLP, Morfometri, Türkiye.

AN INVESTIGATION INTO THE VISIBILITY STABILITY OF AUTOMOBILE BRANDS ACROSS REPEATED QUERIES IN AI SEARCH ENGINES

Lec. Dr. Burcu TEKİN
Ankara Bilim University, Vocational School, E-Commerce and Marketing Program, Ankara, Türkiye
ORCID ID: 0000-0002-8967-9181

ABSTRACT
The increasing use of generative artificial intelligence–based search systems by consumers in information search and alternative evaluation processes has created a new research domain concerning brand visibility. While visibility in traditional search engines is largely assessed through a brand's ranking in search results, in generative artificial intelligence systems, whether a brand is recommended within the generated response and the position in which it is presented have become increasingly important. This study aims to examine the visibility stability of automobile brand recommendations generated by ChatGPT-5.6 across different purchase scenarios. Visibility stability refers to the consistency with which brands appear in the recommendation set and maintain their ranking positions when equivalent queries are repeated. Ten automobile purchase scenarios were developed, focusing on family use, safety, value for money, resale value, durability, fuel economy, urban use, long-distance travel and comfort, technology, and after-sales service and service network. Each scenario was repeated ten times in independent chat sessions, yielding a total of 100 ChatGPT-5.6 responses for analysis. The first five brands recommended in each response were coded, and visibility stability was evaluated across two dimensions. These dimensions comprised the Inclusion Stability Index, which indicates the number of times a brand appeared in the recommendation set across ten repetitions, and the Ranking Stability Analysis, which reveals variations in the brands' recommended rankings. The findings demonstrate that brand visibility varies depending on the purchase scenario and that certain brands exhibit highly stable visibility in particular contexts. Toyota ranked first in every repetition of the family use, durability, and fuel economy scenarios. In the safety scenario, Mercedes-Benz was recommended in all responses, while Volvo appeared in 90% of the responses. In the value-for-money scenario, all five recommended brands were retained across every repetition, although their ranking positions varied. In the technology scenario, the Turkish domestic automobile brand Togg was recommended in seven out of ten repetitions and ranked first in two of them. This represents an important finding demonstrating that brand visibility is reshaped according to the context of the query. The study proposes a two-dimensional framework for measuring visibility in generative AI environments by incorporating the dimensions of inclusion stability and ranking stability into brand visibility assessment through a repeated-query measurement design.
Keywords: Generative AI, AI Search Engines, Brand Visibility, Visibility Stability, Automobile Brands

AI ARAMA MOTORLARINDA OTOMOBİL MARKALARININ TEKRARLANAN SORGULARDAKİ GÖRÜNÜRLÜK KARARLILIĞI ÜZERİNE BİR İNCELEME

ÖZET
Üretken yapay zekâ tabanlı arama sistemlerinin tüketiciler tarafından bilgi arama ve alternatifleri değerlendirme süreçlerinde giderek daha fazla kullanılması, marka görünürlüğü açısından yeni bir araştırma alanı ortaya çıkarmaktadır.

Geleneksel arama motorlarında görünürlük, büyük ölçüde markanın arama sonuçlarındaki sıralaması üzerinden değerlendirilirken üretken yapay zekâ sistemlerinde markanın oluşturulan yanıt içerisinde önerilmesi ve hangi sırada sunulduğu önem kazanmaktadır. Bu araştırmanın amacı, ChatGPT-5.6 tarafından sunulan otomobil markası önerilerinin farklı satın alma senaryolarında görünürlük kararlılığını (markaların eş değer sorguların tekrarlanması sonucunda öneri setinde yer alma ve sıralanma kararlılığını) incelemektir. Araştırmada aile kullanımı, güvenlik, fiyat-performans, ikinci el değeri, dayanıklılık, yakıt ekonomisi, şehir içi kullanım, uzun yol ve konfor, teknoloji ile satış sonrası hizmet ve servis ağı olmak üzere on otomobil satın alma senaryosu oluşturulmuştur. Her senaryo, bağımsız sohbet oturumlarında on kez tekrarlanmış ve toplam 100 ChatGPT-5.6 yanıtı incelenmiştir. Her yanıtta önerilen ilk beş marka kodlanmış ve görünürlük kararlılığı iki boyutta değerlendirilmiştir. Bu boyutlar, markaların on tekrarın kaçında öneri setinde yer aldığını gösteren Yer Alma Kararlılığı Endeksi ile markaların öneri sıralarındaki değişkenliği ortaya koyan Sıralama Kararlılığı Analizidir. Bulgular, marka görünürlüğünün satın alma senaryosuna göre farklılaştığını ve bazı markaların belirli senaryolarda yüksek düzeyde kararlı bir görünürlük sergilediğini göstermiştir. Toyota, aile kullanımı, dayanıklılık ve yakıt ekonomisi senaryolarında tüm tekrarlarda birinci sırada yer almıştır. Güvenlik senaryosunda ise Mercedes-Benz tüm yanıtlarda, Volvo da yanıtların %90'ında önerilmiştir. Fiyat-performans senaryosunda önerilen beş markanın tamamının tüm tekrarlarda korunmasına karşın sıralamaların değişkenlik göstermesi dikkat çekmiştir. Teknoloji senaryosunda yerli otomobil markası Togg'un 10 tekrarın 7'sinde önerilmesi ve iki tekrarda ilk sırada yer alması, marka görünürlüğün sorgunun bağlamına göre yeniden şekillendiğini ortaya koyan önemli bir bulgudur. Çalışma, tekrarlanan sorgulara dayanan ölçüm tasarımıyla marka görünürlüğü değerlendirmesine yer alma kararlılığı ve sıralama kararlılığı boyutlarını kazandırarak, üretken yapay zekâ ortamlarında görünürlüğün ölçümüne yönelik iki boyutlu bir çerçeve önermektedir.

Anahtar Kelimeler: Üretken Yapay Zekâ, Yapay Zekâ Arama Motorları, Marka Görünürlüğü, Görünürlük Kararlılığı, Otomobil Markaları

1. GİRİŞ

Üretken yapay zekâ tabanlı arama sistemlerinin tüketicilerin bilgi arama ve alternatifleri değerlendirme süreçlerindeki rolü giderek artmaktadır. Bu sistemlerin tüketici karar sürecine dâhil olması, markaların dijital ortamlardaki görünürlüğünün de farklı bir çerçevede ele alınmasını gerekli kılmakta ve marka görünürlüğü açısından yeni bir araştırma alanı oluşturmaktadır. Bilgi arama ve alternatiflerin değerlendirilmesi, tüketicilerin satın alma karar sürecinde önemli bir yere sahiptir. Tüketiciler bu aşamalarda ihtiyaç duydukları bilgiye ulaşmak ve farklı seçenekleri karşılaştırmak amacıyla çeşitli kaynaklardan yararlanmaktadır. Son yıllarda ise geleneksel arama motorlarının yanı sıra ChatGPT gibi üretken yapay zekâ araçlarının da ürün ve marka araştırmalarında başvurulan bilgi kaynakları arasında yer almaya başladığı görülmektedir (Gude, 2025).

Yu, Yan ve Cai (2024), kullanıcıların ChatGPT'yi zengin, ilgili ve kapsamlı bilgi sunan bir araç olarak değerlendirdiklerini, aynı zamanda diğer arama motorlarına kıyasla daha güvenilir ve yüksek performanslı bir alternatif olarak gördüklerini belirtmektedir. Benzer şekilde Xu, Feng ve Chen (2023), de ChatGPT tarafından sunulan bilgilerin kullanıcılar tarafından Google Search üzerinden elde edilen bilgilere göre daha yüksek kalitede algılandığını ortaya koymaktadırlar. Buna ek olarak çalışmada ayrıca ChatGPT'nin faydalılık, keyif ve memnuniyet açısından da Google Search'e kıyasla daha olumlu değerlendirildiği görülmektedir.

Geleneksel arama ortamlarında marka görünürlüğü çoğunlukla arama sonuçlarındaki sıralama ve tıklanma oranları üzerinden değerlendirilirken, üretken yapay zekâ sistemlerinin yaygınlaşması bu yapıyı değiştirmeye başlamıştır.

Bu sistemlerde kullanıcılar, sıralanmış bağlantılar arasından seçim yapmak yerine, farklı kaynaklardan elde edilen bilgilerin bir araya getirilmesiyle oluşturulan doğrudan yanıtlarla karşılaşmaktadır (Marutheesh ve Mohanty, 2025). Üretken yapay zekâ ortamında bir markanın yalnızca erişilebilir ya da bulunabilir olması yeterli olmayabilir; markanın kullanıcıya sunulan yanıt içerisinde önerilen seçenekler arasında yer alması da önem kazanmaktadır (Chen et al., 2025). Büyük dil modelleri, markaların yapay zekâ aracılı ortamlarda nasıl değerlendirildiğini ve üretilen yanıtlarda nasıl görünür hâle geldiğini etkileyen birer "kapı bekçisi" (gatekeeper) işlevi görebilmektedir (Smyth ve Dawson, 2025). Bu değişim, markaların dijital ortamlardaki görünürlüğüne de farklı bir boyut kazandırmaktadır. Bu değişim, markaların dijital ortamlardaki görünürlüğüne de farklı bir boyut kazandırmaktadır. Üretken yapay zekâ ortamında bir markanın yalnızca erişilebilir ya da bulunabilir olması yeterli olmamaktadır. Markanın kullanıcıya sunulan yanıt içerisinde önerilen seçenekler arasında yer alması da önem kazanmaktadır (Chen vd., 2025). Bu noktada büyük dil modelleri, hangi markaların yanıtlarda yer alacağı ve bu markaların nasıl sunulacağı üzerinde etkili olabilmektedir. Dolayısıyla bu modeller, markaların yapay zekâ aracılı bilgi ortamlarındaki görünürlüğünü şekillendiren bir tür "kapı bekçisi" (gatekeeper) işlevi görebilmektedir (Smyth ve Dawson, 2025).

Literatürde ChatGPT'nin tüketici araştırmaları ve pazarlama açısından sunduğu olanakların yanı sıra ChatGPT'nin kullanımına bağlı olarak ortaya çıkabilecek çeşitli riskler de tartışılmaktadır (Paul vd., 2023). Tüketici davranışları açısından bakıldığında, çalışmalar özellikle yapay zekâ tarafından sunulan önerilerin tüketiciler tarafından nasıl karşılandığı üzerinde durmaktadır. Kim vd. (2023), tüketicilerin yapay zekâ tarafından oluşturulan önerilere genel olarak olumlu yaklaştıklarını ve sunulan seçeneklerin sayısı arttığında dahi ChatGPT'yi bir öneri aracı olarak kullanmayı tercih ettiklerini ortaya koymaktadır. Benzer şekilde Gerlich (2025), nesnellik ve doğruluğun önem taşıdığı ürün kategorilerinde tüketicilerin yapay zekâ tarafından sunulan önerileri insan etkileyicilerin önerilerine tercih edebildiğini göstermektedir. Bu bulgular, üretken yapay zekâ araçlarının tüketiciler açısından yalnızca bilgi edinilen bir kaynak değil, alternatiflerin değerlendirilmesinde ve tercihlerin şekillenmesinde başvurulan bir öneri aracı hâline geldiğine işaret etmektedir.

Bununla birlikte, üretken yapay zekâ sistemlerinin aynı girdiye her zaman aynı yanıtı vermemesi, bu sistemlerin değerlendirilmesinde göz önünde bulundurulması gereken önemli bir unsur olarak değerlendirilebilir. Yanıt üretim sürecindeki değişkenlik nedeniyle aynı soru farklı zamanlarda tekrarlandığında farklı çıktılar elde edilebilmektedir (Lancaster, 2023).

Nitekim ChatGPT tarafından üretilen yanıtlarda çeşitli hata ve tutarsızlıkların görülebildiği literatürde daha önceki çalışmalarda da ortaya konulduğu görülmektedir (Borji, 2023). Bu nedenle, yapay zekâ sistemlerinin performansını tek bir yanıta dayanarak değerlendirmek yerine, aynı girdiyi birden fazla kez tekrarlamak ve elde edilen yanıtları birlikte değerlendirmek daha sağlıklı bir yaklaşım olarak görülmektedir (Zhu vd., 2024). Marka görünürlüğü açısından değerlendirildiğinde ise bu değişkenlik, bir markanın tek bir sorguda görünür olmasının her zaman aynı şekilde önerileceği anlamına gelmediğini göstermektedir. Dolayısıyla üretken yapay zekâ ortamlarında marka görünürlüğünün, tekrarlanan sorgular boyunca ne ölçüde korunduğunun da dikkate alınması gerekmektedir (Marutheesh ve Mohanty, 2025).

Bu çalışmanın amacı, ChatGPT tarafından önerilen otomobil markalarının farklı satın alma senaryolarındaki görünürlük kararlılığını incelemektir. Bu kapsamda, aynı sorguların tekrarlanması durumunda hangi markaların öneriler arasında yer aldığı ve bu markaların sıralamalarının ne ölçüde değiştiği ele alınmaktadır. Buradan hareketle çalışmanın araştırma sorusu, "ChatGPT tarafından önerilen otomobil markaları, farklı satın alma senaryolarında tekrarlanan sorgular boyunca ne ölçüde kararlı bir görünürlük sergilemektedir?" şeklinde belirlenmiştir. Çalışmada marka görünürlüğü yalnızca bir markanın öneriler arasında yer alıp almaması üzerinden değil, tekrarlanan sorgulardaki yer alma ve sıralama kararlılığı birlikte dikkate alınarak değerlendirilmektedir.

Bu yönüyle araştırma, üretken yapay zekâ ortamlarında marka görünürlüğünün ölçülmesine yönelik, tekrarlı ölçüme dayanan iki boyutlu bir değerlendirme yaklaşımı sunarak literatüre katkı sağlamaktadır.

2. KAVRAMSAL ÇERÇEVE VE LİTERATÜR

2.1. Geleneksel Arama Motorlarından Üretken Yapay Zekâ Tabanlı Aramaya Geçiş

Dijital ortamda bilgi arama biçimi, üretken yapay zekâ sistemlerinin yaygınlaşmasıyla birlikte değişmeye başladığı söylenebilmektedir. Geleneksel arama motorlarında kullanıcılar, arama sonuçlarında sıralanan bağlantılar arasından seçim yaparak ihtiyaç duydukları bilgiye ulaşırken, üretken yapay zekâ tabanlı arama sistemleri farklı kaynaklardan elde edilen bilgileri bir araya getirerek kullanıcıya doğrudan yanıt sunmaktadır. Bu nedenle geleneksel arama ortamlarında görünürlük büyük ölçüde arama sonuçlarındaki sıralama ve tıklanma oranları üzerinden değerlendirilirken, üretken yapay zekâ ortamlarında bir marka ya da kaynağın oluşturulan yanıt içerisinde yer alması önem kazanmaktadır (Marutheesh ve Mohanty, 2025).

Sektör verileri de kullanıcıların bilgi arama davranışlarında yaşanan bu değişime işaret etmektedir. Geleneksel arama hacminin 2026 yılına kadar %25 oranında azalacağı öngörülürken, Google aramalarının %58,5'inin herhangi bir harici web sitesine tıklanmadan sonuçlandığı ve kullanıcıların %41'inin bağlantı listesini incelemek yerine doğrudan oluşturulmuş bir yanıt almayı tercih ettiği bildirilmektedir (Blanco, 2026). Bu gelişmeler, dijital görünürlüğün yalnızca arama sonuçlarındaki konum veya tıklanma oranları üzerinden değerlendirilmesinin yeterli olmayabileceğini göstermektedir. Üretken yapay zekâ tabanlı arama ortamlarında görünürlük, markaların oluşturulan yanıtların içerisinde ne ölçüde yer aldığı ve kullanıcıya hangi konumda sunulduğu üzerinden de değerlendirilmesi gereken bir konu hâline gelmektedir.

2.2. Üretken Yapay Zekâ Sistemlerinde Marka Görünürlüğü

Üretken yapay zekâ sistemlerinin bilgi arama süreçlerinde daha fazla kullanılmaya başlanması, marka görünürlüğünün bu ortamlarda nasıl ölçülebileceği sorusunu da beraberinde getirmiştir. Bu doğrultuda geliştirilen Yapay Zekâ Görünürlük Endeksi (AIVI), markaların üretken bilgi motorlarındaki görünürlüğünü anılma sıklığı ve yanıt içerisindeki konumu üzerinden değerlendirmektedir (Marutheesh ve Mohanty, 2025). Benzer şekilde Üretken Motor Pazarlaması (GEM) çerçevesinde de marka görünürlüğü, anılma oranı ve ortalama konum gibi ölçütler üzerinden ele alınmakta; bunun yanı sıra markaların hangi kategorilerle ilişkilendirildiği incelenerek büyük dil modellerinin markalara yönelik oluşturduğu algı değerlendirilmektedir (Smyth ve Dawson, 2025).

Üretken Motor Optimizasyonu (GEO) yaklaşımı ise konuya markalar arasındaki rekabet açısından yaklaşmaktadır. Bu ortamda rekabetin giderek yapay zekânın kullanıcıya sunduğu sınırlı sayıdaki seçenek üzerinde yoğunlaştığı ve dolayısıyla markalar açısından yalnızca görünür olmanın değil, önerilen seçenekler arasında yer almanın da önem kazandığı belirtilmektedir (Chen vd., 2025). Ancak bir markanın belirli bir yanıtta yer alması, aynı görünürlüğün sonraki sorgularda da korunacağı anlamına gelmemektedir. Nitekim aynı turistik sorguları üç farklı zamanda tekrarlayan Quintana-Gómez (2026), yapay zekâ tarafından sunulan otel önerilerinde markaların görünürlüğünün önemli ölçüde değişebildiğini ve hangi markaların önerildiğinin kullanılan sisteme ve sorgunun gerçekleştirildiği zamana bağlı olarak farklılaşabildiğini ortaya koymuştur. Bu bulgu, üretken yapay zekâ ortamlarında marka görünürlüğünün yalnızca belirli bir anda elde edilen sonuçlar üzerinden değil, tekrarlanan sorgular boyunca ne ölçüde korunduğu açısından da incelenmesi gerektiğine işaret etmektedir.

2.3. Tekrarlanan Sorgularda Görünürlük Kararlılığı: Yer Alma ve Sıralama Kararlılığı

Bu çalışmada görünürlük kararlılığı, öneri sistemleri literatüründe farklı öneri görevleri için ayrı ölçütlerle ele alınan kararlılık (recommendation stability) ve sıralama kararlılığı (ranking stability) yaklaşımlarından hareketle iki boyutlu bir yapı olarak ele alınmaktadır. Bu boyutlar yer alma kararlılığı ve sıralama kararlılığı şeklindedir. Öneri sistemleri literatüründe kararlılığı Adomavičius ve Zhang (2012), bir öneri algoritmasının birbiriyle tutarlı tahminler üretme düzeyi olarak tanımlamaktadır. Sıralama kararlılığı ise literatürde iki liste arasındaki sıralama benzerliği üzerinden tanımlanmaktadır. Sıra duyarlı ölçütler, yalnızca referans öğenin değil tüm öğelerin konum değişimlerini dikkate aldığı için klasik metriklerin yakalayamadığı farklılıkları görünür kılmaktadır. Rank-Biased Overlap bu amaçla kullanılan sıra duyarlı bir ölçüt olup 0 ile 1 arasında değer almakta ve üst sıralardaki benzerliğe daha yüksek ağırlık vermektedir (Oh vd., 2022).

Bu çalışmada ise görünürlük kararlığının, yer alma ve sıralama kararlığı şeklinde iki farklı boyutta ele alınması üretken yapay zekâ yanıtlarının belirlenimci olmayan doğasından kaynaklanmaktadır. Lancaster'a (2023) göre ChatGPT'nin yanıt üretimi, eğitilmiş model, girdi verisi, sohbetin önceki bölümleri ve kullanıcı tarafından görülemeyen rastgele bir sayı (seed) tarafından belirlenmektedir. Aynı girdi aynı seed değeriyle sunulduğunda aynı yanıt üretilebilse de seed değerinin sohbet sırasında değişebilmesi nedeniyle aynı sorunun yeniden sorulması neredeyse farklı yanıtlar üretebilmektedir (Lancaster, 2023). Nitekim ChatGPT'nin yanıtlarında tutarsızlık ve çelişkilerin ortaya çıkabildiği, hatta aynı soruya tekrarlanan sorgulamalarda farklı yanıtlar üretebildiğini ifade eden çalışmalar bulunmaktadır (Borji, 2023). Bu nedenle üretken yapay zekâ performansının değerlendirilmesinde aynı girdiye birden fazla yanıt üretilmesi ve bu yanıtların bir bütün olarak incelenmesi önerilmektedir. Aksi hâlde yanlı sonuç çıkarma riskinin yüksek olduğu vurgulanmaktadır (Zhu vd., 2024). Tekrarlanan özdeş sorgular altında ChatGPT'nin davranışını sistematik biçimde karakterize eden çalışmalar da tekrarlı değerlendirmenin önemini desteklemektedir (Heya, vd., 2024).

Yer alma kararlılığı boyutu, öneri sistemleri literatüründeki top-K set üyeliği kararlılığıyla kavramsal olarak örtüşmektedir. Oh ve arkadaşları (2022), öneri listelerinin etkileşim düzeyindeki veri bozulmalarına (interaction perturbations) karşı duyarlılığını incelerken, perturbasyon öncesi ve sonrası top-K öneri kümelerinin üyelik örtüşmesini Jaccard benzerliğiyle ölçülmektedir (Oh vd., 2022). Büyük dil modelleri bağlamında da aynı boyut, tekrarlanan özdeş sorgular altında yanıt kararlılığı (response/answer stability) olarak incelenmektedir.

Sıralama kararlılığı boyutu ise öneri sistemleri literatüründe ayrı bir kararlılık türü olarak ele alınmaktadır. Oh ve arkadaşları sıra benzerliğini Rank-Biased Overlap metriğiyle ölçmektedirler (Oh vd.,2022). Arama motorları bağlamında Batri ve arkadaşları (2025), Google ve Bing'de tekrarlanan özdeş sorgular sonucunda oluşan sıralama değişimlerini inceledikleri çalışmalarında geliştirdikleri Rmeasure çerçevesinde örtüşen ve örtüşmeyen sonuçları ayrı bileşenler üzerinden değerlendirerek arama sonuçlarının sıralama kararlılığını ölçmektedirler (Batri vd.,2025). Bu literatür, öneri setinin aynı kalmasının sıralamaların da aynı kalacağı anlamına gelmediğini. Yer alma ve sıralamanın birbirinden bağımsız olarak değişkenlik gösterebileceğini ortaya koymaktadır.

İncelenen literatürde yer alan çalışmalar ağırlıklı olarak doğruluk ve eğitim bağlamlarına odaklandığı marka görünürlüğünün tekrarlanan sorgulardaki kararlılığı pazarlama literatüründe yeterince ele alınmadığı görülmektedir. Bu doğrultuda bu çalışmada görünürlük kararlılığı; markanın on tekrarın kaçında öneri setinde yer aldığını gösteren yer alma kararlılığı ile markanın öneri sırasındaki değişkenliği gösteren sıralama kararlılığı boyutlarıyla ele alınmış ve söz konusu boşluk otomobil markaları özelinde doldurulmaya çalışılmıştır.

3. YÖNTEM

3.1. Araştırma Tasarımı

Araştırma, ChatGPT tarafından üretilen otomobil markası önerilerinin tekrarlanan sorgulardaki görünürlük kararlılığını betimleyici (descriptive) tasarımla incelemektedir. Betimleyici tasarımın tercih edilmesinin nedeni, çalışmanın amacının bir müdahale ya da değişken manipülasyonu yoluyla nedensel bir ilişki kurmak değil modelin doğal yanıt davranışının tekrarlanan sorgular altında hangi örüntüleri ürettiğini sistematik biçimde gözlemlemek ve betimlemek olmasından kaynaklanmaktadır. Bu doğrultuda araştırma, yapay zekâ yanıtlarının olasılıksal doğasını dikkate alarak tek seferlik bir gözlem yerine tekrarlı bir örnekleme mantığı benimsemektedir. Bu doğrultuda araştırma, yapay zekâ çıktılarının olasılıksal doğasını dikkate alarak tek seferlik bir gözlem yerine tekrarlı bir örnekleme yaklaşımını benimsemektedir. Nitekim büyük dil modellerinin ürettiği tek bir çıktı, modelin olasılık dağılımından elde edilen yalnızca tek bir örneği temsil etmekte ve bu nedenle tekil çıktılara dayalı değerlendirmeler modelin içsel değişkenliğini ve güvenilirliğini yeterince yansıtmayabilmektedir (Schroeder ve Wood-Doughty, 2025). Nitekim, deterministik olması beklenen ayarlarda dahi büyük dil modellerinin aynı girdiler karşısında kararlı çıktılar üretmeyebildiği tekrarlı çalıştırmalar arasında doğruluk farklılıklarının %15'e kadar çıktığı ve en iyi olası performans ile en kötü olası performans arasındaki farkın yaklaşık %70'e ulaşabildiği gösterilmektedir (Atil vd. 2025). Bu nedenle görünürlük kararlılığı, ancak özdeş sorguların birden fazla kez tekrarlanmasıyla anlamlı biçimde ölçülebilir duruma geleceği düşünülmektedir

Bu kapsamda, tüketicilerin otomobil satın alırken dikkate alabileceği farklı değerlendirme boyutlarını temsil etmek üzere aile kullanımı, güvenlik, fiyat-performans, ikinci el değeri, dayanıklılık, yakıt ekonomisi, şehir içi kullanım, uzun yol ve konfor, teknoloji ile satış sonrası hizmet ve servis ağı olmak üzere on satın alma senaryosu oluşturulmuştur. Senaryoların çeşitlendirilmesinde, otomobil satın alma kararının çok boyutlu bir süreç olması ve önceki çalışmalarda fiyat, marka, güvenlik, yakıt ekonomisi, bakım, güvenilirlik, iç hacim ve bagaj alanı, performans, ikinci el değeri ve araç büyüklüğü gibi farklı unsurların tüketicilerin satın alma kararlarıyla ilişkilendirilmesi dikkate alınmıştır (Kassim vd., 2016). Farklı pazarlarda yürütülen çalışmalar, bu kriterlerin göreli öneminin bağlama göre değişebildiğini göstermektedir. ABD'de yeni araç alıcıları üzerinde yürütülen bir araştırmada, araç satın alma kriterleri arasında güvenlik ve performansın çevresel özelliklere kıyasla daha yüksek önceliğe sahip olduğu belirlendiği görülmektedir (Fujita vd., 2022). Marka tercihi özelinde yürütülen bir çalışmada tüketicilerin en çok tercih ettiği markanın Toyota olduğu; yedek parça bulunabilirliği, marka imajı ve dayanıklılığın belirli bir otomobil markasının tercih edilmesinde öne çıkan faktörler olduğu, güvenliğin ise otomobil satın alma kararında en üst sıradaki değerlendirme ölçütü olarak belirtildiği görülmektedir (Ahmad vd. 2013). Satış sonrası hizmetin satın alma kararı üzerinde etkisinin bulunmadığını raporlayan bulgular da mevcuttur (Shrestha, 2022). Bu farklılıklar, değerlendirme kriterlerinin evrensel bir ağırlık sırası oluşturmadığını ve senaryoların farklı değerlendirme mantıklarını ayrı ayrı temsil edecek biçimde kurgulanması gerektiğini göstermektedir. Bu bulgular, senaryoların gerçek tüketici değerlendirme mantığını temsil edecek biçimde kurgulanmasına dayanak oluşturmaktadır.

Senaryo yaklaşımının temel varsayımı, tek bir genel “otomobil öner” sorgusuna dayalı bir değerlendirmenin farklı satın alma ölçütlerini birbirinden ayrıştırmadan ele alacağı ve bu nedenle marka görünürlüğünün sorgunun bağlamına göre değişen yapısını yeterince yansıtamayacağı şeklindedir. Bu nedenle bu çalışmada her senaryo, tek bir satın alma bağlamına odaklanan eş değer bir sorguyla temsil edilmektedir. Sorgu metinleri kurgulanırken cümle kalıbı sabit tutulmuştur. Sadece değerlendirme kriterini ifade eden bölüm değiştirilmiştir. Bu sabit tutma stratejisi, senaryolar arasında gözlemlenecek çıktı farklılıklarının söz dizimsel ya da biçimsel farklılıklardan değil, doğrudan sorgunun bağlamından kaynaklandığının daha güvenilir biçimde yorumlanabilmesini sağlamaktadır.

Her bir sorgu metni dört ortak bileşenden oluşmaktadır. Bunlar: pazar bağlamını sabitleyen coğrafi referans, satın alma niyetini ifade eden çerçeveleme, senaryoya özgü değerlendirme kriteri ve öneri setinin kapsamını belirleyen talimattır. Sorguların tamamı beş marka önerilmesini ve önerilen her marka için kısa bir gerekçe sunulmasını istemektedir. Beş marka şeklinde sınırlandırma, kodlamada kullanılan top-K yaklaşımıyla uyumlu bir öneri seti tanımlamaktadır. Sorgularda istenen gerekçe talebi ise modelin önerileri gerekçelendirilmiş bir seçenek olarak mı yoksa yalnızca bir marka listesi olarak mı sunduğunu görünür kılmaktadır.
Bu tasarım, görünürlük kararlılığının iki boyutlu olarak operasyonelleştirilmesini mümkün kılmaktadır. Aynı senaryonun özdeş sorguyla tekrarlanması, bir yandan markanın öneri setinde yer alıp almadığının (yer alma kararlılığı), diğer yandan öneri seti içindeki sıralamasının (sıralama kararlılığı) tekrarlar boyunca izlenmesine olanak tanımaktadır. Böylece tasarım, yalnızca hangi markaların önerildiğini değil, bu önerinin tekrarlar arasında ne ölçüde korunduğunu ve sıralamanın ne ölçüde değişkenlik gösterdiğini bir arada değerlendirmeye imkân vermektedir. Tablo 1'de araştırmada kullanılan on senaryo ve her senaryoyu temsil eden sorgu metinleri sunulmaktadır.

Tablo 1. Satın Alma Senaryoları ve Veri Toplamada Kullanılan Sorgu Metinleri

Kod	Kriter	Sorgu Metni
S1	Aile Kullanımı	Türkiye'de otomobil satın almayı düşünüyorum. Aile kullanımı açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S2	Güvenlik	Türkiye'de otomobil satın almayı düşünüyorum. Güvenlik açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S3	Fiyat-Performans	Türkiye'de otomobil satın almayı düşünüyorum. Fiyat-performans açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S4	İkinci El Değeri	Türkiye'de otomobil satın almayı düşünüyorum. İkinci el değerini koruma açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S5	Dayanıklılık	Türkiye'de otomobil satın almayı düşünüyorum. Dayanıklılık ve uzun ömürlü kullanım açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S6	Yakıt Ekonomisi	Türkiye'de otomobil satın almayı düşünüyorum. Yakıt ekonomisi ve düşük kullanım maliyeti açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S7	Şehir içi Kullanım	Türkiye'de otomobil satın almayı düşünüyorum. Şehir içi günlük kullanım açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S8	Uzun Yol ve Konfor	Türkiye'de otomobil satın almayı düşünüyorum. Uzun yol kullanımı ve konfor açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S9	Teknoloji	Türkiye'de otomobil satın almayı düşünüyorum. Teknolojik özellikler açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.
S10	Satış Sonrası Hizmetler	Türkiye'de otomobil satın almayı düşünüyorum. Satış sonrası hizmet ve servis ağı açısından bana en uygun 5 otomobil markasını öner. Önerdiğin her marka için neden önerdiğini kısaca açıkla.

3.2. Veri Toplama Süreci

Veri toplama süreci, bir önceki bölümde yer alan on senaryonun her birinin bağımsız sohbet oturumlarında on kez tekrarlanması biçiminde kurgulanmıştır. Böylece on senaryo × on tekrar = 100 ChatGPT yanıtı elde edilmiş ve analiz birimini bu yanıtların tamamı oluşturmuştur. Her tekrar tek bir sohbet oturumuna karşılık gelmektedir. Bir oturum içinde yalnızca ilgili senaryonun sorgu metni gönderilmekte, modelin yanıtı alındıktan sonra oturum sonlandırılmakta ve bir sonraki tekrar için yeni bir oturum başlatılmaktadır. Lancaster'a (2023) göre, aynı girdi aynı seed değeriyle işlendiğinde aynı çıktı üretilebilmekle birlikte, kullanılan seed değerinin sohbet süresince değişebilmesi, aynı sorunun tekrar sorulması durumunda farklı yanıtların ortaya çıkmasına yol açabilmektedir. Bu durumda aynı oturum içinde yapılan tekrarlar, önceki yanıtların bağlam penceresine eklenmesi nedeniyle bağımsız gözlem niteliğini yitirmekte ve tutarlılığı olduğundan yüksek gösterebilir. Böylece her tekrarın yeni bir oturumda başlatılması, gözlemlenecek değişkenliğin diyalog geçmişinden değil, modelin özdeş girdiye verdiği doğal yanıt dağılımından kaynaklandığını güvence altına almaktadır. Bu doğrultuda, her tekrarda sorgu metni değiştirilmeden ve sözcük düzeyinde özdeş biçimde gönderilmektedir.

Veri toplama süreci, ChatGPT-5.6 ortamında oluşturulan senaryolar temelinde yürütülmüş ve her bir senaryo için aynı sıralı adımlar izlenmiştir. Her tekrarın başlangıcında yeni bir sohbet oturumu açılmış, ardından ilgili senaryoya ait sorgu metni herhangi bir değişiklik yapılmadan modele gönderilmiştir. Modelin yanıtının tamamlanması beklenmiş ve yanıt üretimi kesintiye uğratılmamıştır. Elde edilen yanıt herhangi bir düzenleme yapılmadan ham metin olarak kaydedilmiştir. Son aşamada oturum kapatılmış ve bir sonraki tekrar için yeni bir oturum açılmıştır. Bu sıralı işleyiş, her gözlemin bağımsız bir oturumda ve özdeş bir girdiyle gerçekleştirilmesini güvence altına alarak tekrarlar arası karşılaştırılabilirliği desteklemektedir. Veri toplama sürecinde izlenen adımlarda sorguya ek bir açıklama, örnek, kısıtlama, biçim talebi veya takip sorusu eklenmemiştir. Yanıtların yalnızca senaryo sorgusuna doğrudan tepki olarak üretilmesi sağlanmıştır. Böylece yanıtlar arasındaki farklılıkların kullanıcı tarafından eklenen yönlendirmelerden değil, doğrudan senaryo bağlamından kaynaklandığı söylenebilmektedir.

Toplanan yanıtlar, senaryo kodu ve tekrar numarası ile etiketlenerek (örneğin S3 senaryosunun üçüncü tekrarı) kayıt altına alınmış ve her kayda toplama tarih ve saati işlenmiştir. Bu etiketleme düzeni, sonraki aşamada marka kodlamasının tekrarlar bazında izlenebilmesini ve herhangi bir yanıtın gerektiğinde ham metnine geri dönülebilmesini mümkün kılmaktadır. Marka kodlaması, kaydedilen ham yanıt metinleri üzerinden yapılmıştır. Her yanıtta önerilen ilk beş marka ve bunların yanıt içindeki sunum sırası belirlenen kodlama kurallarına göre kaydedilmiştir. Veri toplamanın geçerliliği açısından, yanıt üretimini etkileyebilecek koşulların tekrarlar boyunca mümkün olduğunca sabit tutulmasına dikkat edilmiştir. Model sürümünün, arayüz dilinin, kullanıcı hesabının ve erişim koşullarının sabit kalması farklı sürümler veya farklı arayüz koşulları arasındaki davranış farklılıklarının kararlılık ölçümüne karışmasını önlemek açısından önem taşımaktadır. Bu doğrultuda veriler 23.08.2026-25.08.2026 tarihleri arasında ChatCPT-5.6 sürümü kullanılarak toplanmıştır. Toplama sürecinin görece kısa ve kesintisiz bir zaman penceresine sıkıştırılması, modelin arka planda güncellenmesi olasılığını azaltarak tüm yanıtların aynı sürüm davranışını yansıtmasını desteklemektedir.

3.3. Kodlama ve Görünürlük Kararlılığı Endeksi

Veri kodlaması, her yanıtta önerilen ilk beş markanın kaydedilmesiyle gerçekleştirilmiştir. Görünürlük kararlılığı, çalışmada kavramsallaştırıldığı üzere iki boyutlu bir yapı olarak değerlendirilmiştir. Bu boyutlar, markaların on tekrarın kaçında öneri setinde yer aldığını gösteren Yer Alma Kararlılığı Endeksi ile markaların öneri sıralarındaki değişkenliği ortaya koyan Sıralama Kararlılığı Analizi şeklindedir.

Bu iki boyutun ayrı ele alınmasının temel nedeni, yer alma temelli benzerlik ölçütlerinin öğelerin sırasına duyarsız olmasından kaynaklanmaktadır. Bu ölçütler yalnızca bir markanın öneri setinde bulunup bulunmadığını değerlendirir, set içindeki konumunu dikkate almamaktadır.

Yer Alma Kararlılığı Endeksi, her senaryo için ayrı hesaplanmakta ve 0 ile 10 arasında değişmektedir. 10 değeri markanın on tekrarın tamamında öneri setinde yer aldığını, 0 değeri hiçbir tekrarda önerilmediğini göstermektedir. Ara değerler ise markanın tekrarlar boyunca öneri setine girip çıktığını ve görünürlüğünün ne ölçüde değişkenlik gösterdiğini ifade etmektedir. Endeks bu yönüyle, bir markanın on tekrarlık örneklemde öneri setine dâhil edilip edilmediğini ölçen top-K odaklı bir ölçüt olarak işlev görmekte ve öneri sistemleri literatüründeki top-K set üyeliği kararlılığıyla kavramsal olarak örtüşmektedir (Oh vd., 2022). Dolayısıyla Yer Alma Kararlılığı Endeksi'nin yüksek olması, markanın önerildiğini ancak öneri seti içindeki konumunun sabit kaldığını göstermemektedir; öneri setindeki öğelerin değişmemesi, bu öğelerin sıralamadaki konumlarının da değişmediği anlamına gelmemektedir.

Bu doğrultuda çalışmada yer alma kararlılığı, on tekrarlı örneklemde markanın öneri setinde yer alma sıklığı üzerinden sıralama kararlılığı ise tekrarlar arasında gözlemlenen konum değişimlerinin dağılımı üzerinden betimlenmiştir. Bu çalışmada Görünürlük Kararlılığı Endeksi, top-K odaklı bağlama karşılık gelmekte ve bir markanın öneri setine dâhil edilip edilmediğini ölçmektedir. Set üyeliğini ölçen ölçütler sıralamaya duyarsızdır: iki öneri listesinin top-K içeriğinin benzerliğini ölçen Jaccard benzerliği, maddelerin sırasını dikkate almaksızın 0 ile 1 arasında bir değer üretmekte ve modelin kararlı sayılması için bu değerin 1'e yakın olması beklenmektedir (Oh vd., 2022). Dolayısıyla Görünürlük Kararlılığı Endeksi'nin yüksek olması, markanın önerildiğini ama öneri seti içindeki konumunun sabit kaldığını göstermemektedir.

Bu nedenle markaların öneri sıralarındaki değişimler analiz edilerek kararlılığın sıralama boyutu ayrıca incelenmiştir. Sıralama boyutu, set üyeliği boyutundan bağımsız olarak ele alınmıştır. Bunun nedeni, bir marka tüm tekrarlarda önerildiği hâlde ilk sıradaki yerini kaybedebilir ya da öneri setinde kalıcı olarak yer alıp konumunu sürekli değiştirebilmesinden kaynaklanmaktadır.

Özetle bu çalışmada yer alma kararlılığı, on tekrarlı örneklemde markanın öneri setinde yer alma sıklığı üzerinden, sıralama kararlılığı ise tekrarlar arasında gözlemlenen konum değişimlerinin dağılımı üzerinden betimlenmiştir. İki boyutun birlikte ele alınması, görünürlük kararlılığının yalnızca "marka öneri setine girdi mi?" sorusuna değil, "girdiğinde hangi konumda ve ne ölçüde istikrarlı biçimde yer aldı?" sorusuna değil, marka öneri setine girdiğinde hangi konumda ve ne ölçüde istikrarlı biçimde yer aldığı sorusuna da yanıt verilmesini mümkün kılmaktadır.

4. Bulgular

Bu bölümde, on satın alma senaryosunun her birinde on bağımsız tekrar boyunca elde edilen yüz yanıtın kodlanmasıyla ulaşılan bulgular sunulmaktadır. Her yanıtta önerilen ilk beş marka kaydedilmiş, marka görünürlüğü, yer alma kararlılığı (markanın on tekrardan kaçında öneri setine girdiğini gösteren 0–10 endeksi) ve sıralama kararlılığı (tekrarlar arasında markanın listedeki konumunun değişimi) çerçevesinde ayrı ayrı değerlendirilmiştir. On senaryo ve on tekrar, toplam yüz yanıt şeklinde incelenmiştir. Bulgular önce senaryo bazında, ardından senaryolar arası örüntüler düzeyinde ele alınmıştır.

4.1 Senaryo Bazlı Bulgular

4.1.1 Aile kullanımı

Aile kullanımı senaryosuna ilişkin bulgular Tablo 2'de yer almaktadır. Aile kullanımı senaryosundaki bulgular incelendiğinde öneri seti, üç otomobil markasının on tekrarın tamamında yer aldığı bir çekirdek etrafında şekillenmiştir.

Bu otomobil markaları, Toyota, Škoda ve Hyundai şeklindedir. Bu markalardan Toyota'nın Yer Alma Kararlılığı Endeksi 10 (endeks = 10) şeklindedir. Renault dokuz tekrarda önerilmiş ve endeksi 9 olarak belirlenmiştir (endeks = 9) şeklindir. Renault yalnızca beşinci senaryonun beşinci tekrarında (T5) set dışında kalmıştır. Volkswagen sekiz tekrarda (endeks = 8; T4 ve T5 hariç), Honda iki tekrarda (T4, T5; endeks = 2), Kia ise yalnızca bir tekrarda (T5; endeks = 1) öneri setine girebilmiştir. Senaryo boyunca toplam yedi farklı marka görüldüğü tespit edilmiştir. Sıralama boyutunda Toyota on tekrarda da birinci sırada yer alarak mutlak kararlılık sergilemiştir. Škoda ve Hyundai'nin set üyeliği tam kararlı olmasına karşın konumları değişkenlik göstermiştir. Škoda 2 ile 5, Hyundai 2 ile 5 arasında hareket etmiş, Volkswagen ise son tekrarlara doğru beşinci sıraya kaymıştır. Bu örüntü, set üyeliği kararlılığının sıralama kararlılığını garanti etmediğini göstermektedir.

Tablo 2. Senaryo 1'de (aile kullanımı) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Toyota	10	10/10	1, 1, 1, 1, 1, 1, 1, 1, 1, 1
Škoda	10	10/10	5, 2, 2, 4, 4, 2, 2, 2, 2, 2
Hyundai	10	10/10	4, 5, 5, 2, 2, 5, 4, 4, 4, 4
Renault	9	9/10(T5 hariç)	2, 4, 4, 3, –, 3, 3, 3, 3, 3
Volkswagen	8	8/10 (T4, T5 hariç)	3, 3, 3, –, –, 4, 5, 5, 5, 5
Honda	2	2/10 (T4, T5)	–, –, –, 5, 3, –, –, –, –, –
Kia	1	1/10 (T5)	–, –, –, –, 5, –, –, –, –, –

Tabloda yer alan T1–T10, senaryonun bağımsız oturumlarda yapılan on tekrarını temsil etmektedir. "–" işareti ise markanın ilgili tekrarda öneri setinde yer almadığını göstermektedir. Sıralar, her yanıtta önerilen ilk beş marka içindeki konumu ifade etmektedir.

4.1.2 Güvenlik

Güvenlik senaryosuna ilişkin bulgular Tablo 3'te yer almaktadır. Güvenlik senaryosunda marka görünürlüğü iki marka etrafında yoğunlaşmış ve incelenen senaryolar içinde on farklı marka gözlenmiştir. En yüksek marka çeşitliliği (on farklı marka) gözlenmiştir. Mercedes-Benz on tekrarın tamamında öneri setinde yer almış (endeks = 10), Volvo dokuz tekrarda önerilmiş (endeks = 9; yalnızca T1'de set dışı) ve bu iki marka, birlikte önerildikleri dokuz tekrarın tamamında ilk iki sırayı paylaşmıştır. Toyota ve Volkswagen yedişer tekrarda (endeks = 7), Subaru beş tekrarda (endeks = 5), Tesla ve Škoda dörder tekrarda (endeks = 4), BMW iki tekrarda (endeks = 2), Mazda ile Togg ise birer tekrarda (endeks = 1) öneri setine girebilmiştir. Sıralama boyutunda, sık önerilen markaların konumlarının değişken olduğu, seyrek önerilen markaların konumlarının ise sabit olabildiği görülmüştür. Tesla önerildiği dört tekrarın tamamında üçüncü sırada sabit kalırken, Toyota yedi tekrarda önerilmiş ancak konumu üçüncü sıradan beşinci sıraya gerilemiştir. Bu durum, yer alma ve sıralama boyutlarının bağımsız hareket edebildiğini desteklemektedir.

Tablo 3. Senaryo 2'de (güvenlik) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Mercedes-Benz	10	10/10	1, 2, 2, 2, 1, 2, 2, 2, 2, 2
Volvo	9	9/10 (T1 hariç)	–, 1, 1, 1, 2, 1, 1, 1, 1, 1
Toyota	7	7/10 (T6, T7, T8 hariç)	3, 4, 4, 3, 3, –, –, –, 5, 5
Volkswagen	7	7/10 (T3, T5, T9 hariç)	5, 5, –, 4, –, 4, 5, 4, –, 4
Subaru	5	5/10 (T1, T2, T3, T5, T9)	4, 3, 5, –, 5, –, –, –, 4, –
Tesla	4	4/10 (T3, T6, T8, T10)	–, –, 3, –, –, 3, –, 3, –, 3
Škoda	4	4/10 (T4, T5, T6, T8)	–, –, –, 5, 4, 5, –, 5, –, –
BMW	2	2/10 (T7, T9)	–, –, –, –, –, –, 3, –, 3, –
Mazda	1	1/10 (T1)	2, –, –, –, –, –, –, –, –, –
Togg	1	1/10 (T7)	–, –, –, –, –, –, 4, –, –, –

4.1.3 Fiyat-performans

Fiyat-performans senaryosuna ilişkin bulgular Tablo 4'ter yer almaktadır. Fiyat-performans senaryosu, yer alma ile sıralamanın birbirinden en net biçimde ayrıştığı örneği sunmaktadır. Renault, Dacia, Hyundai, Fiat ve Toyota'nın tamamı on tekrarın tamamında öneri setinde yer almıştır (endeks = 10). Dolayısıyla öneri seti açısından tam kararlılık gözlenmiştir. Senaryo boyunca sete giren marka sayısı beşte sabit kalmış, hiçbir marka setten çıkmamış, sete yeni bir marka girmemiştir.

Buna karşın sıralama boyutu belirgin biçimde değişkenlik göstermektedir. Renault 1 ile 4, Dacia 1 ile 4, Hyundai 2 ile 4, Fiat ise 1 ile 4 arasında konumlanmıştır. Birincilik sırası tekrarlar boyunca değişkenlik göstermiştir. Renault ilk üç tekrarda (T1–T3) birinci sırada yer alırken, dördüncü tekrarda yerini Dacia'ya (T4–T5) bırakmış, altıncı tekrardan itibaren ise Fiat birinciliği onuncu tekrara kadar korumuştur (T6–T10). Toyota ise on tekrarda da beşinci sırada sabit kalmıştır. Öneri setinin hiç değişmemesine karşın sıralamaların bu ölçüde değişmesi, sıralama kararlılığından ayrı bir boyut olduğunu doğrulamaktadır.

Tablo 4. Senaryo 3'te (fiyat-performans) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Renault	10	10/10	1, 1, 1, 3, 3, 4, 4, 4, 4, 3
Dacia	10	10/10	2, 4, 4, 1, 1, 2, 2, 2, 2, 2
Hyundai	10	10/10	3, 2, 3, 4, 4, 3, 3, 3, 3, 4
Fiat	10	10/10	4, 3, 2, 2, 2, 1, 1, 1, 1, 1
Toyota	10	10/10	5, 5, 5, 5, 5, 5, 5, 5, 5, 5

4.1.4 İkinci El Değeri

İkinci el değeri senaryosuna ilişkin bulgular Tablo 5'te yer almaktadır. İkinci el değeri senaryosunun öneri setinde Toyota ve Volkswagen markalarının on tekrarın tamamında yer aldığı görülmektedir. Toyota, Volkswagen (endeks = 10). Renault dokuz tekrarda önerilmiş (endeks = 9; yalnızca T4'te set dışı), Hyundai ve Honda beşer tekrarda (endeks = 5), Kia ise yalnızca bir tekrarda (T4; endeks = 1) öneri setine girebilmiştir. Senaryo boyunca toplam yedi farklı marka görünmüştür. Sıralama kararlılığının markalar arasında belirgin biçimde farklılaştığı gözlenmiştir. Toyota on tekrarın sekizinde birinci sırada yer alırken, T5'te Volkswagen, T6'da Renault ilk sıraya yükselmiştir.

Fiat on tekrarın dokuzunda dördüncü sırada sabit kalırken, Volkswagen 1 ile 4, Renault ise 1 ile 3 arasında konumlanmıştır. Öneri setinin büyük ölçüde korunmasına karşın hem birinciliğin hem de alt sıraların değişkenlik göstermesi, görünürlük kararlılığının sıralama kararlılığını beraberinde getirmediğini bir kez daha göstermektedir.

Tablo 5. Senaryo 4'te (ikinci el değeri) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Toyota	10	10/10	1, 1, 1, 1, 3, 2, 1, 1, 1, 1
Volkswagen	10	10/10	2, 2, 3, 3, 1, 4, 3, 3, 3, 3
Fiat	10	10/10	4, 4, 4, 4, 4, 3, 4, 4, 4, 4
Renault	9	9/10 (T4 hariç)	3, 3, 2, –, 2, 1, 2, 2, 2, 2
Hyundai	5	5/10 (T1, T5, T7, T8, T10)	5, –, –, –, 5, –, 5, 5, –, 5
Honda	5	5/10 (T2, T3, T4, T6, T9)	–, 5, 5, 2, –, 5, –, –, 5, –
Kia	1	1/10 (T4)	–, –, –, 5, –, –, –, –, –, –

4.1.5 Dayanıklılık

Dayanıklılık senaryosuna ilişkin bulgular Tablo 6'da yer almaktadır. Dayanıklılık senaryosu, sıralama boyutunda incelenen senaryolar arasında en kararlı üst yapıyı sunmaktadır. Toyota, Honda ve Hyundai on tekrarın tamamında öneri setinde yer almıştır (endeks = 10). Renault ve Fiat beşer tekrarda (endeks = 5), Suzuki ve Mazda dörder tekrarda (endeks = 4), Subaru ve Kia ise birer tekrarda (endeks = 1) öneri setine girebilmiştir. Senaryo boyunca toplam dokuz farklı marka görünmüştür.

Toyota on tekrarın tamamında birinci, Honda ise ikinci sırada yer alarak her iki markanın da sıralama kararlılığını koruduğu görülmüştür. Buna karşılık on tekrarın tamamında önerilen Hyundai markasının konumu üçüncü ile beşinci sıralar arasında sürekli değiştirmiştir. Bu durum, görünürlük kararlılığı aynı olan markaların (Endeks = 10) sıralama kararlılığının tamamen farklı olabileceğini göstermektedir.

Tablo 6. Senaryo 5'te (dayanıklılık) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Toyota	10	10/10	1, 1, 1, 1, 1, 1, 1, 1, 1, 1
Honda	10	10/10	2, 2, 2, 2, 2, 2, 2, 2, 2, 2
Hyundai	10	10/10	4, 5, 3, 4, 3, 3, 3, 4, 4, 3
Renault	5	5/10 (T3, T5, T7, T8, T10)	–, –, 4, –, 4, –, 4, 5, –, 4
Fiat	5	5/10 (T3, T4, T5, T7, T10)	–, –, 5, 5, 5, –, 5, –, –, 5
Suzuki	4	4/10 (T1, T6, T8, T9)	3, –, –, –, –, 5, –, 3, 3, –
Mazda	4	4/10 (T1, T2, T4, T6)	5, 4, –, 3, –, 4, –, –, –, –
Subaru	1	1/10 (T2)	–, 3, –, –, –, –, –, –, –, –
Kia	1	1/10 (T9)	–, –, –, –, –, –, –, –, 5, –

4.1.6 Yakıt Ekonomisi

Yakıt ekonomisi senaryosuna ilişkin bulgular Tablo 7'de yer almaktadır. Yakıt ekonomisi senaryosunda Toyota ve Renault markalarının on tekrarın tamamında yer aldığı görülmektedir. Toyota ve Renault (endeks = 10). Fiat dokuz tekrarda yer alırken (endeks = 9; yalnızca T1'de set dışı), Hyundai ve Dacia sekizer tekrarda (endeks = 8), Honda üç tekrarda (endeks = 3), Suzuki ile Kia ise birer tekrarda (endeks = 1) öneri setinde yer almıştır. Senaryo boyunca toplam sekiz farklı marka görünmüştür.

Toyota on tekrarda da birinci sırada yer alarak mutlak kararlılık sergilemiştir. Renault da on tekrarın dokuzunda ikinci sırayı korumuş ve yalnızca T6'da üçüncü sıraya gerilemiştir. Dacia yalnızca sekiz tekrarda önerilmesine karşın konumunu beşincilikten ikinciliğe yükseltmiş (T6), sonraki tekrarlarda üçüncü ve dördüncü sıralar arasında konumlanmıştır.

Tablo 7. Senaryo 6'da (yakıt ekonomisi) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Toyota	10	10/10	1, 1, 1, 1, 1, 1, 1, 1, 1, 1
Renault	10	10/10	2, 2, 2, 2, 2, 3, 2, 2, 2, 2
Fiat	9	9/10 (T1 hariç)	–, 4, 4, 5, 3, 4, 4, 3, 4, 4
Hyundai	8	8/10 (T4, T6 hariç)	5, 3, 3, –, 4, –, 5, 5, 5, 5
Dacia	8	8/10 (T1, T4 hariç)	–, 5, 5, –, 5, 2, 3, 4, 3, 3
Honda	3	3/10 (T1, T4, T6)	3, –, –, 3, –, 5, –, –, –, –
Suzuki	1	1/10 (T1)	4, –, –, –, –, –, –, –, –, –
Kia	1	1/10 (T4)	–, –, –, 4, –, –, –, –, –, –

4.1.7 Şehir içi kullanım

Şehir içi kullanım senaryosuna ilişkin bulgular Tablo 8'de yer almaktadır Şehir içi kullanım senaryosunda Toyota ve Renault markalarının on tekrarın tamamında yer aldığı görülmektedir. Toyota ve Renault (endeks = 10). Hyundai dokuz tekrarda önerilmiş (endeks = 9; yalnızca T7 hariç), Fiat yedi tekrarda (endeks = 7), Honda dört tekrarda (endeks = 4), Kia, Suzuki ve Peugeot üçer tekrarda (endeks = 3), Citroen ise yalnızca bir tekrarda (T8; endeks = 1) öneri setine girebilmiştir. Senaryo boyunca toplam dokuz farklı marka görünmüştür.

Tekrarlanan sorgular sonucunda Toyota on tekrarda da birinci sırada yer alırken Renault on tekrarın dokuzunda ikinci sırayı korumuş ve yalnızca T1'de üçüncü sıraya gerilemiştir. Hyundai set üyeliği açısından güçlü olmasına karşın (9/10) konumunu üçüncü ile dördüncü sıralar arasında sürekli değiştirmiştir. Beşinci sıra, tekrarlanan sorgular boyunca en değişken konum olmuştur. Bu sırada T1'de Suzuki, T2, T4 ve T10'da Peugeot, T3,T5 ve T7'de Honda, T6'da Kia, T8'de Citroen, T9'da Fiat yer almıştır. Honda, Kia, Suzuki, Peugeot ve Citroen'in tamamı yalnızca dördüncü ve beşinci sıralarda görünmüş, hiçbiri üçüncü sıranın üzerine çıkmamıştır.

Tablo 8. Senaryo 7'de (şehir içi kullanım) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Toyota	10	10/10	1, 1, 1, 1, 1, 1, 1, 1, 1, 1
Renault	10	10/10	3, 2, 2, 2, 2, 2, 2, 2, 2, 2
Hyundai	9	9/10 (T7 hariç)	4, 3, 3, 3, 3, 3, –, 3, 3, 3
Fiat	7	7/10 (T2, T3, T4, T6, T7, T9, T10)	–, 4, 4, 4, –, 4, 3, –, 5, 4

Honda	4	4/10 (T1, T3, T5, T7)	2, –, 5, –, 5, –, 5, –, –, –
Kia	3	3/10 (T5, T6, T8)	–, –, –, –, 4, 5, –, 4, –, –
Suzuki	3	3/10 (T1, T7, T9)	5, –, –, –, –, –, 4, –, 4, –
Peugeot	3	3/10 (T2, T4, T10)	–, 5, –, 5, –, –, –, –, –, 5
Citroen	1	1/10 (T8)	–, –, –, –, –, –, –, 5, –, –

4.1.8 Uzun Yol ve Konfor

Uzun yol ve konfora ilişkin bulgular Tablo 9'da yer almaktadır. Uzun yol ve konfor senaryosunda öneri seti, Mercedes-Benz ve Volvo'nun tekrarlanan sorguların onunda da yer aldığı görülmüştür (Endeks = 10). Škoda dokuz tekrarda önerilmiş (endeks = 9; yalnızca T9'da set dışı), Volkswagen ile Toyota altışar tekrarda (endeks = 6), BMW beş tekrarda (endeks = 5), Citroen iki tekrarda (endeks = 2), Peugeot ise bir tekrarda (T9; endeks = 1) öneri setine girebilmiştir. Senaryo boyunca toplam sekiz farklı marka görünmüştür.

Sıralama kararlılığında Mercedes-Benz, on tekrarın yedisinde birinci sırada yer almıştır (T2, T3, T4, T6, T7, T8, T9). Marrka birinciliği yalnızca T1'de Volkswagen'e, T5 ile T10'da Škoda'ya bırakmıştır. Volvo ise hiçbir tekrarda birinci sıraya yükselememesine karşın on tekrarın sekizinde ikinci sırayı korumuş (T2, T3, T5, T6, T7, T8, T9, T10) ve konumu yalnızca 2 ile 4 arasında hareket etmiştir. Böylece aynı endeks değerine (10) sahip iki markadan biri konumunu 1 ile 5 arasında değiştirirken diğeri dar bir bantta sabitlenmiştir. Tekrarlanan sorgularda görünürlük kararlılığının sıralama kararlılığını garanti etmediği bu senaryoda da görülmüştür.

Bu ayrışmanın en dikkat çekici örneği Škoda olduğu görülmektedir. Nitekim endeks değeri 9 olan Škoda markası, T5 ve T10'da birinci sıraya yükseldiği görülürken yer alma kararlılığı endeksi Mercedes-Benz ve Volvo'nun altında olan bir marka, on tekrarda da önerilen Volvo'nun hiç ulaşamadığı liderlik konumuna erişebilmiştir. BMW de yalnızca beş tekrarda önerilmesine karşın önerildiği tekrarların dördünde ilk üç sırada yer almış (T2, T3, T4, T7) ve en düşük sıralaması dördüncülük olmuştur (T6). Buna karşılık altı tekrarda önerilen Toyota, önerildiği tekrarların beşinde beşinci sırada sabitlenmiş (T4, T5, T6, T8, T10), yalnızca T1'de üçüncü sıraya yükselebilmiştir. Aynı endeks değerine sahip Volkswagen ise T1'de birinci sıraya yerleşmiş, önerildiği diğer beş tekrarda dördüncü sırada kalmıştır. Yalnızca iki tekrarda önerilen Citroen (T7'de beşinci, T8'de dördüncü) ile tek tekrarda önerilen Peugeot (T9'da beşinci) setin alt sıralarında konumlanmıştır. Bu örüntüler birlikte değerlendirildiğinde, öneri setinde kalıcı biçimde yer almanın listenin tepesinde yer almayı garanti etmediği ve set üyeliği ile konumun bağımsız boyutlar olarak izlenmesi gerektiği bir kez daha ortaya koymaktadır.

Tablo 9. Senaryo 8'de (uzun yol ve konfor) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi(0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Mercedes-Benz	10	10/10	5, 1, 1, 1, 3, 1, 1, 1, 1, 3
Volvo	10	10/10	4, 2, 2, 3, 2, 2, 2, 2, 2, 2
Škoda	9	9/10 (T9 hariç)	2, 5, 5, 4, 1, 3, 4, 3, –, 1
Volkswagen	6	6/10 (T1, T2, T3, T5, T9, T10)	1, 4, 4, –, 4, –, –, –, 4, 4
Toyota	6	6/10 (T1, T4, T5, T6, T8, T10)	3, –, –, 5, 5, 5, –, 5, –, 5
BMW	5	5/10 (T2, T3, T4, T6, T7)	–, 3, 3, 2, –, 4, 3, –, –, –
Citroen	2	2/10 (T7, T8)	–, –, –, –, –, –, 5, 4, –, –
Peugeot	1	1/10 (T9)	–, –, –, –, –, –, –, –, 5, –

4.1.9 Teknoloji

Teknolojiye ilişkin bulgular Tablo 10'da yer almaktadır. Teknoloji senaryosunda Tesla ve BMW on tekrarın tamamında öneri setinde yer almıştır (endeks = 10). Mercedes-Benz ile Hyundai dokuzar tekrarda (endeks = 9; Mercedes-Benz T1'de, Hyundai T2'de set dışı), Togg yedi tekrarda (endeks = 7), Volvo dört tekrarda (endeks = 4), BYD ise yalnızca bir tekrarda (T1; endeks = 1) öneri setine girebilmiştir. Senaryo boyunca toplam yedi farklı marka görünmüştür. Tesla on tekrarın yedisinde birinci sırada yer alarak senaryonun baskın lideri olmuştur (T1, T5, T6, T7, T8, T9, T10); birincilik T3 ve T4'te Togg'a, T2'de Mercedes-Benz'e geçmiştir. Hyundai dokuz tekrarda önerilmiş olmasına karşın önerildiği tekrarların tamamında beşinci sırada (yalnızca T1'de dördüncü) kalmış ve hiçbir zaman ilk üçe girememiştir. Buna karşılık endeks değeri daha düşük olan Togg (7/10), T3 ve T4'te birinci, T5 ve T6'da ikinci sıraya yükseldiği görülmüştür. Togg'un görünürlüğü ayrıca zamansal bir kümelenme sergilemektedir: marka T1–T6 arasında sürekli öneri setinde yer almış, T7–T9 boyunca setten tamamen çıkmış ve T10'da dördüncü sırada geri dönmüştür.

Tablo 10. Senaryo 9'da (teknoloji) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Tesla	10	10/10	1, 3, 2, 2, 1, 1, 1, 1, 1, 1
BMW	10	10/10	2, 2, 3, 3, 3, 3, 2, 2, 3, 2
Mercedes-Benz	9	9/10 (T1 hariç)	–, 1, 4, 4, 4, 4, 3, 3, 2, 3
Hyundai	9	9/10 (T2 hariç)	4, –, 5, 5, 5, 5, 5, 5, 5, 5
Togg	7	7/10 (T1, T2, T3, T4, T5, T6, T10)	5, 4, 1, 1, 2, 2, –, –, –, 4
Volvo	4	4/10 (T2, T7, T8, T9)	–, 5, –, –, –, –, 4, 4, 4, –
BYD	1	1/10 (T1)	3, –, –, –, –, –, –, –, –, –

4.1.10 Satış sonrası hizmet ve servis ağı

Satış sonrası hizmetler ve servis ağına ilişkin bulgular Tablo 11'de yer almaktadır Satış sonrası hizmet ve servis ağı senaryosunda Renault ve Toyota on tekrarın tamamında öneri setinde yer almıştır (endeks = 10). Fiat dokuz tekrarda önerilmiş (endeks = 9; yalnızca T1'de set dışı), Hyundai sekiz tekrarda (endeks = 8; T6 ve T8 hariç), Ford yedi tekrarda (endeks = 7), Volkswagen altı tekrarda (endeks = 6) öneri setine girebilmiştir. Senaryo boyunca toplam altı farklı marka görünmüş olup bu, fiyat-performans senaryosuyla (beş marka) birlikte en düşük marka çeşitliliğine işaret etmektedir.

Sıralama kararlılığı boyutunda Renault ve Fiat, on tekrarın dokuzunda (T2–T10) ilk iki sırayı paylaşmış ve birinciliği düzenli biçimde değişkenlik göstermiştir. Renault T2, T4 ve T6'da birinci, Fiat T3, T5, T7, T8, T9 ve T10'da birincidir. Böylece senaryoda Renault üç, Fiat altı kez ilk sıraya yer aldığı görülmektedir. Toyota'nın on tekrarda da öneri setinde yer almasına karşın yalnızca T1'de birinci sırada bulunmuş, diğer tekrarlarda üçüncü ve dördüncü sıralar arasında sabitlenmiştir. Set üyeliği tam kararlı (10/10) olan bir markanın, senaryonun ilk tekrarı dışında birinci sırada yer almaması, yer alma ve sıralama boyutlarının ne ölçüde ayrışabildiğini bir kez daha göstermektedir.

Tablo 11. Senaryo 10'da (satış sonrası hizmet ve servis ağı) markaların yer alma kararlılığı endeksi, önerildiği tekrarlar ve gözlenen sıraları

Marka	Yer Alma Kararlılığı Endeksi (0–10)	Önerildiği tekrarlar	Gözlenen sıralar (T1–T10)
Renault	10	10/10	2, 1, 2, 1, 2, 1, 2, 2, 2, 2
Toyota	10	10/10	1, 3, 3, 3, 4, 4, 3, 4, 4, 3
Fiat	9	9/10 (T1 hariç)	–, 2, 1, 2, 1, 2, 1, 1, 1, 1
Hyundai	8	8/10 (T6, T8 hariç)	3, 5, 4, 4, 5, –, 5, –, 5, 5
Ford	7	7/10 (T1, T4, T5, T6, T7, T8, T9)	5, –, –, 5, 3, 3, 4, 3, 3, –
Volkswagen	6	6/10 (T1, T2, T3, T6, T8, T10)	4, 4, 5, –, –, 5, –, 5, –, 4

4.2 Senaryolar Arası Örüntüler

On senaryonun tamamlanmasıyla marka × senaryo endeks matrisi oluşturularak Tablo 12'de sunulmuştur. Aşağıdaki tabloda da görüldüğü üzere, Toplam sütunu, on senaryodaki endeks değerlerinin aritmetik toplamıdır (en yüksek olası değer 100) ve yalnızca senaryolar arası karşılaştırmayı kolaylaştırmak amacıyla verilmiştir.

Tablo 12. Markaların senaryo bazında yer alma kararlılığı endeksi ve toplam değerleri

Marka	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Toplam
Toyota	10	7	10	10	10	10	10	6	–	10	83
Hyundai	10	–	10	5	10	8	9	–	9	8	69
Renault	9	–	10	9	5	10	10	–	–	10	63
Fiat	–	–	10	10	5	9	7	–	–	9	50
Volkswagen	8	7	–	10	–	–	–	6	–	6	37
Mercedes-Benz	–	10	–	–	–	–	–	10	9	–	29
Honda	2	–	–	5	10	3	4	–	–	–	24
Škoda	10	4	–	–	–	–	–	9	–	–	23
Volvo	–	9	–	–	–	–	–	10	4	–	23
Dacia	–	–	10	–	–	8	–	–	–	–	18
BMW	–	2	–	–	–	–	–	5	10	–	17
Tesla	–	4	–	–	–	–	–	–	10	–	14
Suzuki	–	–	–	–	4	1	3	–	–	–	8
Togg	–	1	–	–	–	–	–	–	7	–	8
Kia	1	–	–	1	1	1	3	–	–	–	7
Ford	–	–	–	–	–	–	–	–	–	7	7
Subaru	–	5	–	–	1	–	–	–	–	–	6
Mazda	–	1	–	–	4	–	–	–	–	–	5
Peugeot	–	–	–	–	–	–	3	1	–	–	4

Marka	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Toplam
Citroen	–	–	–	–	–	–	1	2	–	–	3
BYD	–	–	–	–	–	–	–	–	1	–	1

Tablo 12'de görüldüğü üzere, on senaryoda öneri setine giren toplam 21 farklı marka bulunmaktadır. Bunların yalnızca ikisi (Ford yalnızca S10'da, BYD yalnızca S9'da) tek bir senaryoda görünmüştür. Buna karşılık on iki marka en az iki, sekiz marka en az üç farklı senaryoda öneri setine girmiştir. Bu dağılım, marka görünürlüğünün senaryo bağlamına bağlı, yayılımı düzensiz bir yapı sergilediğini göstermektedir.

Bunun yanı sıra Mercedes-Benz, Volvo ve BMW neredeyse yalnızca güvenlik, uzun yol-konfor ve teknoloji senaryolarında görünmekte, ancak göründüklerinde yüksek endeks değerleri almaktadır. Buna karşılık Hyundai, Renault ve Fiat, güvenlik ve uzun yol-konfor senaryolarında sete hiç girmemesine karşın diğer senaryolarda çekirdek marka konumundadır. İki grup arasındaki bu zıtlık, marka görünürlüğünün senaryonun ölçtüğü kriterle ilişkili olduğunu düşündürmektedir.

Toyota, aile kullanımı, dayanıklılık, yakıt ekonomisi ve şehir içi kullanım senaryolarında on tekrarda da birinci sırada yer alırken, fiyat-performans senaryosunda on tekrarda da beşinci sırada kalmıştır. Yani markanın varlığı istikrarlı olsa da konumu senaryo bağlamına göre tamamen değişebilmektedir. Benzer şekilde, senaryo 9'da Hyundai'nin (endeks 9) hiç ilk üçe girememesine karşın Togg'un (endeks 7) iki kez birinci olmasında görülmektedir.

Öneri setine giren farklı marka sayısı fiyat-performansta beşte kalırken güvenlikte ona kadar yükselmektedir (S1 = 7, S2 = 10, S3 = 5, S4 = 7, S5 = 9, S6 = 8, S7 = 9, S8 = 8, S9 = 7, S10 = 6). Bu dağılım, senaryonun ölçtüğü kriterin öneri setinin hem kompozisyonunu hem de genişliğini belirlediğini göstermektedir.

Bütün bu örüntüler birlikte değerlendirildiğinde, görünürlük kararlılığının tek boyutlu bir olgu olmadığı, markaya, senaryo bağlamına ve ölçülen boyuta göre sistematik biçimde farklılaşan çok katmanlı bir yapı sergilediği ortaya çıkmaktadır. Aynı yanıt kümesi içinde set üyeliği tam kararlı olan markalar konum açısından değişkenlik gösterebilmektedir. Endeks değeri düşük markalar ise sıralama boyutunda belirgin biçimde kararlı davranabilmektedir. Bu nedenle tekrarlanan sorgularda görünürlüğün değerlendirilmesinde iki boyutun birlikte raporlanması gerekmektedir.

5. Tartışma

Bu çalışmanın temel bulgusu, üretken yapay zekâ ortamlarında marka görünürlüğünün yalnızca bir markanın öneri setinde yer alıp almaması üzerinden açıklanamayacağını ortaya koymaktadır. Tekrarlanan aynı sorgulara verilen yanıtlar incelendiğinde, bir markanın öneri setine girme sıklığı ile bu set içerisindeki konumunu koruma düzeyinin birbirinden ayrışabildiği görülmektedir. Dolayısıyla görünürlük, yalnızca bulunma ya da bulunmama üzerinden değerlendirildiğinde, model çıktılarındaki değişkenliğin önemli bir bölümü gözden kaçırılabilmektedir.

Bu ayrışma özellikle fiyat-performans senaryosunda (S3) açık biçimde görülmektedir. Renault, Dacia, Hyundai, Fiat ve Toyota markalarının tamamının on tekrarın tamamında öneri setinde yer almasına karşın, markaların liste içerisindeki konumları aynı ölçüde istikrarlı değildir. Renault, Dacia, Hyundai ve Fiat'ın sıralamadaki yerleri birinci ile dördüncü sıralar arasında değişmiş ve birincilik tekrarlar arasında üç kez farklı markalara geçmiştir. Başka bir ifadeyle, öneri setinin üyeleri sabit kalırken bu set içerisindeki rekabet değişmeye devam etmiştir. Bu durum, öneri sistemlerinde yalnızca liste üyeliğine dayanan ölçümlerin sıralama bilgisini yeterince temsil edemeyeceğine ilişkin literatürdeki değerlendirmelerle uyumludur.

Top-K Jaccard benzerliği liste üyelerinin örtüşmesine odaklanırken, listedeki öğelerin konumsal değişimini değerlendirmek için sıra duyarlı ölçütlere ihtiyaç duyulmaktadır (Oh vd., 2022). Bu çalışmanın bulguları da benzer biçimde, görünürlüğün yalnızca öneri setine dahil olma üzerinden değil, öneri seti içerisindeki konumun korunması üzerinden de ele alınması gerektiğine işaret etmektedir.

Yer alma ve sıralama boyutlarının birbirinden ayrılması, aynı yer alma endeksine sahip markaların farklı davranışlar sergileyebilmesi nedeniyle ayrıca önem taşımaktadır. Dayanıklılık senaryosunda (S5) Toyota, Honda ve Hyundai'nin tamamı 10/10 yer alma düzeyine ulaşmıştır; ancak bu üç markanın sıralama davranışları aynı değildir. Toyota tüm tekrarlar boyunca birinci, Honda ikinci sırada sabit kalırken Hyundai üçüncü ve beşinci sıralar arasında değişkenlik göstermiştir. Benzer biçimde, teknoloji senaryosunda (S9) Mercedes-Benz ile Hyundai'nin yer alma endeksleri aynı olmasına rağmen, sıralama davranışları farklılaşmıştır. Bu örnekler, yüksek yer alma kararlılığının tek başına yüksek sıralama kararlılığı anlamına gelmediğini göstermektedir. Tersine, düşük yer alma sıklığına sahip bir marka bazı durumlarda önerildiğinde oldukça istikrarlı bir konum sergileyebilmektedir. Tesla'nın güvenlik senaryosunda yalnızca dört tekrarın dördünde de üçüncü sırada yer alması ve Fiat'ın dayanıklılık senaryosunda beş önerinin tamamında beşinci sırada bulunması bu duruma örnek oluşturmaktadır.

Bu sonuç, üretken yapay zekâ ortamlarında marka görünürlüğünün değerlendirilmesinde “kaç kez önerildi?” sorusunun tek başına yeterli olmayacağını düşündürmektedir. Bir markanın öneri setine düzenli biçimde dahil olması, o markanın kullanıcıya sunulan seçenekler içerisindeki konumunun da istikrarlı olduğu anlamına gelmemektedir. Özellikle kullanıcıların sınırlı sayıdaki öneri arasından değerlendirme yaptığı düşünüldüğünde, ilk sıralardaki konumun korunması ile yalnızca liste içerisinde herhangi bir konumda bulunmak arasında anlamlı bir fark bulunmaktadır.

Bulguların bir diğer önemli yönü, gözlenen değişkenliğin aynı model sürümü ve kısa bir zaman aralığı içerisinde ortaya çıkmış olmasıdır. Öneri sistemlerinde önerilerin zaman içerisinde değişmesi, veri kümesindeki değişiklikler, kullanıcı davranışlarındaki farklılaşmalar veya sistem güncellemeleri gibi faktörlerle açıklanabilmektedir. Bu çalışmada ise veri toplama süreci 23.08.2026–25.08.2026 tarihleri arasında, aynı model sürümü (ChatGPT-5.6) kullanılarak ve her tekrar yeni bir sohbet oturumunda başlatılarak gerçekleştirilmiştir. Buna rağmen aynı sorgulara verilen yanıtların marka varlığı ve marka sıralaması bakımından farklılaşması, görünürlük değişkenliğinin yalnızca zaman içerisinde meydana gelen dışsal değişimlerle açıklanamayacağını düşündürmektedir.

Bu durum, tek bir sorgu sonucuna dayalı marka görünürlüğü ölçümlerinin dikkatle yorumlanması gerektiğini de göstermektedir. Teknoloji senaryosunda Togg'un ilk tekrarların bir bölümünde birinci sırada yer alması, sonraki tekrarlar boyunca öneri setinden çıkması ve daha sonra yeniden listeye dahil olması, tek bir gözleme dayanılarak yapılacak değerlendirmenin markanın görünürlüğüne ilişkin farklı ve hatta birbirine zıt sonuçlar üretebileceğini göstermektedir. Benzer biçimde, aile kullanımı senaryosunda Honda ve Kia'nın yalnızca sınırlı sayıdaki tekrarda önerilmesi, tek bir sorgu sonucunun bu markaların ilgili kullanım bağlamındaki görünürlüğünü olduğundan daha yüksek veya daha düşük göstermesine neden olabilmektedir. Dolayısıyla tekil yanıt, modelin aynı girdiye verebileceği yanıtların tamamını temsil eden bir gözlem olarak değil, belirli bir anda gerçekleşen olası çıktılardan biri olarak değerlendirilmelidir.

Bu bulgu, aynı girdilerin tekrarlanması durumunda farklı ChatGPT yanıtlarının ortaya çıkabileceğini belirten Lancaster'ın (2023) değerlendirmeleriyle de ilişkilendirilebilir. Lancaster (2023), model çıktılarının yalnızca kullanıcı girdisiyle değil, modelin çalışma koşulları ve görünmeyen bazı üretim parametreleriyle de ilişkili olabileceğine dikkat çekmektedir.

Bununla birlikte, mevcut çalışmanın verileri söz konusu değişkenliğin hangi teknik mekanizma tarafından üretildiğini doğrudan ortaya koymamaktadır. Bu nedenle burada elde edilen sonuç, belirli bir teknik nedene indirgenmekten ziyade, aynı sorgunun tekrarlanması halinde marka görünürlüğünün değişebildiğine ilişkin ampirik bir gözlem olarak değerlendirilmelidir. Bu ayrım, çalışmanın bulgularının teknik nedensellik iddiasının ötesine taşınmaması açısından önemlidir.

Çalışmanın kısa zaman aralığında gerçekleştirilmiş olması, elde edilen değişkenliğin zamansal boyutuna ilişkin de dikkat çekici bir sonuç ortaya koymaktadır. Quintana-Gómez (2026), farklı zaman noktalarında gerçekleştirilen sorgulamalarda yapay zekâ tarafından oluşturulan otel önerilerindeki marka varlığının değişebildiğini ve görünürlüğün üretim bağlamına bağlı olarak şekillendiğini ortaya koymaktadır. Mevcut çalışmada ise gözlemler birbirinden uzun zaman aralıklarıyla ayrılmamış, aynı model sürümü kullanılmış ve her tekrar yeni bir sohbet oturumunda gerçekleştirilmiştir. Buna rağmen marka önerilerindeki değişkenliğin devam etmesi, üretken yapay zekâ ortamlarında görünürlüğün yalnızca zaman içerisindeki içerik veya sistem değişimleri üzerinden açıklanamayacağını düşündürmektedir. Bu açıdan çalışma, görünürlük araştırmalarında tekrarlı ölçümün neden gerekli olabileceğine ilişkin ampirik bir gerekçe sunmaktadır.

Bununla birlikte, elde edilen marka sıralamalarının tamamen rastlantısal olduğu sonucuna ulaşmak da doğru olmayacaktır. Bazı senaryolarda belirli markaların tekrarlar boyunca istikrarlı biçimde üst sıralarda yer alması, model çıktılarında belirli bir tercih örüntüsünün bulunduğunu göstermektedir. Dayanıklılık senaryosunda Toyota'nın, güvenlik senaryosunda Mercedes-Benz'in ve bazı kullanım bağlamlarında diğer belirli markaların yüksek düzeyde görünürlük sergilemesi bu açıdan dikkat çekicidir. Bu durum, üretken yapay zekâ yanıtlarının değişken olmakla birlikte bütünüyle yapısal olmayan çıktılar üretmediğini ve belirli marka, senaryo eşleşmelerinin tekrarlar boyunca görece istikrarlı kalabildiğini düşündürmektedir. Dolayısıyla araştırma açısından asıl mesele, değişkenlik ile istikrarın birbirinin karşıtı olarak ele alınmasından ziyade, hangi senaryolarda ve hangi markalarda bu iki örüntünün birlikte ortaya çıktığının belirlenmesidir.

Markaların senaryo bazındaki görünürlüğü, Türkiye'deki tüketici araştırmalarında ortaya konan bazı marka algılarıyla da kısmen örtüşmektedir. Narin ve Alnıaçık (2025) tarafından gerçekleştirilen çalışmada, otomobil satın alma kararında “sağlamlık ve güvenilirlik” en önemli kriter olarak belirlenirken, değerlendirilen C segmenti modeller arasında Toyota Corolla ilk sırada yer almıştır. Araştırmacıların Toyota Corolla’nın diğer alternatiflere kıyasla güvenilirlik ve sağlamlık açısından üstünlük gösterdiğine ilişkin değerlendirmeleri, mevcut çalışmada dayanıklılık senaryolarında Toyota’nın tekrarlanan sorgular boyunca istikrarlı biçimde öne çıkmasıyla örtüşmektedir. Benzer şekilde Öztürk vd. (2010), güvenlik ve reklam kampanyalarını marka tercihi açısından öne çıkan boyutlar arasında değerlendirmiş ve Mercedes'in güvenlik boyutunda olumlu algılandığını ortaya koymuştur. Bununla birlikte, bu benzerlikler doğrudan bir nedensellik ilişkisi olarak yorumlanmamalıdır. Tüketici araştırmalarında ölçülen marka algısı ile üretken yapay zekânın oluşturduğu öneri listeleri farklı veri üretim süreçlerine dayanmaktadır. Buradaki benzerlik daha çok, yapay zekâ tarafından oluşturulan önerilerin bazı durumlarda mevcut tüketici algılarıyla aynı yönde bir marka örüntüsü sergileyebildiğini göstermesi bakımından anlamlıdır.

Bu çerçevede çalışma, üretken yapay zekâ ortamlarında marka rekabetinin yalnızca görünür olma mücadelesi olarak ele alınmasının yetersiz kalabileceğine işaret etmektedir. Chen vd. (2025) tarafından üretken yapay zekâ ortamlarındaki rekabetin “kısa liste mücadelesi” olarak kavramsallaştırılması, bu çalışmanın bulgularıyla birlikte düşünüldüğünde daha geniş bir anlam kazanmaktadır. Çünkü bir markanın yapay zekâ tarafından oluşturulan kısa listeye dahil edilmesi ilk aşamayı oluştururken, bu liste içerisinde hangi konumda yer aldığı ikinci bir rekabet boyutu yaratmaktadır.

Bu nedenle marka açısından stratejik hedef yalnızca yapay zekâ yanıtında anılmak değil, kullanıcıya sunulan seçenekler arasında istikrarlı ve mümkün olduğunca yüksek bir konum elde edebilmektir.

Çalışmanın kuramsal katkısı bu noktada belirginleşmektedir. Üretken yapay zekâ ve yapay zekâ arama ortamlarında görünürlüğü ölçmeye yönelik güncel yaklaşımlar ise anılma sıklığı, anılma oranı ve ortalama konum gibi göstergelere odaklanmaktadır (Smyth ve Dawson, 2025). Ancak bu göstergelerin aynı sorgunun tekrarlanması durumunda ne ölçüde istikrarlı kaldığı yeterince açıklığa kavuşturulmamıştır.

Bu çalışma, söz konusu boşluğa görünürlük kararlılığını iki ayrı boyutta ele alarak katkı sunmaktadır. Yer alma kararlılığı, markanın tekrarlanan sorgular sonucunda öneri setine dahil olma sürekliliğini 0–10 aralığındaki bir endeks üzerinden değerlendirirken sıralama kararlılığı, markanın önerildiği durumlarda liste içerisindeki konumunu ne ölçüde koruduğunu dikkate almaktadır. Böylece yüksek yer alma oranı ile yüksek sıralama istikrarının aynı kavram olmadığı ampirik olarak gösterilmektedir. Bu ayrım, üretken yapay zekâ ortamlarında marka görünürlüğünün daha hassas biçimde ölçülmesine ve tekil yanıtların ötesinde tekrarlı gözlemlere dayalı değerlendirmelerin geliştirilmesine olanak sağlamaktadır.

Sonuç olarak bulgular, üretken yapay zekâ tarafından oluşturulan marka önerilerinin belirli ölçüde değişkenlik gösterdiğini, ancak bu değişkenliğin tüm markalar ve tüm senaryolar açısından aynı düzeyde gerçekleşmediğini ortaya koymaktadır. Bazı markalar hem öneri setinde düzenli biçimde yer almakta hem de konumlarını büyük ölçüde korurken, bazı markalar yüksek yer alma oranına rağmen sıralamada önemli dalgalanmalar yaşayabilmektedir. Dolayısıyla yapay zekâ ortamlarında marka görünürlüğünün değerlendirilmesinde tek bir yanıtın veya yalnızca anılma sıklığının esas alınması, görünürlüğün sürekliliği ve sıralamadaki konumu hakkında eksik bir değerlendirmeye yol açabilmektedir. Bu nedenle tekrarlanan sorgulara dayalı ölçüm yaklaşımı, özellikle üretken yapay zekâ ortamlarında marka görünürlüğünün daha güvenilir ve karşılaştırılabilir biçimde değerlendirilmesi açısından dikkate alınması gereken bir yaklaşım olarak değerlendirilebileceği düşünülmektedir.

6. Sonuç

Bu çalışma, ChatGPT-5.6 tarafından sunulan otomobil markası önerilerinin farklı satın alma senaryolarında, özdeş sorguların tekrarlanmasıyla ölçülen görünürlük kararlılığını incelemeyi amaçlamıştır. Bu doğrultuda on satın alma senaryosu, her biri bağımsız bir sohbet oturumunda on kez tekrarlanarak toplam yüz yanıt elde edilmiştir. Her yanıtta önerilen ilk beş marka kaydedilerek beş yüz marka ve konum kaydı analiz edilmiştir. Görünürlük kararlılığı, markanın on tekrarda öneri setine girme sıklığını gösteren Yer Alma Kararlılığı Endeksi ile tekrarlar arasındaki konum değişkenliğini gösteren sıralama kararlılığı boyutları üzerinden değerlendirilmiştir.

Bulgular, üretken yapay zekâ ortamlarında marka görünürlüğü kararlılığının tek boyutlu bir yapı olarak ele alınamayacağını göstermektedir. Çalışmada görünürlük kararlılığının yer alma ve sıralama olmak üzere iki farklı boyuttan oluştuğu ortaya konmuştur. Bir markanın tekrar eden sorgularda öneri setinde sürekli biçimde yer alması, aynı zamanda öneri listesindeki konumunu koruduğu anlamına gelmemektedir. Bu nedenle yapay zekâ ortamlarındaki marka görünürlüğünün değerlendirilmesinde yalnızca markanın listede bulunup bulunmadığına odaklanmak yeterli olmayıp, listenin hangi konumunda ve ne ölçüde istikrarlı biçimde yer aldığı da dikkate alınmalıdır.

Aynı zamanda marka görünürlüğünün senaryo bağlamına güçlü biçimde bağlı olduğu sonucuna varılmaktadır. On senaryoda toplam 21 farklı marka öneri setine girmiştir. Bunlardan ikisi yalnızca tek bir senaryoda görünürken, 12 marka en az iki, sekiz marka ise en az üç farklı senaryoda önerilmiştir. Toyota, on senaryonun dokuzunda öneri setinde yer almış ve toplam 100 tekrarın 83'ünde görünür olmuştur.

Yedi senaryoda Yer Alma Kararlılığı Endeksi 10 değerine ulaşırken, dört senaryoda tüm tekrarlarda birinci sırada yer almıştır. Buna karşılık fiyat-performans senaryosunda tüm tekrarlarda beşinci sırada kalmıştır. Bu sonuç, bir markanın görünürlük açısından istikrarlı olmasının, öneri listesindeki konumunun da istikrarlı olduğu anlamına gelmediğini, marka konumunun sorgunun bağlamına bağlı olarak önemli ölçüde değişebildiğini göstermektedir.

Tekrarlanan özdeş sorgularda gözlenen değişkenlik, tek bir sorguya dayalı görünürlük ölçümlerinin yanıltıcı olabileceğine ilişkin önemli bir bulgu sunmaktadır. Örneğin teknoloji senaryosunda Togg'un T1–T6 arasında sürekli olarak öneri setinde yer alması, T3 ve T4'te birinci sıraya yükselmesi, T7–T9 arasında listeden tamamen çıkması ve T10'da dördüncü sırada yeniden görünmesi, aynı sorgunun farklı tekrarlarında markanın görünürlüğünün ne ölçüde değişebildiğini göstermektedir. Benzer biçimde, aile kullanımı senaryosunda Honda'nın yalnızca iki, Kia'nın ise yalnızca bir tekrarda önerilmesi, tek bir sorguya dayalı ölçümün aynı markayı bir durumda kategorinin önde gelen seçeneklerinden biri, başka bir durumda ise tamamen görünmez bir marka olarak değerlendirmesine yol açabileceğini ortaya koymaktadır. Bu sonuçlar, üretken yapay zekâ yanıtlarının belirlenimci olmayan üretim yapısıyla uyumlu olup marka görünürlüğünün sabit bir değer yerine olasılıksal bir özellik olarak ele alınması gerektiğini desteklemektedir.

Çalışmanın katkıları kuramsal, yöntemsel ve uygulamalı olmak üzere üç düzeyde değerlendirilebilmektedir. Kuramsal açıdan çalışma, üretken yapay zekâ ortamlarında marka görünürlüğü kararlılığını yer alma ve sıralama olmak üzere iki boyutlu bir yapı olarak kavramsallaştırmaktadır. Yöntemsel açıdan, özdeş sorguların bağımsız sohbet oturumlarında tekrarlanmasına dayanan tasarım, diyalog geçmişinin oluşturabileceği yapay tutarlılığın önüne geçerek görünürlükteki değişkenliğin daha doğrudan gözlemlenmesine olanak sağlamaktadır. Uygulamalı açıdan ise bulgular, marka görünürlüğünün tek bir sorguyla ölçülmesinin yeterli olmadığını hem markanın öneri setinde yer alma sıklığının hem de öneri listesindeki konumunun birlikte değerlendirilmesi gerektiğini göstermektedir. Bu durum, üretken yapay zekâ ortamlarında rekabetin yalnızca görünür olma değil, önerilen seçenekler arasındaki konumu istikrarlı biçimde koruma ekseninde de değerlendirilmesi gerektiğine işaret etmektedir.

Her çalışmada olduğu gibi bu çalışmanın da bazı sınırlılıkları bulunmaktadır. İlk olarak, verilerin yalnızca tek bir yapay zekâ aracı olan ChatGPT-5.6 üzerinden ve görece kısa bir zaman aralığında (23.08.2026–25.08.2026) toplanmış olmasından kaynaklanmaktadır. Bu durum bulguların diğer yapay zekâ sistemlerine ve farklı dönemlere doğrudan genellenmesini sınırlandırmaktadır. İkinci olarak, analizler her yanıtta önerilen ilk beş marka ve on tekrarlı örneklem ile sınırlandırılmıştır. Bunun yanında çalışma marka düzeyinde gerçekleştirilmiş, farklı yapay zekâ modelleri veya araçları arasında karşılaştırma yapılmamıştır. Verilerin yalnızca ChatGPT-5.6 çıktılarından oluşması ve tüketici tarafına ilişkin herhangi bir gözlem içermemesi nedeniyle, yapay zekâ ortamlarındaki görünürlük kararlılığının tüketici tercihlerine, marka algısına veya satın alma davranışına etkisi bu çalışmanın kapsamı dışında bırakılması bu çalışmanın kısıtlarını oluşturmaktadır

Gelecek araştırmalarda benzer tekrarlı sorgu tasarımlarının farklı üretken yapay zekâ sistemleri üzerinde karşılaştırmalı olarak uygulanması, model kaynaklı değişkenliğin sistemler arasında ne ölçüde farklılaştığını ortaya koyabileceği düşünülmektedir. Görünürlük kararlılığının farklı dillerde, pazarlarda ve ürün kategorilerinde test edilmesi, senaryo bağlamının etkisine ilişkin daha genel sonuçlar üretebilmektedir. Aynı senaryoların boylamsal analizle değerlendirilmesi, tekrarlar arası değişkenliği zaman içi değişkenlikten ayırmayı mümkün kılabileceği düşünülmektedir. Tekrarlanan sorgularda senaryolardaki metinlerin her marka için gerekçe istemesiyle elde edilen gerekçe metinlerinin içerik analizi, görünürlüğün yalnızca varlık ve konum değil, sunum biçimi boyutunda da değerlendirilmesini sağlayabilecektir.

Son olarak, yapay zekâ tarafından önerilen markaların tüketici tercihleri üzerindeki etkisini inceleyen deneysel tasarımlar, model çıktıları ile tüketici davranışı arasındaki bağlantının kurulmasına katkı sağlayacaktır.

Sonuç olarak bu çalışma, üretken yapay zekâ ortamlarında marka görünürlüğünün tek bir sorgudan elde edilen sabit bir sonuç olmadığını; sorgu tekrarları karşısında değişebilen, senaryoya duyarlı ve olasılıksal bir yapı taşıdığını göstermektedir. Bu nedenle yapay zekâ ortamlarında bir markanın görünür olması tek başına yeterli bir performans göstergesi değildir; asıl önemli olan, markanın farklı tekrarlar boyunca öneri setinde ne ölçüde yer aldığı ve bu set içerisindeki konumunu ne kadar istikrarlı koruyabildiğidir. Bu çerçevede çalışma, marka görünürlüğünün ölçülmesini tek seferlik bir varlık tespitinden, tekrarlı ölçüme dayalı bir istikrar değerlendirmesine taşımakta; böylece üretken yapay zekâ çağında marka rekabetinin yalnızca görünür olmak değil, istikrarlı biçimde önerilen ve öneri listesindeki konumunu koruyabilen bir marka olmak üzerinden yeniden düşünülmesi gerektiğini ortaya koymaktadır.

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MANAGEMENT IN NUCLEAR MEDICINE DEPARTMENTS: AN EVALUATION IN TERMS OF QUALITY, PATIENT SAFETY, AND RESOURCE MANAGEMENT

Mucize SARIHAN
Istanbul Okan University, Vocational School of Health Services, Istanbul, Türkiye
ORCID ID: 0000-0001-8013-7370

ABSTRACT
Nuclear medicine services constitute a field with unique managerial requirements within healthcare due to their use of advanced technologies, work involving ionizing radiation, high-cost equipment, and the management of radioactive products. Effective management in these settings encompasses not only the coordination of clinical processes but also the efficient utilization of human resources, cost control, equipment and technology management, radiation safety, patient safety, and continuous improvement of service quality.
Workforce planning and competency development are particularly important in the management of nuclear medicine departments. The multidisciplinary collaboration of physicians, nurses, technologists/technicians, medical physicists, pharmacists, and other healthcare professionals contributes to the safe and efficient implementation of healthcare processes. In addition, the procurement, storage, use, and disposal of radioactive materials expand the scope of managers' responsibilities in terms of regulatory compliance, risk management, and institutional safety policies.
With the rapid advancement of technology, artificial intelligence, hybrid imaging systems, automation, and digital health applications offer new opportunities for the management of nuclear medicine services. However, the integration of these technologies into healthcare institutions requires the simultaneous consideration of managerial dimensions such as investment decisions, cost-effectiveness, staff training, data security, and the restructuring of existing processes.
In conclusion, a strategic management approach is essential for the provision of sustainable and high-quality healthcare services in nuclear medicine. Effective workforce planning, rational resource utilization, quality and patient safety practices, technology management, and continuous performance evaluation can be considered fundamental management components that will determine the future success of nuclear medicine services. In this context, nuclear medicine managers should address clinical, technological, and managerial processes in an integrated manner, thereby contributing to the improvement of service quality and institutional sustainability.
Keywords: Nuclear medicine, healthcare management, quality management, patient safety, human resources, technology management, resource management

NÜKLEER TIP ALANLARINDA YÖNETİM: KALİTE, HASTA GÜVENLİĞİ VE KAYNAK YÖNETİMİ AÇISINDAN BİR DEĞERLENDİRME

ÖZET
Nükleer tıp hizmetleri; ileri teknoloji kullanımı, iyonlaştırıcı radyasyonla çalışma, yüksek maliyetli ekipman ve radyoaktif ürünlerin yönetimi gibi özellikleri nedeniyle sağlık hizmetleri içerisinde kendine özgü yönetimsel gereksinimleri bulunan bir alandır. Bu alanlarda etkili yönetim; yalnızca klinik süreçlerin koordinasyonunu değil, aynı zamanda insan kaynaklarının etkin kullanımını, maliyet kontrolünü, cihaz ve teknoloji yönetimini, radyasyon güvenliğini, hasta güvenliğini ve hizmet kalitesinin sürekli iyileştirilmesini kapsamaktadır.
Nükleer tıp birimlerinin yönetiminde özellikle iş gücü planlaması ve yetkinliklerin geliştirilmesi önem taşımaktadır.

Hekim, hemşire, tekniker/teknisyen, fizikçi, eczacı ve diğer sağlık profesyonellerinin multidisipliner bir anlayış içerisinde çalışması, hizmet süreçlerinin güvenli ve etkin yürütülmesine katkı sağlamaktadır. Bunun yanında radyoaktif maddelerin temini, saklanması, kullanımı ve atık yönetimi; mevzuata uygunluk, risk yönetimi ve kurumsal güvenlik politikaları açısından yöneticilerin sorumluluk alanlarını genişletmektedir.

Teknolojik gelişmelerin hızlanmasıyla birlikte yapay zekâ, hibrit görüntüleme sistemleri, otomasyon ve dijital sağlık uygulamaları nükleer tıp hizmetlerinin yönetiminde yeni fırsatlar sunmaktadır. Ancak bu teknolojilerin kuruma entegrasyonu; yatırım kararları, maliyet-etkililik, çalışanların eğitimi, veri güvenliği ve süreçlerin yeniden yapılandırılması gibi yönetsel boyutların birlikte değerlendirilmesini gerektirmektedir.

Sonuç olarak nükleer tıp alanlarında sürdürülebilir ve kaliteli sağlık hizmeti sunumu için klinik etkinliğin yanı sıra stratejik yönetim yaklaşımının benimsenmesi gerekmektedir. Etkin insan gücü planlaması, kaynakların rasyonel kullanımı, kalite ve hasta güvenliği uygulamaları, teknoloji yönetimi ve sürekli performans değerlendirmesi; nükleer tıp hizmetlerinin gelecekteki başarısını belirleyen temel yönetim bileşenleri olarak değerlendirilebilir. Bu bağlamda nükleer tıp yöneticilerinin klinik, teknolojik ve yönetsel süreçleri bütüncül biçimde ele alması, hizmet kalitesinin ve kurumsal sürdürülebilirliğin geliştirilmesine katkı sağlayacaktır.

Anahtar Kelimeler: Nükleer tıp, sağlık yönetimi, kalite yönetimi, hasta güvenliği, insan kaynakları, teknoloji yönetimi, kaynak yönetimi

LSTM-BASED FORECASTING FRAMEWORK FOR RENEWABLE ENERGY AND LOAD DATA: A CASE STUDY FOR A TEXTILE FACILITY IN İZMİR

Assoc. Prof. Dr. Tuba TEZER
Balıkesir Vocational School, Balıkesir University, Balıkesir, Türkiye
Renewable Energy Research, Application and Development Center (BAÜNSEM), Balıkesir University, Balıkesir, Türkiye
ORCID ID: 0000-0003-2097-5086

ABSTRACT
In hybrid renewable energy system (HRES) design, embedding uncertainty directly into the optimization framework, rather than treating it as a post-optimization evaluation step, is becoming increasingly important. A prerequisite for such uncertainty-embedded approaches is the reliable characterization of the stochastic behavior of renewable generation and load demand. This study presents a deep-learning-based forecasting framework developed as the foundational stage of a broader research program on uncertainty-embedded metaheuristic optimization. A Long Short-Term Memory (LSTM) network was developed to forecast four key variables, namely ambient temperature, wind speed, solar radiation, and electrical load, for a hypothetical textile facility in the İzmir Atatürk Organized Industrial Zone. Hourly meteorological data were obtained from the HOMER software, while the temperature data were supplemented from an independent reanalysis source to ensure realistic daily variation. The load profile was derived by scaling a previously validated industrial facility load dataset. The dataset (8760 hourly records) was converted into sliding-window sequences (24-hour input, single-step output) and used to train an LSTM network with 64 hidden units. The trained model achieved strong forecasting performance across all variables, with a validation Root Mean Square Error (RMSE) of 0.095 (normalized scale). In actual units, the RMSE values were 0.67°C for temperature, 1.44 m/s for wind speed, 0.048 kW/m² for solar radiation, and 129.93 kW for load. The Mean Absolute Percentage Error (MAPE) was 1.57% for load and 31.46% for wind speed; the latter is consistent with the relatively high stochasticity of the wind resource reported in the literature. The proposed framework demonstrates that reliable multivariate forecasting can be achieved from a single year of hourly data, providing a data-driven foundation for embedding forecast-derived uncertainty into the metaheuristic optimization of hybrid renewable energy systems.
Keywords: Deep Learning, LSTM, Renewable Energy Forecasting, Hybrid Renewable Energy Systems, Load Forecasting.

INTRODUCTION
In hybrid renewable energy systems (HRES) that integrate renewable generation with storage and complementary technologies, current research focus is no longer limited to optimum sizing and operation decisions, but is increasingly shifting toward data-driven forecasting and the direct incorporation of forecast uncertainty into the optimization process. The uncertainty inherent in renewable generation and load demand is a factor that cannot be ignored in real-world applications; failing to account for this uncertainty can cause a design identified as optimal to underperform in the field or to violate reliability constraints. For this reason, a growing body of literature treats this uncertainty not as a post-optimization evaluation step, but as a constraint or objective embedded directly within the optimization formulation.
A review of the relevant literature reveals several approaches to incorporating uncertainty into optimization.

One group of studies embeds uncertainty directly into the optimization formulation using analytical methods such as IGDT, CCP, RO, or DRO, solving this formulation with classical exact solvers such as CPLEX and GAMS (Wang et al., 2023; Guan et al., 2023; Phu et al., 2024; Bedrood et al., 2025), or, as in studies such as Sun et al. (2026), with custom numerical solution methods, embedding uncertainty via Fuzzy-IGDT in integrated electricity-heat systems that include a heat pump. Other studies first characterize uncertainty as stochastic scenario sets and incorporate this set directly into the metaheuristic algorithm's search process; for example, Kamjoo et al. (2016) combined NSGA-II with chance-constrained programming to address the design of a wind-PV-battery system under uncertainty, while Ssekulima and Etemadi (2026) benchmarked six different metaheuristic algorithms for PV-small-hydropower sizing under stochastic hydrology scenarios. In these studies, the input provided to the optimization is not a single exact value but a scenario set or probability distribution. By contrast, in some studies a single deterministic forecast value is fed directly into the metaheuristic optimization as an input, with uncertainty neither embedded in the optimization nor evaluated afterward; for example, Krishnamoorthy et al. (2026) feed an LSTM-based load forecast directly into a Non-dominated Sorting Moth-Flame Optimization (NSMFO) algorithm. A related approach also works with deterministic inputs but does not disregard uncertainty entirely: the metaheuristic optimization is likewise run with deterministic inputs, but uncertainty is evaluated through a separate scenario analysis after the optimization is complete (Yu et al., 2024). This diversity indicates that uncertainty management in hybrid renewable energy system design remains a maturing field.

Regardless of the method chosen, a necessary prerequisite for any uncertainty-embedded optimization is the reliable, data-driven characterization of the stochastic behavior of the system's inputs, namely renewable generation and load demand. Deep learning methods, particularly Long Short-Term Memory (LSTM) networks, have become a standard tool for this purpose owing to their ability to capture long-range temporal dependencies in sequential meteorological and load data (Silva-Rodriguez et al., 2024); a recently proposed SARIMA-LSTM hybrid model likewise demonstrates a similar approach to solar power plant forecasting through multi-source data fusion (Liu et al., 2026).

This study presents a multivariate deep learning (LSTM) forecasting framework that enables the reliable forecasting of renewable generation and load demand. Using a hypothetical textile facility case study in the İzmir Atatürk Organized Industrial Zone (İAOSB), ambient temperature, wind speed, solar radiation, and electrical load are forecast. The developed framework and the resulting forecast errors form the data and forecasting foundation of a broader research program aimed at incorporating uncertainty into metaheuristic multi-objective optimization.

MATERIALS AND METHODS

Case Study and Data

The case study considers a hypothetical textile production facility located in the İzmir Atatürk Organized Industrial Zone (İAOSB), Çiğli, Türkiye, a region with a significant textile and apparel industry presence. Hourly wind speed and solar radiation data for the site were obtained from the HOMER software. Since HOMER's temperature series provides only a monthly-constant synthetic profile, ambient temperature data were instead obtained from an independent meteorological reanalysis dataset in order to preserve realistic hourly and daily variation. The electrical load profile was derived by scaling a previously validated hourly load dataset recorded at an operating industrial facility to represent demand at the scale of a textile facility. The full dataset spans a one-year period (8760 hourly records).

LSTM Model Architecture and Training

An LSTM recurrent neural network was selected for its well-established capability to model long-range temporal dependencies in sequential data without the vanishing-gradient limitation of standard recurrent architectures (Hochreiter & Schmidhuber, 1997). The four input variables (ambient temperature, wind speed, solar radiation, and electrical load) were min-max normalized to the [0,1] range and converted into sliding-window sequences; a 24-hour input window was used to forecast all four variables jointly, one step ahead. The network architecture begins with a sequence input layer, followed by a single LSTM layer with 64 hidden units, operating in last-time-step output mode. Next is a fully connected layer with 32 units and ReLU activation, followed by a fully connected output layer with four outputs (one for each forecast variable). The final layer is a regression (mean-squared-error) output layer. The model was trained in MATLAB (Deep Learning Toolbox) on a single CPU. The Adam (Adaptive Moment Estimation) optimization algorithm was used for training. Adam is a gradient-based stochastic optimization algorithm that adaptively adjusts the learning rate for each parameter using estimates of the first and second moments of the gradients. The algorithm was applied with an initial learning rate of 0.005 and a gradient threshold of 1. The model was trained for a maximum of 100 epochs, with a mini-batch size of 32, and the training data were reshuffled at every epoch. The dataset was split chronologically into training and test subsets (80%/20%, corresponding to 6989 and 1747 samples after windowing, respectively); the test subset was also used as validation data during training to monitor convergence (evaluated every 50 iterations).

Evaluation Metrics

Forecast performance was evaluated using the Root Mean Square Error (RMSE), computed both jointly for the four variables on the normalized (0-1) scale and, after inverse transformation, for each variable in its actual physical unit. To express forecast accuracy in relative terms, the Mean Absolute Percentage Error (MAPE) was additionally computed for the load and wind speed variables. MAPE was not reported for temperature and solar radiation, because both variables contain values at or near zero (for example, solar radiation at night hours, or winter temperatures near or below zero on the normalized/Celsius scale). This renders the percentage-based metric unstable or undefined.

RESULTS

The trained LSTM network showed strong forecasting performance across all four variables. Table 1 summarizes the resulting error metrics. The overall validation RMSE on the normalized scale was found to be 0.095. In actual units, the RMSE values were calculated as 0.67°C for ambient temperature, 1.44 m/s for wind speed, 0.048 kW/m² for solar radiation, and 129.93 kW for electrical load. The MAPE was 1.57% for load (indicating very high relative accuracy, consistent with the load's relatively regular, cyclical industrial pattern) and 31.46% for wind speed, which is consistent with the relatively high stochastic variability of the wind resource widely reported in the forecasting literature.

Table 1. Forecast error metrics by variable.

Variable	RMSE (normalized)	RMSE (actual units)	MAPE (%)
Temperature	-	0.67 °C	n/a[1]
Wind speed	-	1.44 m/s	31.46

Solar radiation	-	0.048 kW/m²	n/a[1]
Electrical load	-	129.93 kW	1.57
All variables (combined)	0.095	-	-

MAPE is not reported for temperature and solar radiation; both series contain values at or near zero, which renders the percentage-based metric unstable.

Figure 1 compares the forecast and actual values for the four variables over the first week of the test set. Temperature and solar radiation forecasts closely track the actual daily cycles, reflecting their strong daily periodicity. Wind speed forecasts follow the general trend but show larger deviations at sharp, short-lived peaks (e.g., around hour 60), consistent with the higher MAPE reported for this variable. The load forecast closely tracks the facility's operating pattern, including its weekday/weekend step changes.

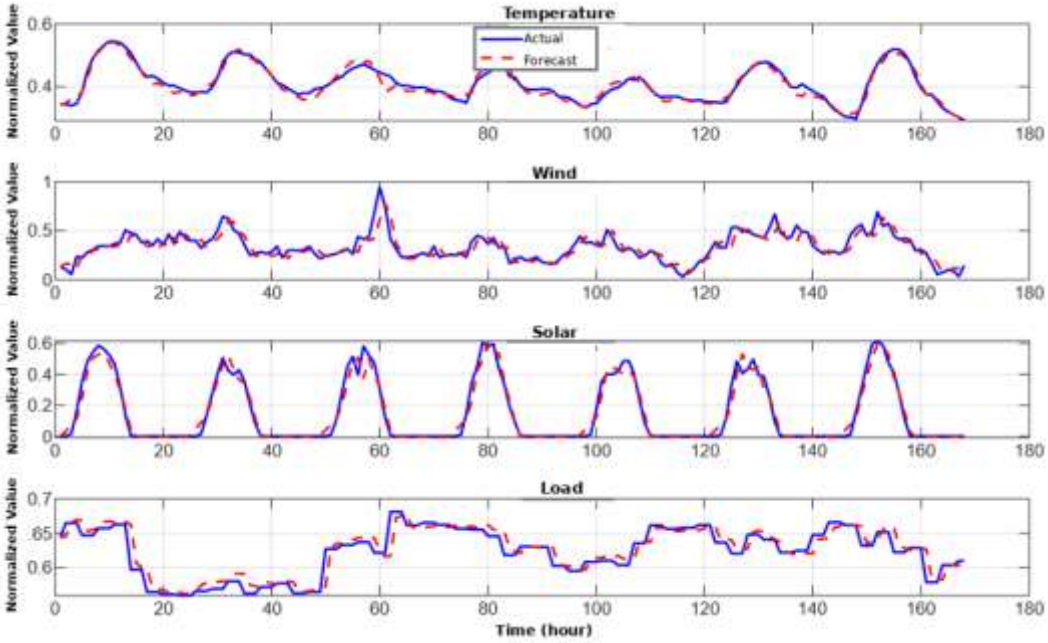


Figure 1. Test-set forecast comparison for the four variables, first week (actual vs. forecast, normalized scale).

Figure 2 extends the comparison for the load variable to the full test period (approximately 1750 hours). The forecast closely tracks the overall seasonal demand decline and most short-term fluctuations, with the largest deviations occurring at two isolated, sharp demand drops (around hours 280 and 950); these drops are thought to correspond to unplanned or infrequent facility shutdown events that are not well represented within the 24-hour input window. Toward the end of the test period (after approximately hour 1200), forecast accuracy decreases slightly, with the model showing a mild systematic over-forecasting tendency; this pattern is consistent with the conditions of that period being less represented in the training data.

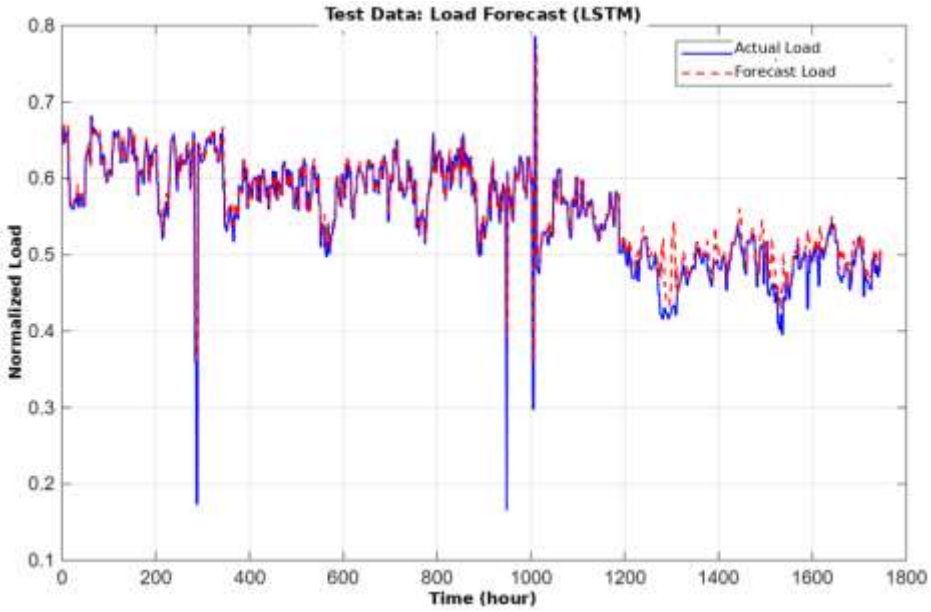


Figure 2. Full test-period load forecast (actual vs. forecast, normalized scale).

CONCLUSION AND DISCUSSION

This study developed and evaluated a multivariate LSTM forecasting framework for ambient temperature, wind speed, solar radiation, and electrical load, using a single year of hourly data for a hypothetical textile facility case study in İzmir. The model achieved strong accuracy for load, temperature, and solar radiation, while the wind speed forecasts, although reasonable, exhibited the relatively higher error expected from this resource's more stochastic nature. These results confirm that a reliable, data-driven multivariate forecast can be obtained from a single year of hourly data using a relatively compact LSTM architecture (64 hidden units, 24-hour input window).

The main contribution of this study is its methodological positioning rather than its optimization performance. The forecasting framework presented here constitutes the foundational, data-generating stage of a broader study aimed at incorporating forecast-derived uncertainty into the metaheuristic multi-objective optimization of hybrid renewable energy systems.

This study has several limitations. The wind and solar meteorological data obtained from HOMER correspond to a single historical reference year rather than multi-year or more recent records; while this is sufficient to demonstrate the forecasting methodology, more recent or multi-year data would increase the robustness of the resulting uncertainty characterization. Although the load profile was derived from a previously validated real facility dataset, it was scaled to represent demand at the scale of a hypothetical textile facility rather than measured directly at the case study site. The reported test-set metrics were obtained by splitting the dataset into only two subsets, training and test, rather than into three fully independent subsets for training, validation, and test. The same test subset was used both as validation data to monitor convergence in MATLAB during training and for the final error evaluation. To rule out a possible optimistic bias in the reported errors, a strictly separate validation subset will be adopted in subsequent stages of this study. Finally, the relatively high MAPE obtained for wind speed reflects an inherent characteristic of the resource rather than a model deficiency; however, this indicates that wind-related uncertainty will require particular attention in the subsequent uncertainty-embedded optimization stage.

Future work will extend this framework in three directions. First, the dataset will be expanded with multi-year meteorological and load records to increase the statistical robustness of the forecast-derived uncertainty bounds.

Second, the resulting forecast error characterization will be incorporated into an optimization carried out with a population-based metaheuristic algorithm for the multi-objective design of the facility's hybrid renewable energy system. Third, this optimization stage is planned to also include a module that models the performance of system components under variable input conditions.

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SOCIAL PERCEPTION, CULTURAL TRANSMISSION, AND THE TRANSFORMATION OF PRODUCTION MODES IN GRAFFITI PRACTICE: A PHENOMENOLOGICAL STUDY

Yaren Ezgi GÖÇÜLÜ
Istanbul Esenyurt University, Faculty of Engineering and Architecture, Department of Industrial Design, İstanbul, Türkiye
ORCID ID: 0009-0004-5074-8188

Türkü Deniz MALKOÇ
Nevşehir Hacı Bektaş Veli University, Institute of Social Sciences, Department of Visual Communication Design, Nevşehir, Türkiye
ORCID ID: 0009-0005-8614-6899

Tolga YILMAZ
Eskişehir Technical University, Faculty of Architecture and Design, Department of Industrial Design, Eskişehir, Türkiye
ORCID ID: 0000-0002-0491-1165

ABSTRACT
As one of the fundamental elements of hip-hop culture, graffiti constitutes an important part of contemporary art and popular culture as a means of identity construction in the social sphere and a form of individual expression. This study examines the changes in the social perception of graffiti, significant aspects of its cultural transmission, and the transformation of its modes of production over time, based on graffiti artists' direct accounts of their experiences and their knowledge of the subject. A phenomenological research design, one of the qualitative research approaches, was employed. In this context, semi-structured interviews were conducted with graffiti artists who are currently active and experienced in the field in different cities across Türkiye and abroad. The data were analyzed within the framework of the artists' working methods and the meanings they attribute to the subculture.
The findings reveal that graffiti, a street-based practice previously labeled and marginalized as "hooliganism" and "vandalism," is now recognized as an artistic discipline. In addition, its legitimacy in public space has increased. However, interviews with experienced graffiti artists indicate that the master-apprentice relationship has weakened and has been replaced by individualized learning practices detached from their context through digital media. While digitalization provides artists with the advantage of establishing a global network and increasing their visibility, the accompanying pressure to produce content rapidly has led to uniformity and caused traditional letter-based styles to recede in favor of figurative and decorative tendencies. Digitalization has particularly detached anonymous graffiti production from its context and turned images shared on social media into a means of gaining likes. Consequently, this study aims to address the positive and negative aspects accompanying graffiti's transformation from a practice once regarded as vandalism into a legitimate artistic field.
Keywords: Graffiti, Phenomenology, Cultural Transmission, Artist Narratives

SOCIAL PERCEPTION, CULTURAL TRANSMISSION, AND THE TRANSFORMATION OF PRODUCTION MODES IN GRAFFITI PRACTICE: A PHENOMENOLOGICAL STUDY

ÖZET

Graffiti hiphop kültürünün temel unsurlarından biri olarak, toplumsal alanda kimlik yaratımı ve bireysel bir ifade biçimi bakımından çağdaş sanatın ve popüler kültürün önemli bir parçasını oluşturmaktadır. Çalışmada, graffiti sanatçılarının deneyimlerinin doğrudan aktarımları ve konu üzerindeki bilgileri üzerinden graffitinin; toplumsal algılamadaki değişimi, kültürel aktarım yollarındaki önemli noktaları ve üretim biçimlerinin zaman içerisindeki dönüşümü incelenmiştir. Çalışmada nitel araştırma yaklaşımlarından biri olan fenomenolojik inceleme yöntemi kullanılmıştır. Bu bağlamda Türkiye'nin farklı şehirlerinde ve yurt dışında güncel olarak graffiti yapan ve bu alanda deneyim sahibi graffiti sanatçılarıyla yarı yapılandırılmış görüşmeler gerçekleştirilmiştir. Elde edilen veriler, sanatçıların çalışma yöntemlerine ve alt kültüre yükledikleri anlamlar çerçevesinde analiz edilmiştir.

Araştırma bulguları, önceden ‘‘serserilik’’ ve ‘‘vandallık’’ adı altında etiketlenen ve dışlanan, sokak eylemi olan graffitinin günümüzde bir sanat disiplini olarak kabul gördüğünü ortaya koymaktadır. Bu bulguların yanı sıra günümüzde graffitinin kamusal alandaki meşruiyeti artmıştır. Ancak graffiti alanında, sokakta deneyimli isimlerle kurulan mülakatlarda ortaya konulan bulgularda usta-çırak ilişkisi zayıflamış; yerini dijital mecralar üzerinden yürütülen bireysel ve bağlamdan kopuk öğrenme biçimlerine bırakmıştır. Bu bağlamda dijitalleşme sanatçılara küresel bir ağ sistemi oluşturma ve görünürlüklerini arttırma avantajı sağlarken beraberinde ortaya çıkan hızlı içerik üretme baskısıyla birlikte tekdüzeliğe yol açmış, harf temelli geleneksel stillerin figüratif ve dekoratif yönelimler karşısında geri plana itilmesine neden olmuştur. Dijitalleşme özellikle anonim temelli yapılan graffiti üretimini bağlamından koparmış ve sosyal medyaya yüklenen görselleri beğeni aracı haline getirmiştir. Sonuç olarak bu çalışma, bir dönem vandalizm olarak anılan graffitinin güncel meşru bir sanat alanına evrilirken bu dönüşümün beraberinde getirdiği olumlu ve olumsuz yanları bir bütün olarak ele almayı amaçlamaktadır.

Anahtar Kelimeler : Graffiti, Fenomenoloji, Kültürel Aktarım, Sanatçı Anlatıları

AN EVALUATION OF OTTOMAN EDUCATION FROM A THEOCRATIC PERSPECTIVE

Seyit TAŞER
Necmettin Erbakan Unıversty A.K.Educatıon Faculty, Department of Social Science Teaching, Konya, Turkey
ORCID ID: 0000-0002-2236-4644

ABSTRACT
The administrative structure of the Ottoman State has occasionally been a subject of debate. Various characterizations have been made regarding the state's administrative structure; it has been viewed as existing somewhere between a state and an empire. Furthermore, writings have been produced discussing whether or not the state was theocratic. As is known, the Ottoman Sultan did not view himself as possessing divine power; rather, he administered the state in accordance with rules established by divine authority. However, customary law (*örfi hukuk*) also played an influential role alongside these rules. To understand the educational structure of the Ottoman State, one must first evaluate it from legal, political, and administrative perspectives. In one of his articles, Sadri Maksudi Arsel described the state's administrative structure as "nim-theocratic"—that is, semi-theocratic.
The Ottoman educational system can be examined under various categories, such as palace educational institutions, military training schools, *sıbyan* schools (primary schools), *medreses*, and vocational training schools. Were Ottoman educational institutions theocratic? To answer this, one must examine their curricula. This study evaluates Ottoman education from a theocratic perspective by analyzing the curricula of these educational institutions.
Keywords: Ottoman State, Educational Institutions, Theocracy.

OSMANLI DEVLETİ EĞİTİMİNİN TEOKRATİK AÇIDAN DEĞERELENDİRİLMESİ

ÖZET
Osmanlı Devleti idari yapısı zaman zaman tartışma konusu olmuştur. Devletin idari yapısı ile ilgili çeşitli nitelendirmeler yapılmıştır. Devlet veya imparatorluk arasında kalındığı görülmüştür. Bunun yanında devletin teokratik olup olmadığı ile ilgili yazılar kaleme alınmıştır. Osmanlı Devleti'nde bilindiği üzere padişah kendini ilahi bir güç olarak görmemiştir. İlahi gücün koyduğu kurallarla devleti idare etmiştir. Fakat bu kuralların yanında örfi hukuk da etkili olmuştur. Osmanlı Devleti'nin eğitim yapısını anlamak için öncelikle hukuki, siyasi ve idari açıdan değerlendirme yapılabilir. Sadri Maksudi Arsel bir makalesinde devletin idari yapısını nim teokratik olarak izah etmiştir. Nim yani yarı teokratik.
Osmanlı Devleti eğitim sistemi saray eğitim kurumları, askeri eğitim veren mektepler, sıbyan mektepleri, medreseler ve mesleki eğitim veren okullar gibi çeşitli başlıklarda incelenebilir. Osmanlı Devleti eğitim kurumları teokratik miydi? Bunu anlayabilmek için müfredatlara bakmak gerekecektir. Bu çalışmada Osmanlı Devleti eğitim kurumları müfredatları üzerinden eğitimin teokratik açıdan değerlendirmesi yapılacaktır.
Anahtar Kavramlar: Osmanlı Devleti, Eğitim Kurumları, Teokrasi

OMER SIKKIN AND RENEWAL OF HIS TOMB

Seyit TAŞER
Necmettin Erbakan Unıversty A.K.Educatıon Faculty, Department of Social Science Teaching, Konya, Turkey
ORCID ID: 0000-0002-2236-4644

ABSTRACT
Akşemseddin is a prominent figure—a scholar, mystic, and Sufi master—who accompanied Fatih Sultan Mehmed and provided both material and spiritual support during the conquest of Istanbul. Akşemseddin's tomb is located in Göynük, Bolu. Another blessed figure is also interred in Göynük: Ömer Sıkkin. His mausoleum is situated close to Akşemseddin's tomb. Ömer Sıkkin lived during the same period as Akşemseddin, in the 15th century. In Ottoman archival documents, he is also referred to as Emir Sıkkin. The literal meaning of "Sıkkin" is "knifemaker," reflecting the fact that knifemaking was indeed Emir's profession. Akşemseddin had come to Göynük as a *khalifa* (deputy) of Hacı Bayram-ı Veli. However, Emir Sıkkin was also a great Sufi; together with Akşemseddin, he engaged in spiritual guidance activities in Göynük, following the path of Hacı Bayram-ı Veli.
There are two separate documents in the Presidency's Ottoman Archives concerning Ömer/Emir Sıkkin. These documents pertain to the repair and renovation of Emir Sıkkin's mausoleum. The documents also mention plans to construct a *tekke* (dervish lodge) next to the mausoleum. Accordingly, a tender was held, and the task of reconstructing the mausoleum was awarded to the company or individual submitting the lowest bid. It is understood that these proceedings, carried out in 1891, coincided with the reign of Sultan Abdülhamid II. This study will detail the correspondence regarding Ömer Sıkkin and the renovation of his mausoleum.
Keywords: Göynük, Akşemseddin, Ömer Sıkkin

ÖMER SIKKİN HAZRETLERİ VE TÜRBESİNİN TADİLATI (1890) HAKKINDA

ÖZET
Akşemseddin malum Fatih Sultan Mehmed'in yanında bulunmuş İstanbul'un fethinde maddi ve manevi destek vermiş alim, arif ve tasavvuf erbabı bir büyük şahsiyettir. Akşemseddin'in kabri Bolu Göynüktedir. Göynük'te metfun mübarek zatlardan biri de, Ömer Sıkkin Hazretleridir. Türbesi Akşemseddin'in kabrine yakın bir mesafededir. Ömer Sıkkin Hazretleri de hemen Akşemseddin ile aynı dönemde 15. Asırda yaşamıştır. Aslında Osmanlı Arşivi belgelerinde Emir Sıkkin olarak da geçmektedir. Sıkkin'in kelime manası da bıçakçı olarak bilinmektedir. Zira aynı zamanda bıçakçılık Emir'in mesleğidir. Akşemseddin Hacı Bayram-ı Veli Hazretlerinin halifesi olarak Göynük'e gelmiştir. Ancak Emir Sıkkin Hazretleri de büyük bir mutasavvıf olup Göynük'te Akşemseddin ile birlikte Hacı Bayram-ı Veli'nin yolunda irşad faaliyetlerinde bulunmuşlardır.
Başkanlık Osmanlı Arşivinde Ömer/Emir Sıkkin Hazretleri ile ilgili olmak üzere iki ayrı belge bulunmaktadır. Bu belgeler Emir Sıkkin'in türbesinin tamir ve tadilatı hakkındadır. Hatta belgelerde geçtiği üzere türbenin yanına bir tekke yapılması da planlanmıştır. Bu doğrultuda ihale yapılarak en düşük teklif veren şirkete veya şahsa türbenin yeniden inşası görevi verilmiştir. 1891 senesinde gerçekleştirilen bu işlemlerin Sultan II. Abdülhamid sönemine tesadüf ettiği anlaşılmaktadır. Bu çalışmada Ömer Sıkkin Hazretleri ve türbesinin tadilatı maksadıyla gerçekleştirilen yazışmaların detaylarına yer verilecektir.
Anahtar Kavramlar: Göynük, Akşemseddin, Ömer Sıkkin.

GİRİŞ

Ömer Dede Sikkînî veya Emir Sıkkini'nin mesleğinin bıçakçılık olması sebebiyle bu şekilde anıldığı bilinmektedir. Asıl adının ne ve aslen nereli olduğu konusu tartışmalıdır. Emir Sikkînî'nin doğum tarihi ve nereli olduğu kesin olarak bilinmemektedir. Ömer Dede'nin ilk tasavvuf terbiyesini Somuncu Baba'dan aldığı rivayet edilir. Daha sonra Hacı Bayrâm-ı Velî'ye intisab etmiş, tasavvufi merhaleleri onun yanında tamamlamıştır(Şahin, 2015). Emir Sıkkin'in kabri Akşemseddin Hazretleri gibi Göynük'tedir. Türbe'de yer alan bilgilendirme yazısı Emir Sıkkin'in Akşemseddin ile aynı dönemlerde yaşadığını belirtir. Bu da 15. Asra tekabül etmektedir.

İsmi Sultan Âmir Dede şeklinde kaydedilir ve halk arasında Bıçakçı Emîr Dede olarak tanındığı belirtilir. Mir'âtü'l-ışk'tan kısa bir süre sonra yazılan Kefevî'nin eserinde Emîr Sikkînî diye anılmaktadır. Kendisinden Ömer ismiyle ilk defa bahseden Taşköprizâde'nin onunla ilgili verdiği bilgi Hacı Bayrâm-ı Velî'nin halifesi olmasından ibarettir(Şahin, 2007: 55-56).

Emir Sikkînî'nin gündelik yaşantısında oldukça cezbeli bir karakter olduğu, kendisinin yolunu takip edenlere de böyle bir yol bıraktığı bilinmektedir. Şeyhinin vefatının akabinde Göynük'e yerleşmiştir. Akşemseddin hazretleri de malum İstanbul'un fethinde bulunmuş, daha sonra Beypazarı'na gelip tasavvuf yolunda hareket etmiştir. Ardından da Göynük'e geldiği bilinmektedir. Ancak Akşemseddin hazretleri ile Emir Sıkkin'in anlaşamadığına ilişkin rivayetler de söz konusudur. Bu tartışmanın bir nedeni de Hacı Bayram-ı Veli Hazretlerine hilafet konusundadır (Şahin, 2015). Hacı Bayram-ı Veli'den sonra Bayramilik tarikatinin Melamilik kolunu Emir Sıkkin temsil etmiştir.

Melâmilik tasavvufta eski bir geçmişe sahip olmakla beraber, belirgin bir şekilde IX. Yüzyılda İran'ın eski kültür merkezlerinden olan Horasan'da ortaya çıkan kendine özgü bir yapısı bulunan tasavvufi bir akımdır. Tasavvuf tarihçileri Melâmiliği üç evrede ele almaktadırlar. Melâmiliğin en güçlü temsilcisi Nişaburlu Hamdûn Kassarilk ilk evre Melâmilerindendir. Kassariyye ekolünün öncüsüdür. Horosan'dan gelen ve Anadolu'da ortaya çıkan ikinci evre Melâmiliğin öncülerinden Dede Ömer Sikkinî tarafından yürütülmüştür. Melâmiliğin Osmanlı döneminde Dede Ömer Sikkinî'nin Bayrâmiyye tarikatı şemsiyesi altında gelişimi oldukça önemlidir(Kaplan & Öksüzoğlu, 2025).

Bıçakçı Ömer Dede'nin önderliği doğrultusunda, ilahi aşk ve cezbeyi sülûkun esası kabul eden klasik Horasan Melamîliği'nin bir anlamda devamı olarak tarih sahnesine çıkmış ve daha ziyade siyasal zümrelerden zarar gördüğü düşünülen, çiftçi ve esnaf zümresine hitap etmiştir. Tac ve hırkanın terk edilmesi ile tarikat sembollerine ehemmiyet verilmediği anlaşılmıştır. Mal ve mevki düşkünlüğü yoktur. Bunun klasik zühdi tasavvuf anlayışını reddediş olarak yorumlamak mümkündür. Ayrıca, klasik tarikat erkân ve sembollerine ve görüntüye önem vermemenin ötesinde, bu tür ayırıcı ve bir bakıma kimlik belirleyici sembollerin, kendi apayrı dünya ve din görüşleri ve tasavvuf anlayışlarının dışarıdan kolayca tespit edilebileceği endişesiyle, bu tehlikeden kaçıp, özel kılık kıyafetleri olmaksızın daha rahat hareket edebilme ve fikirlerini yayabilme çabası olarak da değerlendirilmektedir. Sünni temeller üzerine kurulamuştur (Şahin, 2015) Bayramiliğin Melamilik kolunu bir anlamda tesis etmiş olan Ömer Sıkkin'in bazı kerametlerinden de bahsedilir.

Hacı Bayram'ın öldüğü gece müritlerden bazılarının Emîr Dede'yi kızdırmaları üzerine onun, "Dervişlik hırkada ve taçta değildir" diyerek aşçıların dört koyunu pişirdikleri bir ateşin yanına gidip ani bir hareketle ateşe girip oturduğu, taç ve hırkanın yandığı, ancak kendisine ve Hacı Bayram'ın hediye ettiği şala bir şey olmadığı şeklinde anlatılmış, olayın geçtiği yer hakkında bilgi verilmemiştir(Şahin,2007:55,56). Emir Sıkkin'in Hacı Bayram-ı Veli'ye olan güveni tam olduğu anlaşılır. Yine başka bir rivayette Hacı Bayrâm-ı Velî'nin, kaç müridi bulunduğunu II. Murad'a bildirmek üzere müridlerini kurban etmek için topladığına ve bu toplantı esnasında sadece bir kişinin Hacı Bayram'a tam teslimiyetle bıçağın altına boynunu uzattığına dair menkıbede sözü edilen şahsın Ömer Dede olduğu belirtilir .

Ömer Dede'nin ilk tasavvuf terbiyesini Bursa'da iken Somuncu Baba'dan (Hamîdüddin Aksarâyî) aldığı rivayet edilmektedir Kefevî'nin eserinde ve Bayramî-Melâmî kaynaklarında ise Hacı Bayram'ın asıl halifesinin Ömer Dede olduğunu ispata ve Hacı Bayrâm-ı Velî'nin hayatta iken bu yönde bazı işaretler verdiğine yönelik çeşitli menkıbeler anlatılmaktadır(Şahin,2007:55-56)

Mehmed Tahir Bursalı'nın Osmanlı Müellifleri isimli eserde zikr edilen "İbrahim bin Demirhan bin Hamza el Bosnevi", mutasavvıf ve seyyah bir zat olup Kazar şöhretiyle bilinmektedir. Bayramiyye Tarikatinin Melami kolundandır. 1617'de vefat etmiştir. Babülvezirde Nizamiye karşısında metfundur. Kazar İbrahim eserinde Hacı Bayram-ı Veliye nisbeti şu şekilde açıklamıştır: Mehmed-i Rumi Seyyid Cafer, Dede Ömer Sıkkini, Hacı Bayram-ı Veli(Saraç,2016:15). 17. asırda yaşamış olan Kazar İbrahim Efendi eserinde Hacı Bayram-ı Veli'den devam edegelen tarikatın silsilesine yani intisab edilenlere yer vermiş olduğu anlaşılır. Buna göre, Hacı Bayram-ı Veli'den sonra o yoldan gelen Ömer Sıkkin'e daha sonra Seyyid Cafere sonra da Mehmed-i Rumi'ye sırasıyla intisab edilmiştir. Bazı kaynaklarda ise Hacı Bayram-ı Veli'nin birinci halifesi Akşemseddin olarak gösterilir.

Hacı Bayrâm-ı Velî'nin ölümünün ardından Göynük'e yerleşen Ömer Dede'nin adı, Hacı Bayrâm-ı Velî'nin gerçek halifesinin kim olduğu konusunda o dönemde yaşandığı rivayet edilen tartışmalarda ön plana çıkar. Akşemseddin'e dair yazılan menâkıbnâmede ve daha sonraki bazı kaynaklarda Hacı Bayrâm-ı Velî'nin birinci halifesi Akşemseddin olarak gösterilir(Şahin,2007:55,56)

XV. yüzyıl ortalarında Osmanlı imparatorluğunda Melâmiliği yeniden canlandıran Emir Sikkînî, Hacı Bayram-ı Velî'nin halifelerinden olup Sikkînî lakabıyla anılmaktadır. Bayrâmiyye tarikatı iki farklı usulle devam etmiştir. Akşemseddin, tarikat usulünü şeriat adabı ve erkanı ile sürdürürken, Dede Ömer Melâmi hareketi yeniden canlandırmıştır. Ömer Dede'den sonra Bünyamin Ayaşi'nin devam ettirdiği Bayrâmî Melâmi tarikatı Pir Aksarâyi'ye geldiğinde Melâmi şeyhleri hakkında birtakım dedikodular ortaya çıkmıştır. Aksarâyi döneminde itibar edilmese de Pir Ali Aksarâyi'nin oğlu olan İsmail Maşuki'nin bazı söylemleri idamına neden olmuştur. Sonraki dönem şeyhlerinde Hamza Bali'nin Ebussuud Efendi'nin fetvası ile idam edilmesi gerginliği tırmandırmıştır. Hamza Bali'den sonra tarikatın silsilesi Bursalı Hasan Kabadüz ile devam ederek İdris Muhtefîye kadar gelmiştir(Kaplan & Öksüzoğlu, 2025). Dolayısıyla zaman içinde Melamilik hakkında bazı olumsuz değerlendirmelerin yapıldığı anlaşılır. Bu tenkitlerin Osmanlı Devleti'nde diğer bazı tarikatlarda görülen sorunlar veya yıpranmaların benzeri bir durum olarak görmek mümkündür.

Ömer Sıkkin Türbesinin Tamiri Hakkında

15. asrın sonlarında Göynük'de vafat etmiş olan Emir Sıkkin'e burada bir türbe yaptırılmıştır. Ancak türbede zaman içerisinde tadilat ihtiyacı oluşmuştur. Bu tadilatın da Akşemseddin Hazretlerinin türbesi ile birlikte gerçekleştirildiği anlaşılmaktadır. Bu tadilat ve tekke yapımı hususları Sultan II.Abdülhamid döneminde uygulamaya geçirilmiştir.

Konuyla ilgili olarak Bolu'dan Padişahın kalemine 23Aralık 1890 tarihinde gönderilen yazıda şu ifadeler yer almaktadır "*İstanbul'un hin-i fethinde cennetmekan Fatih Sultan Mehmed Han Hazretlerinin maiyetlerinde bulunmuş olan Akşemseddin Hazretleri ile Emir Ömer Sıkkin Veli Hazretlerinin Göynük kazasında bulunan türbe-i şerifelerinin tamir ve müceddiden inşası ve bunların civarında icray-ı ayin için bir de tekke yapılması hakkında şerefsadır olunan irade-i seniyye cenab-ı hilafetpenahiyi meblağ olan tahrirat-ı aliye daverileri rahzib takrim olunarak işbu tesisat-ı hayriyenin bir eser-i latif-i mahsus hazret-i şehriyarı olmak üzere nezaret-i acizanem tahtında icrası hususunda şereftalik eden ferman-ı celile hazret-i veli nimet azimeden dolayı daima zib-i lisan sadık beyan acizim olan davet-i mefruza-i hazret-i zilullahı müteşekkirane arz bargah icabet kılınmıştır*"(Y.PRK.UM:1308).

Dolayısıyla yazıda Emir Sıkkin türbesi ve burada yapılacak bir tekke için Padişah hazretlerine mahsus, güzel ve hoş bir eser ifadeleri kullanılmıştır.
Yazının devamında: "*Ebniye-i aliye-i mezkurenin keşfi için hazine-i hassa-i şahane nezaret-i celilesinden memur olan hısbülmevsim havanın müsadesizliği cihetiyle doğruca Göynüğe azimeti kabil olamamasına mebni Dersaadet tarıkıyla gitmek üzere ereğli'den hareket eden yaveran hazret-i şehriyariden ebniye-i seniye anbar müdürü miralay izzetlü osman beyin veya diğer keşfe memur buyurulacak zatın vürudunda inşallah mevsim baharın hululuyla beraber inşaata mübaşeret olunmak üzere şimdiden keşfi icra olunarak levazımının istihfarına başlanması mühimdir. Kabil-i tesrad olmayan medan-ı celile-i hazret-i hilafetpenahiye bir lahika-i ruhaniyet calib olacak olan işbu tesisat-ı seniyenin mütetehhim zimmet msarifin olduğu üzere matlub-ı ali şehriyari vechle hizaray-ı husul olması için kemaliyle bezl-i makdur kılınacağı arz olunur olbabda emr ve idare-i hazret-i minlehül emrindir*" ifadeleri yer almaktadır(Y.PRK.UM:1308) Belgede kış şartları nedeniyle doğrudan Göynük'e gidemeyip İstanbul üzerinden gitmek için Ereğli'den hareket eden Miralay Osman Bey'in bölgeye ulaşması, baharın gelmesiyle inşaata başlanabilmesi için şimdiden keşif ve malzeme hazırlıklarının yapılması gerektiği bildirilmekte ve padişaha bağlılık sunulmaktadır.
13 Kanun-ı evvel 1307 (25 Aralık 1891) tarihli bir başka belgede "Göynük'te medfun Akşemseddin hazretlerinin türbe-i şerife tamirleriyle müceddiden inşasına dergah-ı şerife ve dervişan odası inşası ve kabristan muhafaza duvarlarıyla mukarrer sair tefriş ve kezalik emir sıkkın hazretlerinin türbe-i şerifinin ihdamıyla müceddid inşası hazine-i hassa şahanece tanzim olunan üç kıta keşif ile defteriyle resimlerini ve fenni muvaffak surette tamamen mükemmelen hüsn-ü inşayı ikmal etmek…" (ML.EEM.R.10.08.1309) ifadeleri bulunmaktadır. Bu belge de Akşemseddin hazretlerinin türbesinin tadilatı ve buraya dervişan odası ile bir dergâh yaptırılması konularını ele almaktadır
11 Safer 1308 (26 Eylül 1890) tarihinde Bolu mutasarrıfının hazineye telgraf olarak göndermiş olan bir arşiv belgesine göre; Göynükte vaki Akşemseddin ve Emir Sıkın Hazretlerinin türbe-i Şerifeleriyle Süleyman Paşa Camii şerifinin yaptırılması işlemleri için ihale gerçekleştirilmiştir. Ve en düşük teklif veren Zağfiranbolulu (Safranbolulu) Hancı oğlu Yordan Ağa tarafından tadilatın gerçekleştirileceği anlaşılmıştır. Hassından 4450 kuruş tenziliyle 50 bin kuruş tenkis edildiği Safranbolu kaymakamlığının telgrafnamesinde bildirilmektedir. Bu belgenin ekinde Emir Sıkkin Hazretlerinin türbesinin tecdidinin maliyeti de belirtilmiştir. Buna göre Göynük'te Emir Sıkkin hazretlerinin türbe-i şerifinin tecdidi için 31.736 kuruş ayrılmış olduğu arşiv belgesinden anlaşılmaktadır. (ML.EEM.R.10.08.1309)
Yine arşiv belgesinde Akşemseddin için Kutbülarifin ifadesi kullanılırken; Emir Sıkkin için de şu şekilde bir hitap cümlesi yer alır: "*Göynük'te metfun kutbülarifin Akşemseddin Hazretleri ve Emir sıkkin Kaddesesırrahul Mümin* (Allah o müminin manevi sırrını yüceltsin, mübarek kilsin)" (ML.EEM.R.10.08.1309)ifadesi de bu zatlara Osmanlı Devleti'nin vermiş olduğu önemi göstermektedir.

SONUÇ

Akşemseddin ile aynı dönemlerde yaşamış olan Ömer Sıkkin hakkında çok detaylı bilgilere ulaşılamamıştır. Siyasi tarihteki rolü üzerine bir bilgi olmasa da Akşemseddin kadar tasavvufi açıdan kayda değer bir yönü olduğu anlaşılmaktadır. Hacı Bayram-ı Veli'ye intisab etmiş olan bu mutasavvıflar iki yol oluşturmuşlardır. Ömer Sıkkin'e ilişkin olarak anlatılan rivayetler onun keramet ehli bir zat olduğunu da göstermektedir.
Ömer Sıkkin'e kıymet verildiğini gösteren en önemli gelişme hiç şüphesiz türbesinin yeniden inşası ve tamiri ile ilgilidir. Türbenin yanına bir tekke de yapılması planlandığı arşiv belgelerinden anlaşılmaktadır. Göynük'te bulunan Akşemseddin Hazretleri'nin türbesi ile aynı anda yenileme işlemlerine başlanmıştır.

Akşemseddin'in kabrinin hemen yanında Süleyman Paşa Camii bulunmaktadır. Hem bu camii hem türbe restore edilirken buraya da bir dergâh yapılmasının planlandığı tespit edilmiştir.

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THE PROPRIETARY KNOWLEDGE PRODUCTION METHOD CONSTRUCTION OF ISLAMIC CIVILIZATION AGAINST THE POSITIVIST AND HERMENEUTIC KNOWLEDGE PRODUCTION METHODS OF THE MODERN WEST: THE TEVHIDI THOUGHT METHOD OF KNOWLEDGE PRODUCTION

Prof. Dr. Osman ŞİMŞEK
Ankara Hacı Bayram Veli Üniversitesi İİBF Çal.Eko. ve End. İliş. Bölümü Öğretim Üyesi
ORCID ID : 0000-0001-8347-1913

ABSTRACT

Every civilization possesses a characteristic that establishes its authentic civilizational system through its own authentic understanding of knowledge generation methodology. Accordingly, Modern Western civilization manifested the systematic foundations of the materialist knowledge generation methodology through 18th-century Enlightenment thought within the framework of its own scientific understanding. Features grounded in pure rationalism, secular thinking, irreligious academic knowledge generation/scientific thought, and empiricism—which contributed to the formation of Enlightenment thought—produced the positivist knowledge generation methodology and its understanding of science (science) in the 19th century. In the positivist knowledge generation methodology, the academic mind that generates knowledge systematized the logic of scientific knowledge generation according to the principle "there is only what you see," without relying on revelation or dogmas. Thus, the positivist knowledge generation methodology centered on generating knowledge from the material realm through observation and experiment via pure rationalism. It accepted that knowledge obtained from the field through experiment and experience is uniquely scientific knowledge (science). Consequently, it is observed that the knowledge generation methodology based on positivist thought imposed this knowledge generation methodology upon the entire universal system in the name of "scientificity" and "being scientific," with the understanding that knowledge can only be generated through materialist content. Through this knowledge generation methodology, Modern Western civilization guided the minds and thought generation of intellectuals in world societies, rendering world societies dependent through the interaction of "university and knowledge generation methodology."

A second knowledge generation methodology was developed in Modern Western civilization in opposition to the positivist knowledge generation methodological understanding. This is called the hermeneutic (interpretive) thought knowledge generation methodological understanding. The hermeneutic thought knowledge generation methodology developed a knowledge generation methodology (knowledge) based on Western Christian conservatism that opposed the revelation and spiritual content rejected by the materialist/modern-pagan-content positivist knowledge generation methodology (science). Consequently, branches of knowledge constructed on the basis of these two knowledge generation methodologies present in Modern Western civilization were established across all universities worldwide. Modern Western civilization, by guiding the academic mental structures and thought generation traditions of intellectuals and faculty members in non-Western societies through these knowledge generation methodologies, channels the dominant, hegemonic Western civilizational values into the thought systems and academic minds of world societies.

Islamic civilization was also subjected to the influence of modernization and Westernization, especially after the 19th century, transforming into a state where the existence of its own civilization's knowledge generation methodology was forgotten or caused to be forgotten.

This adverse effect of transformation established such a dominant influence through scientists and intellectuals in the universities of the Islamic world that it prompted the question, "Does Islamic civilization possess a knowledge generation methodology at all?" among academics and faculty members within countries of Islamic civilization today. No civilization can rise without possessing an authentic knowledge generation methodology.

A civilization cannot drive its own civilizational rise and social resurgence by employing the knowledge generation methodology of another civilization. Therefore, fundamentally, Islamic civilization attached paramount importance to this matter. In Islamic civilization, the first revealed verse is: “Read in the name of your Rab (the Creator, Sustainer, and Nurturer).” In one aspect, this verse indicates the necessity for the reader, intellectual, or academician to read and analyze everything such as economics, sociology, philosophy, education, politics, and beyond according to the Tevhidi methodology of the One and Only Allah, the Creator. This fundamental directive demonstrates that Islamic civilization establishes its understanding of knowledge generation first and foremost according to the principle of Tevhid, thereby signaling how knowledge regarding all facets of existence is to be generated until the Day of Judgment.

Today, the most fundamental problem facing the Islamic world is the challenge of re-establishing the knowledge generation methodology of its own civilization in accordance with its true essence. Only by achieving this, shaking off the materialist (positivist) and materialist-conservative (hermeneutic) content knowledge generation methodology of Modern Western civilization, and generating its scholarly view directed toward every field can it reach a position capable of providing authentic direction to the new world of the 21st century. In this context, in 2015, Islamic civilization's own knowledge generation methodology containing Tawhidi essence was conceptualized under the name “The Tevhidi Thought Method Of Knowledge Productıon” /("Tevhidi Düşünce Bilgi Üretme Yöntemi") and made the subject of academic studies.

In conclusion, independent of the positivist thought knowledge generation methodology (science) and hermeneutic thought knowledge generation methodology (knowledge) present in Modern Western civilization and in global circulation neither imitating them nor engaging in transferism from them—the knowledge generation methodology formed in the name of Islamic civilization in alignment with the Tevhidi essence is “The Tevhidi Thought Method Of Knowledge Productıon” /("Tevhidi Düşünce Bilgi Üretme Yöntemi"). It can be stated that through this knowledge generation methodology, Islamic civilization has regained the possibility of offering authentic knowledge generation across every branch of knowledge, thereby providing direction to the 21st-century world within the context of revivalism (ihyacılık). Accordingly, based on the divergence in the modes of knowledge production across civilizations, this study addresses the constitutive features of the renewed revival of the social and human disciplines such as Islamic civilization's society-building outlook, social philosophy, economic ethos and the foundational roots of its economic system, political thought, and cultural theory through its own 21st-century mode of knowledge production, namely the tawhidic thought methodology of knowledge production."

Keywords: Knowledge generation methodology, “The Tevhidi Thought Method Of Knowledge Productıon” /("Tevhidi Düşünce Bilgi Üretme Yöntemi"), Positivism, Hermeneutics, Revival and Revivalism

MODERN BATI DÜNYASININ POZİTİVİST VE HERMONOTİK BİLGİ ÜRETME YÖNTEMLERİNE KARŞIN İSLAM MEDENİYETİNİN ÖZGÜN BİLGİ ÜRETME YÖNTEM İNŞASI: TEVHİDİ DÜŞÜNCE BİLGİ ÜRETME YÖNTEMİ

ÖZET

Her medeniyet kendi özgün bilgi üretme yöntem anlayışı ile özgün medeniyet sistemini kuran bir özelliğe sahiptir. Bundan dolayı Modern Batı medeniyeti, 18. Yüzyılda Aydınlanma düşüncesi üzerinden materyalist bilgi üretme yönteminin sistem temellerini kendi bilimsel anlayışı çerçevesinde ortaya çıkarmıştır. Aydınlanma düşüncesinin oluşumuna katkı sağlayan; salt akılcılık, seküler düşünme, la-dini akademik bilgi üretimi/bilimsel düşünce, ampirizm-deneycilik temelli özellikler, 19. yüzyılda pozitivist bilgi üretme yöntemini ve onun bilimsel(science) anlayışını ortaya çıkarmıştır. Pozitivist bilgi üretme yönteminde bilgi üreten akademik aklın ;vahiy ya da doğmalara dayanmadan, "sadece gördüğün vardır" ilkesine göre bilimsel bilgi üretim mantığını sistemleştirmiştir. Böylece pozitivist bilgi üretme yöntemi; salt akılcılıkla maddi alandan, gözlem-deney yoluyla bilgi üretilmesini merkezine almıştır. Alandan deney ve tecrübe ile elde edilen bilginin, ancak bilimsel bilgi(science) olduğunu kabul etmiştir. Böylece pozitivist düşünceye dayalı bilgi üretme yöntemi, bilginin ancak materyalist içerikle üretilmesiyle mümkün olduğu anlayışını "bilimsellik" ve "bilimsel olma" adına,tüm üniversal sistemi bu bilgi üretme yöntemini dayatmış olduğu görülür. Modern Batı medeniyeti bu bilgi üretme yöntemi yoluyla da dünya toplumlarının aydınlarının akıllarına ve düşünce üretimlerine yön vererek, dünya toplumlarını "üniversite-bilgi üretme yöntem" etkileşimi ile bağımlılaştırdığı görülmektedir. Modern Batı medeniyetinde pozitivist bilgi üretme yöntem anlayışına karşı olan ikinci bir bilgi üretme yöntemi geliştirilmiştir. Buna da hermonotik(yorumsamacı) düşünce bilgi üretme yöntem anlayışı denilmektedir. Hermonotik düşünce bilgi üretme yöntemi ise materyalist/modern pagan içerikli pozitivist bilgi üretme yönteminin(science) vahiy ve mana içeriğine karşı çıkan, Batı Hıristiyan muhafazakarlığına dayalı bilgi üretme yöntemini(knowledge) geliştirmiştir.

Sonuçta; tüm dünya üniversitelerinde Modern Batı medeniyetinde bulunan bu iki bilgi üretme yöntemine dayalı oluşturulan ilim dallarını inşa edilmiştir. Modern Batı medeniyeti, Batı dışı toplumların aydınlarının/öğretim üyelerinin akademik akıl yapılarının oluşumuna ve düşünce üretme geleneklerine bu bilgi üretme yöntemleri vasıtasıyla yön vererek, hâkim hegemonik Batı medeniyeti değerlerini bu yolla, dünya toplumlarının düşünce sistemlerine ve akademik akıllarına kanalize etmekte olduğu görülmektedir.

İslam medeniyeti de özellikle 19. yüzyıldan sonra modernleşme, batılılaşma etkisine girdirilerek, kendi medeniyetinin bilgi üretme yönteminin varlığını unutmuş ya da unutturulmuş bir hale dönüştürülmüştür. Bu olumsuz dönüşüm etkisi, günümüzde İslam medeniyeti bünyesindeki ülkelerin akademilerinde ve öğretim üyelerinde; "İslam medeniyetinin bir bilgi üretme yöntemi var mı ki" sorusunu sorduracak kadar, Modern Batı medeniyetinin hegemonik bilgi üretme yöntemlerini, İslam dünyası üniversitelerinde, ilim adamları ve aydınları üzerinden baskın bir etki kurmuştur.

Hiçbir medeniyet özgün bilgi üretme yöntemine sahip olmadan yükselemez. Bir medeniyet, başka bir medeniyetin bilgi üretme yöntemini kullanarak kendi medeniyetini, yükselişe ve sosyal dirilişe geçiremez. Bundan dolayı temelde İslam Medeniyeti, bu konuya çok önem vermiştir.

İslam medeniyetinde ilk inen ayet "Yaradan Rabbinin adı ile oku"dur. Bu ayette bir yönüyle okuyan kişinin/aydının/öğretim üyesinin, Yaradan Tek(Bir) olan Allah'ın tevhidi yöntemine göre her şeyi(örneğin iktisatı, sosyolojiyi, felsefeyi, eğitimi, siyaseti…vb.) okumasının gerekliliğine işaret bulunmakta olduğu söylenebilir. Bu durum ise esasında İslam medeniyetinin, kendi bilgi üretme anlayışını en önce tevhit anlayışına göre belirleyerek, buna göre de kıyamete kadar her şeye yönelik bilgini nasıl üretileceğinin işaretini vermektedir.

Günümüzde İslam dünyasının en temeldeki sorunu kendi medeniyetinin bilgi üretme yöntemini tekrar özüne uygun oluşturma sorunudur. Bunun sağlanması ile Modern Batı medeniyetinin materyalist(pozitivist) ve materyalist muhafazakâr(hermonotik) içerikli bilgi üretme yönteminden sıyrılarak kendi medeniyetini her alan yönelik ilmi görüşünü üreterek 21. Yeni dünyasına ancak bu yol ile özgün yön verebilir bir konuma gelebilir. Bu bağlamda 2015 yılında İslam medeniyetinin tevhit içerikli kendi bilgi üretme yöntemi; "tevhidi düşünce bilgi üretme yöntemi" ismi ile kavramsallaştırarak akademik çalışmalara konu edilmiştir.

Sonuç olarak Modern Batı medeniyetinde bulunan ve dünya ölçeğinde kullanım dolaşımında olan pozitivist düşünce bilgi üretme yöntemi(science) ve hermonotik düşünce bilgi üretme yönteminden(knowledge) bağımsız, onları taklit etmeyen ve onlardan aktarmacılık yapmayan İslam medeniyeti adına tevhidi öze bağlı olarak oluşan bir bilgi üretme yöntemi "Tevhidi Düşünce Bilgi Üretme Yöntemi" dir. Bu bilgi üretme yöntemi, İslam medeniyetinin her ilim dalı alanına yönelik özgün bilgi üretimi ile 21. yüzyıl dünyasına yön verebilmesi imkânına yeniden ihyacılık bağlamında kavuşmuş olduğu söylenebilir. Buna göre bu incelemede, medeniyetlerin bilgi üretme yöntemlerinin farklılığı üzerinden, İslam medeniyetinin 21. yüzyıl sürecindeki kendi bilgi üretme yöntemi olan tevhidi düşünce bilgi üretme yöntem anlayışı üzerinden medeniyetinin; toplum kurucu anlayışı, toplum felsefesi, iktisat zihniyeti ve iktisat sisteminin kuruluş kökleri, siyaset anlayışı, kültür nazariyesi…vb. sosyal ve beşerî ilim dallarının yeni ihya durumunun kurucu özellikleri ele alınacaktır.

Anahtar Kavramlar: Bilgi üretme yöntemi, Tevhidi düşünce bilgi üretme yöntemi, pozitivizm, hermonotizm, ihya ve ihyacılık

CURRENT STATUS OF WRESTLING TRAINING PROGRAMS

Prof. Dr. Aydoğan SOYGÜDEN
Erciyes Üniversitesi, Kayseri, Türkiye
ORCID ID: 0000-0002-9117-3569

ABSTRACT
Objective: This study aims to identify the advantages and disadvantages of current wrestling training programs in Türkiye and compare them with those worldwide.
Materials and Methods: This study employs a semi-structured design model from qualitative research methods. It was conducted using an Interpretive Phenomenological Analysis (IPA) design. In this study, online interviews were conducted with 10 (ten) wrestling coaches who hold Level 3 or higher wrestling coaching certificates and have at least 5 (five) years or more of coaching experience at club, wrestling training center, and national team levels. Before the study, questions about the advantages and disadvantages of wrestling training programs were determined, and main themes and sub-themes were prepared.
Findings: The study identified 7 (seven) main themes reflecting the coaches' experiences. These are: traditional training methods; training periodic phases; performance analysis; digital visual training programs; loading and recovery; overtraining (excessive training, exhaustion); and peak performance timing. It was determined that these main themes influenced the preparation of training programs. The study findings revealed that traditional training methods were used in approaches based on coaches' experiences; digitalization offered opportunities to watch different training programs through visual digital tools such as YouTube and Instagram; attention was not paid to training periodic phases; there was an inconsistency in the relationship between loading and recovery; overtraining was frequent in wrestlers; and the peak performance timing of wrestlers was inconsistent with competition.
Conclusion: It is recommended that wrestling coaches pay attention to the phases of the wrestling training periodization and coordinate the pre-training, in-training, and post-training processes effectively. It has been observed that overtraining among wrestlers leads to mental and physical exhaustion, negatively affecting athletes.
Keywords: Wrestling, wrestling training programs, and the current situation.

GÜREŞ ANTRENMAN PROGRAMLARININ GÜNCEL DURUMU

ÖZET
Amaç: Bu çalışma Türkiye'de güncel güreş antrenman programlarının artı ve eksilerini belirlemek ve Dünya'da yapılan güreş antrenman programları ile karşılaştırmak amacıyla yapılmıştır.
Gereç ve Yöntemler: Çalışma nitel araştırma yöntemlerinden yarı yapılandırılmış desen modelindedir. Yorumlayıcı Fenomenolojik Analiz (YFA/IPA) deseninde yapılmıştır. Çalışmada, 3 (üç) kademe ve üstü güreş antrenörlük belgesine sahip olan, kulüp, Güreş Eğitim Merkezi ve Milli Takım seviyesinde güreş antrenörlüğü yapan en az 5 (beş) yıl ve üstü antrenörlük tecrübesine sahip 10 (on) güreş antrenörü ile çevrimiçi görüşmeler yapılmıştır. Çalışmadan önce güreş antrenman programlarının artı ve eksileri hakkında sorular belirlenerek ana temalar ve alt temalar hazırlanmıştır.
Bulgular: Çalışma sonucunda antrenörlerin deneyimlerini yansıtan 7 (yedi) ana tema belirlenmiştir. Bunlar: geleneksel antrenman yöntemleri: antrenman periyodik evreleri: performans analizi: dijital görsellik antrenman programı: yüklenme ve toparlanma: sürantrenman (fazla antrenman, tükenme): performans zirve zamanlaması şeklinde belirtilen ana temaların antrenman programı hazırlanma aşamalarını etkilediği belirlenmiştir.

Çalışma bulgularında, antrenörlerin deneyimlerine bağlı yaklaşımlarda geleneksel antrenman yöntemlerinin kullanıldığı, dijitalleşme ile youtube, Instagram gibi görsel dijital araçların farklı antrenman programlarını izleme fırsatı sunduğu, antrenman periyodik evrelerine dikkat edilmediği, yüklenme ve toparlanma ilişkisinin uyumsuzluğu, güreşçilerde sürantrenman olma sıklığı ve güreşçilerin performans zirve zamanının müsabaka ile uyumsuzluğu şeklinde bulgular elde edilmiştir.
Sonuç: Güreş antrenörlerinin, güreş antrenman periyotlaması evrelerine dikkat ederek, antrenman öncesi, antrenman esnası ve antrenman sonrası süreçlerin iyi koordine edilmesi önerilmektedir. Güreşçilerde sürantrenmandan dolayı zihinsel ve fiziksel tükenmenin sporcuları olumsuz etkilediği görülmektedir.
Anahtar Kelimeler: Güreş, güreş antrenman programları ve güncel durumu

INTRODUCTION

Wrestling was a significant part of the ancient Olympics and remains one of the most important sports in the modern Olympic Games. This combat sport is based on a weight-class system designed to balance the physical attributes of the wrestlers, thereby enhancing performance levels driven by technical and psychological skills (Garcia et al., 2011).
Wrestling—along with athletics, the oldest sport in world history—is a sport in which two individuals aim to overcome one another on the mat using various holds, maneuvers, and tactical variations, while being required to adhere to specific rules and regulations (Pepe et al., 2006).
Wrestling is recognized as a complex sport that utilizes both aerobic and anaerobic systems and requires a multifaceted physiological foundation—including speed, strength, agility, flexibility, balance, muscular and cardiovascular endurance, and coordination (Horswill 1992; Horswill et al. 1989, 1992).
The aim of training athletes is to leverage the organism's capacity for physiological adaptation to bring it to the level of the next targeted performance (Gabbett, 2016; Foster, 1998).
Sports scientists, strength and conditioning specialists, and coaches are constantly seeking new training methods to improve the performance of athletes and the health-related parameters of sedentary individuals (Issurin, 2010).
Sports scientists, coaches, and strength and conditioning specialists expect athletes or sedentary individuals engaging in exercise to develop new adaptations by employing more effective exercise methods involving stresses generated through various patterns (McMillan et al., 2005).
The Wingate style is one of the earliest examples of high-intensity interval training methods. This style is widely used in scientific studies (30-second bouts performed 4–6 times on a Wingate cycle ergometer against a resistance of 7.5% of body mass—with participants instructed to give a maximal effort—separated by 4-minute recovery intervals, three days a week on alternate days) (Bayati et al., 2011).
This study was conducted to determine the current state of wrestling training programs. It presents new insights by evaluating the training programs of wrestling coaches in Turkiye, based on the views of national coaches.

METHODOLOGY

This study employs a semi-structured design model from qualitative research methods. It was conducted using an Interpretive Phenomenological Analysis (IPA) design. In this study, online interviews were conducted with 10 (ten) wrestling coaches who hold Level 3 or higher wrestling coaching certificates and have at least 5 (five) years or more of coaching experience at club, wrestling training center, and national team levels. Before the study, questions about the advantages and disadvantages of wrestling training programs were determined, and main themes and sub-themes were prepared.

The national wrestling coaches were coded as Participant 1 (P1) through Participant 10 (P10). Questions were posed to the coaches regarding topics such as traditional training methods, training phases (periodization), performance analysis, digital-visual training programs, load and recovery, overtraining (excessive training, exhaustion), peak performance timing, and the "Turkish model." The responses obtained were categorized under main headings and subheadings to derive average responses.

RESULT

Table 1. Demographic variables

		F	%
Gender	Male	10	100
	Female	-	-
Education	High School	-	-
	University	8	80
	Master Degree	2	20
	Doctorate	-	-
National Wrestling Coach	Yes	10	100
	No	-	

Table 2. Participants' experiences regarding wrestling training programs: main themes and sub-themes-

Main Theme	Sub-themes
1. Traditional Training Methods	1.1. Insistence on high-intensity endurance training
2. Training Periodization Phases	2.1. Coaches providing day-to-day training programs
3. Performance Analysis	3.1. Preparing training programs for wrestlers without conducting performance analysis
4. Digital Visual Training Programs	4.1. Opportunity to view various training programs via digital visual platforms like YouTube and Instagram
5. Training Load and Recovery	5.1. Lack of recovery opportunities
6. Overtraining	6.1. Perception that "hard work equals success"
7. Peak Performance Timing	7.1. Accurately determining the timing of peak form
8. Turkish Wrestling Model	8.1. Wrestling models implemented globally: Russian, American, and Iranian models

Theme 1: Traditional Training Methods

Participants stated that traditional training programs have been implemented in wrestling for many years. This theme comprises the sub-dimension 1.1: Persistence in high-intensity endurance training.

Coaches coded P1, P2, and P3 described these traditional training programs as follows:

P1. Generally, traditional methods are used 80% of the time. Coaches are either completely closed off to new methods or simply do not want to engage with them. Furthermore, training seminars are inadequate, and conducting them online is ineffective.

P2. Traditional methods involve long-distance running and lengthy training sessions; we close ourselves off to new training models because no one wants to put in the mental effort.

P3. We still use the training models of Sapunov (Greco-Roman) and Shahmorodov (freestyle)—coaches of Russian origin who worked in Turkey during the 1990s.

Theme 2: Periodic Phases of Training

Participants stated that wrestling coaches generally do not pay attention to the periodic phases of training. This theme comprises the sub-dimension: "2.1. Coaches presenting day-to-day training programs."

Coaches coded P3, P4, P6, and P8 expressed their views regarding the implementation of periodic training phases as follows:

P3. I think that, in general, coaches do not pay attention to the periodic phases of training.
P4. Very intense training programs are implemented even during the off-season.
P6. I do not think that even 50% of coaches are knowledgeable about periodic training phases.
P8. No attention is paid to training periodization; generally, the same workouts are repeated constantly, without regard for the specific training phase.

Main Theme 3: Performance Analysis

The participants stated that coaches are unfamiliar with performance analysis practices and, consequently, do not implement them. This theme comprises the sub-dimension: 3.1. Preparing training programs for wrestlers without conducting performance analysis.

Coaches coded P2, P3, P5, and P8 expressed their views on performance analysis practices as follows:

P8. Measurement, evaluation, performance analysis tracking, and the creation of test batteries are necessary; unfortunately, many coaches do not carry these out.
P2. Performance analyses of athletes are not conducted during the pre-competition, competition, and post-competition periods.
P3. Performance analyses and maximal strength measurements are not performed at the beginning of the season.
P5. I do not think they know how to conduct performance analysis.

Theme 4: Digital Visuals in Training Programs

Participants stated that digital visuals have a positive impact on the preparation of training programs. This theme comprises the sub-dimension of having the opportunity to view various training programs via digital visual tools such as YouTube and Instagram.

Coaches coded P1, P2, and P6 expressed their views on the role of digital visuals in training programs as follows:

P1. It offers coaches the opportunity to see different training methods; it is 40% effective.
P2. I follow digital training programs; it is 100% effective.
P6. There is a high level of digital visibility; it positively influences coaches' training programs.

Theme 5: Training Load and Recovery

Participants stated that there is no proper balance between training load and recovery. This theme comprises the sub-dimension 5.1: Lack of opportunity for recovery.

Coaches coded P2, P3, and P9 expressed their views on training load and recovery practices as follows:

P9. Coaches do not attach importance to the relationship between training load and recovery.
P2. The necessary time between training load and recovery is not provided; recovery periods are not properly adjusted.
P3. The prevailing mindset is about working hard, not working correctly.

Theme 6: Overtraining

Participants indicated that the athletes were experiencing a state of overtraining. This theme consists of the sub-dimension: 6.1. Perception of "hard work, little success."

Coaches coded P1, P7, and P8 expressed their views regarding the prevalence of overtraining among the athletes as follows:

P8: Overtraining is observed at a very high rate among wrestlers.
P7: The incidence of overtraining is very high; 50% of them are heavily overtrained by the end of the first half of the season.
P1: I believe that 80% of the wrestlers suffer from overtraining.

Main Theme 7: Timing of Peak Performance
Participants stated that coaches are rarely able to successfully time peak performance. This theme comprises the sub-dimension 7.1: Accurately determining the timing of peak fitness.
Coaches coded P1 and P2 expressed their views on peak performance timing practices as follows:
P1: Because the wrestling activity schedule is announced very late, the timing of peak performance is rarely successfully managed.
P2: Adjusting the timing of peak performance is difficult because performance analysis is not conducted.

Theme 8: The Turkish Wrestling Model
The participating coaches stated that there is no "Turkish model" in wrestling. This theme comprises the sub-dimension of wrestling models implemented globally—specifically the Russian, American, and Iranian models.
Coaches coded P6 and P7 expressed their views on the Turkish wrestling model as follows:
P6. We do not have a Turkish model.
P7. Unfortunately, we do not have a Turkish-model training style.

Discussion and Conclusion
A key finding is that there is no directly proportional relationship between training load and recovery; athletes are not afforded the opportunity for recovery (Table 2). It has been reported that high-intensity interval training yields significant improvements in health for sedentary individuals and in physical performance for athletes within a short timeframe, and may serve as an alternative to prolonged endurance training (Akgül, 2017). Consequently, it is inferred that interval training could positively influence the recovery status of wrestlers.
It should be noted that when athletes employ this training method to enhance physical performance, nutrition plays a vital role in improving overall exercise performance and shortening the recovery period (Akgül, 2017).
It is a principle acknowledged by sports scientists that the scope and intensity of exercise depend on glucose availability and that maintaining muscle glycogen stores during exercise is crucial (Akgül, 2017).
In training, variables such as intensity, duration, rest intervals, and frequency are manipulated in alignment with the desired adaptation goal (Gabbett, 2016; Cardinale & Varley, 2017; Hulin et al., 2018). The outcome of a well-designed training program is an improvement in the structure and function of targeted physiological systems, leading to enhanced human performance. Conversely, poor training design and inappropriate progression can result in health issues, maladaptation, alterations in hormonal profiles, and typically, reduced performance (Cardinale & Varley, 2017).
Theme 6: Overtraining and sub-dimension 6.1. The perception that "hard work equals success" negatively affects wrestlers. Optimizing the training program is effective in managing what the athlete does and how they respond to the training activities undertaken. The physiological responses of athletes' bodies to training are assessed by measuring their training load (Akyıldız, 2019).

The main theme concerns the periodic phases of training—an aspect often overlooked by wrestling coaches—and comprises the sub-dimension of coaches providing day-to-day training programs (Table 2). Research regarding the relationships between training loads across daily, weekly, monthly, annual, and seasonal timeframes indicates that the ratio between loads should also be monitored on a weekly basis (Gabbett, 2016). Paying attention to the periodic phases of training has a positive impact on an athlete's success.

In conclusion, it is evident that wrestling coaches persistently implement traditional training programs. This indicates a lack of training regimens aligned with evolving wrestling rules; consequently, programs tailored to current regulations need to be developed. It has been noted that coaches fail to properly plan periodic training phases, instead relying on daily training schedules. As this lack of planning leads to haphazard and uncontrolled training practices, it results in overtraining among wrestlers. Indeed, a significant number of wrestlers have reported suffering from overtraining. Since working harder does not necessarily equate to greater success, it is essential to devise appropriate training programs.

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NEW MONUMENTAL TREE INVENTORY AND DIMENSIONAL ASSESSMENT IN ESKİPAZAR (KARABÜK)

Sena MALAY
Karabük University, Faculty of Forestry, Department of Forest Engineering, Karabük, Türkiye
ORCID ID: 0009-0009-7757-0064

Nagihan SEKİ
Karabük University, Faculty of Forestry, Department of Forest Engineering, Karabük, Türkiye
ORCID ID: 0000-0002-4367-6153

ABSTRACT

Introduction and Purpose: Monumental trees represent invaluable components of natural and cultural heritage due to their extraordinary dimensions, advanced ages, and ecological significance. With approximately 71% of its surface area covered by forests, Karabük province possesses a high biological richness and significant potential for aged forest heritage. The aim of this study is to identify undocumented trees with monumental characteristics in the Eskipazar district of Karabük, determine their dendrometric dimensions, and assess their monumental values according to national standards.

Materials and Methods: Candidate trees were identified through interviews with local forestry staff and residents. On-site dendrometric measurements, including tree height, diameter at breast height (dbh, 1,30 m), and crown diameter were performed. Herbarium specimens were collected for taxonomic verification The evaluation was carried out using the "Genç-Güner Method" integrated into the Turkish Standards Institute standard (TS 13137). Current Monumental Value (CMV) and Minimum Monumental Point (MMP) scores were calculated for each tree.

Results: Field evaluations revealed a total of four candidate specimens, comprising three Anatolian black pines (Pinus nigra J.F.Arnold subsp. pallasiana (Lamb.) Holmboe) and one downy oak (Quercus pubescens Willd.). Based on the TS 13137 assessment criteria, all evaluated individuals achieved Current Monumental Values (CMV) exceeding their respective Minimum Monumental Point (MMP) thresholds. Consequently, each specimen was classified as a "dimensional monumental tree," although none currently have official protection or registration status.

Discussion and Conclusion: The examined trees have survived well beyond the typical lifecycle of their species and establish a vital temporal and cultural bridge between the past and the future. None of these valuable specimens currently have official conservation or registered status. Official registration procedures by the High Council of Monuments should be initiated urgently. Furthermore, scientific arboricultural maintenance and physical protection measures must be implemented to preserve these natural monuments for future generations.

Keywords: Dimensional Monumental Tree; Pinus nigra subsp. pallasiana; Quercus pubescens; Karabük; Nature Conservatio

A SEPTIC HERMITE BASIS FUNCTION-BASED COLLOCATION METHOD FOR NUMERICAL APPROXIMATION

Merve GÜLER
M.Sc. Student, İnönü University, Department of Mathematics, Malatya, 44280, TÜRKİYE
ORCID ID: 0009-0007-1895-3191

Dr. Nuri Murat YAĞMURLU
Prof. Dr., Inonu University, Mathematics Department, Malatya, 44280, TÜRKİYE.
ORCID ID: 0000-0003-1593-0254

ABSTRACT
In contemporary science and engineering research, the mathematical modeling of natural phenomena constitutes a fundamental area of study across numerous disciplines, particularly in astronomy, chemistry, physics, geology, and marine sciences. The models arising from this process are frequently expressed through ordinary, partial, or fractional-order differential equations. Obtaining analytical (exact) solutions for these differential equations is often theoretically impossible or extremely difficult due to their inherent complexity. This limitation drives researchers toward high-precision approximate (numerical) solution methods that can serve as alternatives to analytical solutions. A review of the literature reveals that finite difference, finite element, variational, and weighted residual approaches are among the most widely used numerical methods. The primary objective of these methods is to reduce continuous differential equations—or systems thereof—into solvable systems of algebraic equations through discretization. Numerical solutions are obtained by executing the algorithmic schemes resulting from this reduction process with the aid of computational software. The reliability and accuracy order of the obtained results are quantitatively evaluated using the L_2 and L_∞ error norms, which are accepted as standards in the literature. This study presents the theoretical framework and implementation steps of the septic Hermite-based collocation finite element method. To transparently demonstrate the procedural steps of the methodology, a prototype ordinary differential equation with appropriate boundary conditions is considered. The numerical solutions to the problem are presented in tables and graphs, alongside comparisons with exact solutions and calculated error norms. It is anticipated that the method validated on this prototype problem can be readily adapted to a wide class of linear and nonlinear differential equations encountered in the natural sciences and engineering.
Keywords: Septic Hermite B-spline; Collocation method; Shifted Legendre and Chebyshev polynomials Roots, Finite Element Method.

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ÖZET
Günümüz fen ve mühendislik araştırmalarında doğa olaylarının matematiksel olarak modellenmesi; astronomi, kimya, fizik, jeoloji ve deniz bilimleri başta olmak üzere birçok disiplinde temel bir araştırma alanını oluşturmaktadır. Bu süreçte ortaya çıkan modeller sıklıkla adi, kısmi veya kesirli mertebeden diferansiyel denklemler ile ifade edilir. Bahse konu diferansiyel denklemlerin analitik (tam) çözümlerine ulaşmak, denklemlerin karmaşıklığı nedeniyle çoğu zaman teorik açıdan imkânsız veya oldukça güçtür. Bu kısıt, araştırmacıları analitik çözümlerin yerini alabilecek yüksek hassasiyetli yaklaşık (nümerik) çözüm yöntemlerine yöneltmektedir.

Literatür incelendiğinde; sonlu farklar, sonlu elemanlar, varyasyonel ve ağırlıklı kalan yaklaşımları en yaygın kullanılan nümerik yöntemler arasında yer almaktadır. Bu yöntemlerin temel amacı, sürekli diferansiyel denklem veya denklem sistemlerini ayrıklaştırarak çözülebilir cebirsel denklem sistemlerine indirgemektir. İndirgeme neticesinde oluşturulan algoritmik şemalar, hesaplamalı yazılımlar yardımıyla koşturularak nümerik çözümler elde edilir. Elde edilen sonuçların güvenilirliği ve doğruluk mertebesi ise literatürde standart kabul edilen L2 ve L∞ hata normları vasıtasıyla nicel olarak değerlendirilir. Bu çalışmada, septik Hermite tabanlı kollokasyon sonlu elemanlar yönteminin teorik altyapısı ve uygulama adımları sunulmaktadır. Metodolojinin işlem adımlarını şeffaf biçimde göstermek amacıyla, uygun sınır koşullarına sahip prototip bir adi diferansiyel denklem ele alınmıştır. Problemin nümerik çözümleri, tam çözümler ve hesaplanan hata normları ile karşılaştırmalı olarak tablo ve grafikler halinde sunulmuştur. Bu prototip problem üzerinde doğrulan yöntemin, doğa bilimleri ve mühendislikte karşılaşılan geniş bir lineer ve lineer olmayan diferansiyel denklem sınıfına kolaylıkla uyarlanabileceği öngörülmektedir.
Anahtar Kelimeler: Septik Hermite B-spline; Kollokasyon yöntemi; Kaydırılmış Legendre and Chebyshev polinom kökleri; Sonlu Eleman Yöntemi.

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INTRODUCTION

The Finite Element Method (FEM) represents a relatively modern numerical paradigm, having developed over approximately seven decades. Methodologically, rather than attempting a global approximation across the continuous domain of a boundary value problem, FEM discretizes the solution space into a mesh of smaller, finite subdomains referred to as elements. The governing equations are subsequently formulated over a representative element, integrated with prescribed boundary conditions, and solved algorithmically via high-level computational programming. The fidelity and convergence of the resulting numerical scheme are systematically evaluated by benchmarking the approximate solutions against exact analytical solutions—where available—using comparative tables and visual plots. As with any numerical approximation technique, FEM entails specific trade-offs regarding computational efficiency and accuracy. For a more comprehensive theoretical exposition and literature review, readers are directed to Karakaş (2020) and the references therein.

LITERATURE SURVEY

This section reviews key contributions in the application of the Finite Element Method (FEM), lower-order Hermite spline basis functions, and higher-order septic Hermite spline formulations for solving differential equations.

1. Finite Element Method and Spline Collocation

Finite element collocation techniques have been widely utilized to solve nonlinear wave equations and boundary value problems. Shallu and Kukreja (2023) obtained approximate solutions for the generalized regularized long-wave (GRLW) equation using an optimal spline finite element collocation approach combined with implicit Crank–Nicolson and explicit SSP-RK43 time-integration schemes. Similarly, Yağmurlu and Karakaş (2020) implemented a trigonometric cubic B-spline finite element collocation method to model the equal-width (EW) wave equation, evaluating performance via comparative tables and figures. The same authors subsequently extended this methodology to the modified equal-width (MEW) wave equation by incorporating a novel Rubin–Graves linearization technique (Yağmurlu & Karakaş, 2022).

2. Lower-Order Hermite Basis Functions

Hermite basis functions are particularly effective for differential problems because they interpolate both field variables and their derivative values, ensuring higher continuity across element boundaries. Kumari et al. (2024) developed a shock-capturing Hermite collocation method for nonlinear coupled Burgers-type systems operating at high Reynolds numbers. In transient diffusion studies, Kutluay et al. (2022) investigated one-dimensional heat conduction problems subject to Dirichlet boundary conditions using cubic Hermite basis functions. Building on this framework, Kutluay et al. (2024a) applied cubic Hermite B-spline collocation to simulate the MEW wave equation, confirming numerical accuracy and computational efficiency. Subsequently, Kutluay et al. (2024b) extended their work to quintic Hermite B-spline collocation for 1D heat conduction problems, providing rigorous stability analysis alongside computational test cases.

3. Septic Hermite Basis Functions

To achieve higher spatial accuracy and derivative continuity, recent investigations have increasingly focused on seventh-order (septic) Hermite formulations. Kumari et al. (2022) solved non-homogeneous self-adjoint singularly perturbed boundary value problems via septic Hermite collocation, demonstrating that empirical rates of convergence closely match theoretical predictions. Furthermore, Kumari and Kukreja (2023) conducted a numerical investigation of the GRLW equation using septic Hermite collocation coupled with Crank–Nicolson and SSP-RK43 time-stepping schemes, successfully capturing solitary wave propagation and soliton dynamics.

COLLOCATION METHOD

The operator equation defined on the solution domain Ω is formulated as follows:

$$A(U) = f. \qquad \textbf{(1)}$$

In this formulation, A denotes a linear or non-linear operator, U represents the dependent variable, and f is a prescribed function of the independent variable(s). An approximate solution U_N in place of exact solution U is sought as

$$U_N = \sum_{j=1}^{8} a_{j+6k-6} \mathrm{H}_j \qquad \textbf{(2)}$$

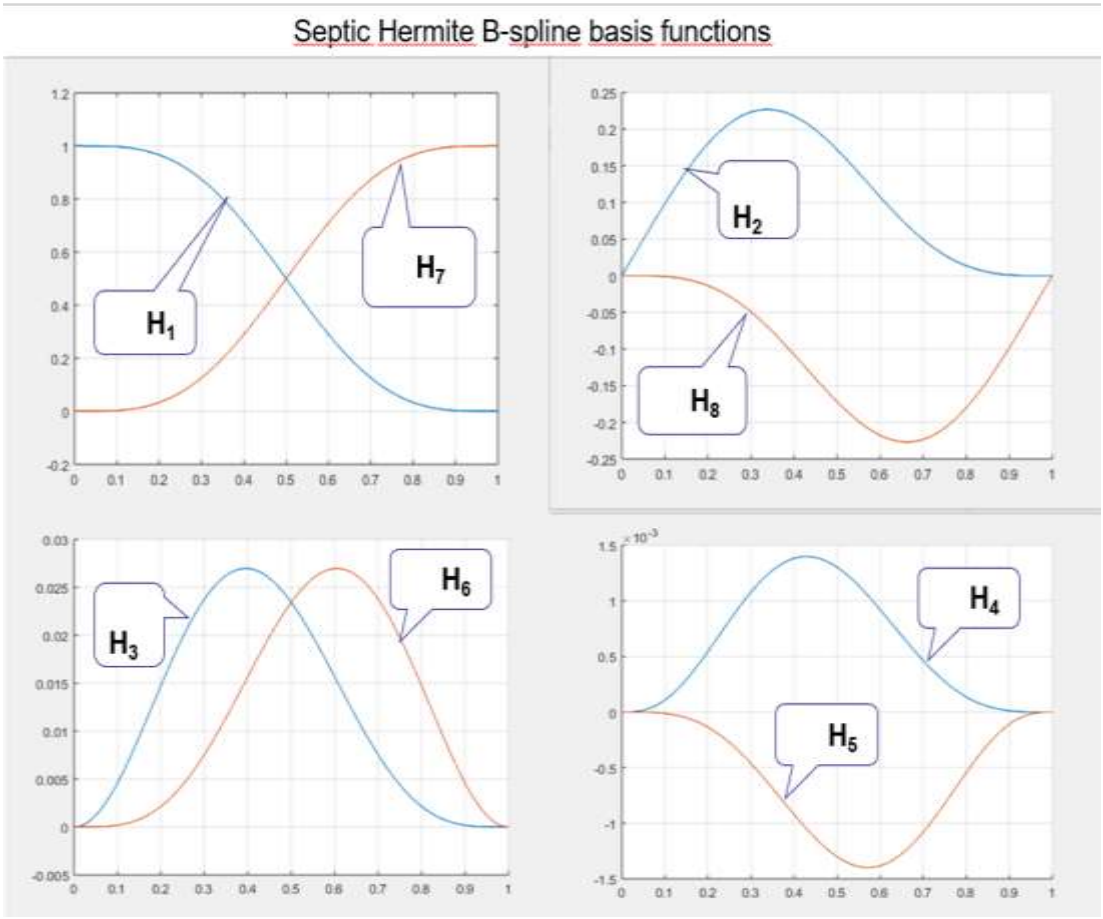
where H_j's are approximation functions and a_{j+6k-6}'s are unknown parameters to be determined by the application of the method itself and initial/boundary conditions given together with the governing equation. Here k stands for the element number in the solution domain (Karakaş, 2020).

THE DERIVATION OF THE SEPTIC HERMITE BASES

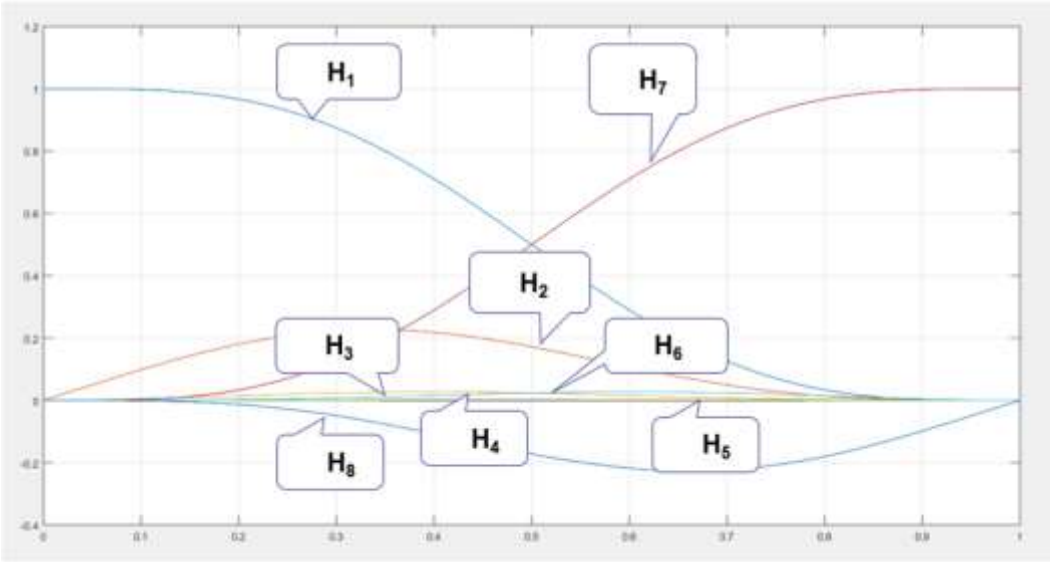
In this study, septic (seventh-degree) Hermite spline basis functions are employed to construct the finite element trial space. The selection of approximation functions in numerical discretization depends fundamentally on the order of the governing differential operator, requiring a polynomial degree equal to or higher than the order of the equation. For the second-order differential model investigated herein, a seventh-degree polynomial serves as an appropriate approximation polynomial.

While lower-order formulations such as cubic and quintic Hermite splines have been examined in earlier studies, higher-order septic Hermite splines are selected here to assess their influence on solution accuracy, convergence rates, and derivative continuity across element boundaries.

For a detailed theoretical exposition regarding the mathematical construction and properties of septic Hermite splines, readers are referred to Kumari et al. (2022) and Kutluay et al. (2025). The spatial distribution of the resulting eight local septic Hermite basis functions defined over a representative finite element is depicted in Figure 1, showcasing both individual shape profiles and their collective behavior.



Hermite bases on one element.



SHIFTED LEGENDRE VE CHEBYSHEV ROOTS

When employing septic Hermite basis functions, four interior collocation points are assigned per element. These interior points are evaluated at the shifted roots of either Legendre or Chebyshev polynomials. These shifted roots are Legendre roots.

and Chebyshev roots

$\xi_1^C = 0.017037086855466,$	$\xi_2^C = 0.146446609406726$
$\xi_3^C = 0.370590477448740,$	$\xi_4^C = 0.629409522551260,$
$\xi_5^C = 0.853553390593274,$	$\xi_6^C = 0.982962913144534.$

To evaluate the numerical performance of the proposed scheme, computational results are tabulated across different collocation root distributions. Specifically, shifted Legendre and Chebyshev roots are designated by L and C, respectively. The choice of these orthogonal polynomial roots is motivated by their well-documented ability to minimize approximation error and enhance interpolation stability throughout simulations, as widely established in the literature. In addition to these standard root distributions, a set of custom shifted collocation points—denoted as Special—is introduced in this study, defined as follows:

$$\xi_1 = \frac{1}{7}, \qquad \xi_2 = \frac{2}{7}, \qquad \xi_3 = \frac{3}{7}, \qquad \xi_4 = \frac{4}{7} \qquad \xi_5 = \frac{5}{7} \qquad \xi_6 = \frac{6}{7}$$

Furthermore, this choice facilitates a comprehensive comparative analysis in tabular form.

MODEL PROBLEM

In the present study, for the sake of simplicity, the following prototype model equation

$$\frac{d^2U}{dx^2} + U = x^2 e^{-x}$$

is going to be handled on the solution domain of the problem

$$0 < x < 10$$

together with the following boundary conditions

$$U(0) = U(10) = 0.$$

The exact analytical solution to this problem is well-documented in the literature and is defined as follows:

$$U(x) = \frac{1}{2} e^{-x} \left[1 + 2x + x^2 - e^x \cos x - 2e^x \left\{ -\frac{\cot 10}{2} + \frac{121 \csc 10}{2e^{10}} \right\} \sin x \right]$$

Having established the governing model problem, we now proceed to the implementation of the finite element collocation method based on septic Hermite basis functions. The resulting numerical simulation data are generated and subsequently presented in both tabular and graphical formats to systematically evaluate the accuracy and computational efficiency of the proposed scheme. In the following approximation

$$U_M = \sum_{j=1}^{8} a_{j+6k-6} \mathrm{H}_{ji}$$

where a_{j+6k-6} denote the unknown coefficients to be determined, k represents the element index, and $i = 1,2,\ldots,6$ indexes the internal collocation points. Furthermore, $\mathrm{H}_{ji} = \mathrm{H}_j(\xi_i)$ represents the septic Hermite basis functions evaluated at the ith collocation point xi. Applying the following local coordinate transformation to the kth element,

$$\xi = \frac{x - x_k}{h}$$

the global internal $[x_k,\ x_{k+1}]$ is converted to into local unit interval $[0,1]$. In terms of this local coordinate variable ξ, the septic Hermite base functions

$\mathrm{H}_1(\xi) = 1 - 35\xi^4 + 84\xi^5 - 70\xi^6 + 20\xi^7$, $\mathrm{H}_2(\xi) = (\xi - 20\xi^4 + 45\xi^5 - 36\xi^6 + 10\xi^7)h$,

$$\mathrm{H}_3(\xi) = (0.5\xi^2 - 5\xi^4 + 10\xi^5 - 7.5\xi^6 + 2\xi^7)h^2,$$

$$\mathrm{H}_4(\xi) = \left(\frac{1}{6}\xi^3 - \frac{2}{3}\xi^4 + \xi^5 - \frac{2\xi^6}{3} + \frac{1}{6}\xi^7\right)h^3,$$

$\mathrm{H}_5(\xi) = \left(-\frac{1}{6}\xi^4 + \frac{1}{2}\xi^5 - \frac{1\xi^6}{2} + \frac{1}{6}\xi^7\right)h^3$, $\mathrm{H}_6(\xi) = \left(\frac{5}{2}\xi^4 - 7\xi^5 + \frac{13\xi^6}{2} - 2\xi^7\right)h^2$,

$\mathrm{H}_7(\xi) = 35\xi^4 - 84\xi^5 + 70\xi^6 - 20\xi^7$, $\mathrm{H}_8(\xi) = (-15\xi^4 + 39\xi^5 - 34\xi^6 + 10\xi^7)h$

and their second order derivatives

$\mathrm{B}_1(\xi) = -420\xi^2 + 1680\xi^3 - 2100\xi^4 + 840\xi^5$, $\mathrm{B}_2(\xi) = (-240\xi^2 + 900\xi^3 - 1080\xi^4 + 420\xi^5)h$,

$\mathrm{B}_3(\xi) = (1 - 60\xi^2 + 200\xi^3 - 225\xi^4 + 84\xi^5)(h^2)$, $\mathrm{B}_4(\xi) = (\xi - 8\xi^2 + 20\xi^3 - 20\xi^4 + 7\xi^5)(h^3)$,

$\mathrm{B}_5(\xi) = (-2\xi^2 + 10\xi^3 - 15\xi^4 + 7\xi^5)(h^3)$, $\mathrm{B}_6(\xi) = (30\xi^2 - 140\xi^3 + 195\xi^4 - 84\xi^5)(h^2)$,

$\mathrm{B}_7(\xi) = 420\xi^2 - 1680\xi^3 + 2100\xi^4 - 840\xi^5$, $\mathrm{B}_8(\xi) = (-180\xi^2 + 780\xi^3 - 1020\xi^4 + 420\xi^5)h$,

are given as above, respectively. The updated values of U_i and its second-order derivative U''_i at the interior collocation points are evaluated as follows:

$U_i = \mathrm{a}_{6\mathrm{k}-5}H_{1\mathrm{i}} + \mathrm{a}_{6\mathrm{k}-4}H_{2\mathrm{i}} + \mathrm{a}_{6\mathrm{k}-3}H_{3\mathrm{i}} + \mathrm{a}_{6\mathrm{k}-2}H_{4\mathrm{i}} + \mathrm{a}_{6\mathrm{k}-1}H_{5\mathrm{i}} + \mathrm{a}_{6\mathrm{k}}H_{6\mathrm{i}} + \mathrm{a}_{6\mathrm{k}+1}H_{7\mathrm{i}} + \mathrm{a}_{6\mathrm{k}+2}H_{8\mathrm{i}}$

$$h^2 U''_i = a_{6k-5}B_{1i} + a_{6k-4}B_{2i} + a_{6k-3}B_{3i} + a_{6k-2}B_{4i} + a_{6k-1}B_{5i} + a_{6k}B_{6i} + a_{6k+1}B_{7i} + a_{6k+2}B_{8i}$$

Substituting these newly derived approximations into the governing equation yields the following linear system of algebraic equations:

$$[a_{6k-5}B_{1i} + a_{6k-4}B_{2i} + a_{6k-3}B_{3i} + a_{6k-2}B_{4i} + a_{6k-1}B_{5i} + a_{6k}B_{6i} + a_{6k+1}B_{7i} + a_{6k+2}B_{8i}] /h^2 +$$

$$[a_{6k-5}H_{1i} + a_{6k-4}H_{2i} + a_{6k-3}H_{3i} + a_{6k-2}H_{4i} + a_{6k-1}H_{5i} + a_{6k}H_{6i} + a_{6k+1}H_{7i} + a_{6k+2}H_{8i}] + (h\xi + x_k)^2 e^{-(h\xi + x_k)} = 0.$$

Imposing the prescribed boundary conditions onto the discretized governing equation yields a well-posed and solvable system of algebraic equations. Consequently, the two unknown parameters are determined as follows:

$$a_1 = 0 \ \ and \ a_{6M+1} = 0.$$

When those unknowns are placed in their places and required calculations are carried out, a system of the following form

$$Lhs\ \boldsymbol{a} = Rhs$$

is obtained. Here, Lhs and Rhs denote matrices of dimensions $(6M \times 6M)$ and $(6M \times 1)$, respectively. Numerical simulations are conducted for various values of M using MATLAB (R2015a). To evaluate the accuracy of the proposed method, the standard L_2 and L_∞ error norms are defined as follows:

$$L_2 = \left(h \sum_{i=1}^{M} |U_i - (U_M)_i|^2 \right)^{1/2}$$

$$L_\infty = \max_{1 \le i \le M} |U_i - (U_M)_i|.$$

Consequently, numerical simulations were conducted for different values of M, and the corresponding results are systematically summarized in Tables I, II, and III.

An analysis of the L_2 and L_∞ error norms presented in Table I across increasing spatial partition numbers M demonstrates that the scheme utilizing shifted Legendre roots yields superior accuracy for lower values of M, while achieving strong agreement with the shifted Chebyshev root formulation as M increases. Notably, beyond a critical spatial refinement threshold, the error norms exhibit a gradual increase. This performance reversal is attributed to the accumulation of floating-point round-off errors and numerical noise inherent to high-dimensional systems, underscoring the critical necessity of selecting an optimal mesh size M.

Furthermore, the seventh-order spatial accuracy of the septic Hermite basis functions employed in this study allows for minimal error levels using relatively coarse spatial discretizations (small M). In contrast, a previous study utilizing lower-order cubic basis functions required a fine discretization of M = 512 to achieve comparable error magnitudes (Kutluay et al., 2024c). This benchmark highlights the distinct computational efficiency and accuracy advantages provided by higher-order basis formulations.

Table I				
	L_2		L_∞	
M	L	C	L	C
2	0.0019	0.0136	4.1818e-04	0.0027
4	1.2487e-05	1.6385e-04	4.3018e-06	4.1485e-05
8	6.8504e-08	6.7924e-06	3.0822e-08	1.2707e-06
16	3.0243e-10	1.2214e-07	1.6855e-10	2.2956e-08
32	1.9087e-12	1.9651e-09	7.8521e-13	3.6903e-10
64	1.0352e-12	3.1256e-11	2.3626e-13	5.8276e-12

An inspection of Table II reveals that both shifted Legendre and Chebyshev root configurations yield superior numerical accuracy at coarser spatial discretizations. However, as the number of elements exceeds a critical threshold, the error norms for both root formulations exhibit a gradual increase. This performance degradation is consistently driven by the accumulation of computational propagation and floating-point round-off errors.

Table II				
	L_2		L_∞	
M	L	C	L	C
10	1.2157e-08	1.9134e-06	5.9027e-09	3.6386e-07
50	8.2687e-13	1.3495e-10	1.9929e-13	2.5405e-11
100	1.9068e-12	3.3972e-12	4.4587e-13	8.6142e-13
150	1.3264e-12	5.8079e-12	3.0942e-13	1.4064e-12
200	3.9711e-12	6.6457e-12	1.1426e-12	1.9598e-12

Table III presents a comparative performance analysis of the scheme using shifted Legendre, shifted Chebyshev, and custom ('Special') root distributions. Notably, the formulation utilizing shifted Legendre roots demonstrates superior accuracy, significantly outperforming both the Chebyshev and Special root configurations.

Table III						
	L_2			L_∞		
M	L	C	Special	L	C	Special
25	8.7341e-12	8.5914e-09	3.3024e-07	5.3763e-12	1.6148e-09	6.1955e-08
50	8.2687e-13	1.3495e-10	5.1827e-09	1.9929e-13	2.5405e-11	9.7278e-10
100	1.9068e-12	3.3972e-12	8.7894e-11	4.4587e-13	8.6142e-13	1.6534e-11
200	3.9711e-12	6.6457e-12	1.4000e-11	1.1426e-12	1.9598e-12	3.9951e-12

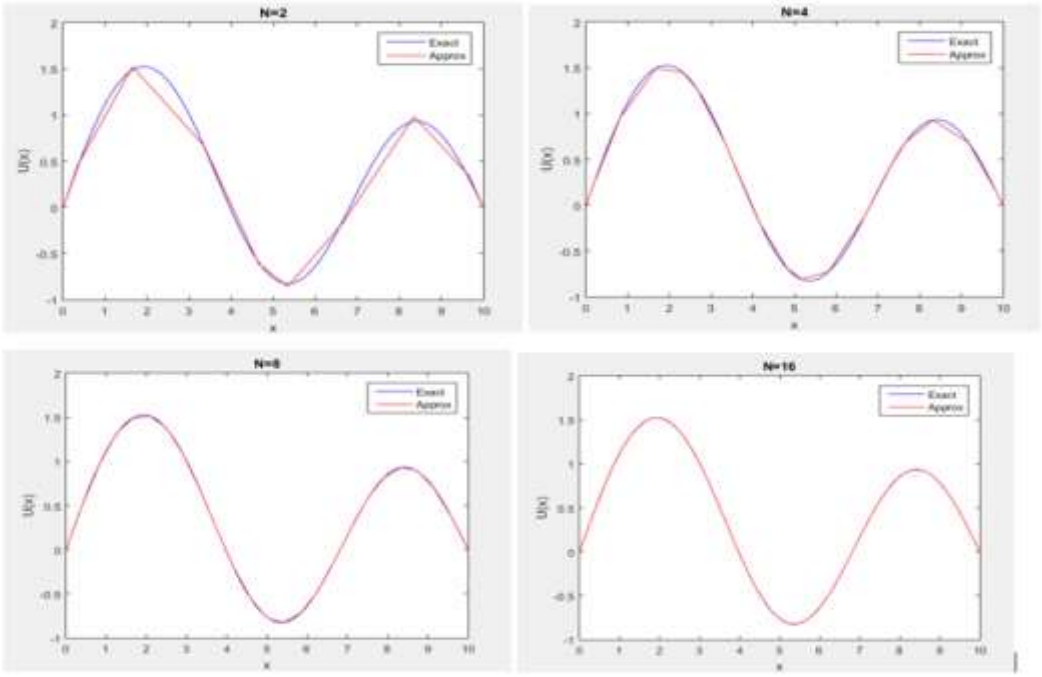


Figure 1. Graphical representation of both the analytical and approximate solutions for M=2,4,8 and 16.

Figure 1 presents the spatial profiles of the numerical solutions obtained for partition parameters M = 2, 4, 8, and 16 alongside the exact analytical solution. Visual inspection confirms excellent agreement between the computed and exact solution curves across all resolution levels. Notably, even at a modest spatial discretization of M = 32, the approximate solution achieves such high fidelity that its trajectory becomes visually indistinguishable from the analytical benchmark.

CONCLUSION AND DISCUSSION

This study investigated the computational efficiency and numerical precision achieved by employing high-order Hermite basis functions to solve a model boundary value problem, with particular emphasis on comparing the performance of distinct collocation root distributions. Methodological accuracy was quantitatively evaluated using standard L_2 and L_∞ error norms, supported by comprehensive tabular and graphical data. A primary advantage of the proposed Hermite formulation is its capacity to deliver high-fidelity approximations across the solution domain using relatively low spatial partition numbers (M). Conversely, achieving comparable accuracy with classical or trigonometric basis functions requires significantly higher grid refinement levels. The insights and methodology established in this work provide a foundational reference for extending higher-order Hermite collocation schemes to more complex linear and nonlinear ordinary, partial, and fractional-order differential models in future research.

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BREAST CANCER CLASSIFICATION FROM HISTOPATHOLOGICAL IMAGES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE: A PATIENT-WISE EVALUATION OF CNN AND VISION TRANSFORMER ARCHITECTURES

Arda GÖNÜL
Çankaya University, Engineering Faculty, Department of Computer Engineering, Ankara, Türkiye
ORCID ID: 0009-0004-3234-020X

Kardelen PEÇENEK
Burdur Mehmet Akif Ersoy University, Bucak Faculty of Computer and Information Sciences, Department of Software Engineering, Burdur, Türkiye
ORCID ID: 0009-0005-1057-7449

Fatih EKİNCİ
Ankara University, Faculty of Engineering, Department of Artificial Intelligence and Data Engineering, Ankara, Türkiye
ORCID ID: 0000-0002-1011-1105

Mehmet Serdar GÜZEL
4Ankara University, Faculty of Engineering, Department of Computer Engineering, Ankara, Türkiye
ORCID ID: 0000-0002-3408-0083

ABSTRACT

Introduction and Purpose: Automated classification of breast cancer from histopathological images may support diagnostic assessment. This study compared CNN and Vision Transformer architectures under a patient-wise data split in terms of classification performance, computational cost, and explainability. It also investigated the relationship between performance, computational efficiency, and explanation faithfulness.

Materials and Methods: The 7,909 benign and malignant images from 82 patients in the BreakHis dataset were divided into training, validation, and test sets without placing images from the same patient in different sets. ResNet50, DenseNet121, EfficientNet-B3, ViT-B/16, Swin-T, CrossViT-15, and MaxViT-T were trained, and the checkpoint with the highest validation F1 score was selected for each model. Performance was evaluated at image and patient levels using accuracy, sensitivity, specificity, F1, and ROC-AUC. Computational requirements were also examined. Grad-CAM, Integrated Gradients, and KernelSHAP were applied to EfficientNet-B3 and MaxViT-T selected according to validation results. Explanation faithfulness was measured using 100 balanced test images.

Results: CrossViT-15 achieved the highest threshold-based performance, with 92.41% accuracy, 94.67% F1, and 98.00% sensitivity. MaxViT-T showed the strongest class discrimination with a ROC-AUC of 97.45%. DenseNet121 was the most compact model, with 6.96 million parameters. Integrated Gradients demonstrated the strongest explanation faithfulness for both models in the XAI evaluation.

Discussion and Conclusion: No single architecture was superior across all criteria. When patient-wise evaluation, computational cost, and multiple XAI methods were considered together, CrossViT-15, MaxViT-T, and DenseNet121 emerged as preferable models for different priorities.

Keywords: Breast cancer, histopathology, deep learning, Vision Transformer, explainable artificial intelligence

EVALUATION OF PATIENT DATA FOLLOWING RADIOFREQUENCY THERMAL ABLATION FOR CALCANEAL SPUR

Dr. Tuba YÜKSEL AYDINER
Department of Physical Medicine and Rehabilitation, Ankara Atatürk Sanatorium Training and Research Hospital, Ankara, Türkiye
ORCID ID: 0000-0001-6339-9969

ABSTRACT

Background and Objective: Calcaneal spur is a common cause of heel pain. Conservative treatment options include rest, appropriate footwear and insoles, exercise programs, physical therapy modalities, and extracorporeal shock wave therapy (ESWT). This study aimed to evaluate the effectiveness of radiofrequency thermal ablation (RFA) in reducing pain in patients with heel pain associated with calcaneal spur.

Materials and Methods: A total of 45 patients who presented to the Physical Medicine and Rehabilitation outpatient clinic with heel pain, were diagnosed with calcaneal spur on plain radiography, and underwent RFA between May 2025 and October 2025 were included in the study. Demographic and clinical characteristics, including age, sex, affected side, and presence of comorbidities, were recorded. Pain severity was assessed using the Visual Analog Scale before treatment (VAS_0) and at 8 weeks after treatment (VAS_1). Pre- and post-treatment VAS scores were statistically compared.

Results: A total of 45 patients were included in the study. The mean age was 53.64±12.41 years; 40 patients (88.9%) were female and 5 (11.1%) were male. RFA was performed on the right heel in 19 patients (42.2%), on the left heel in 6 patients (13.3%), and bilaterally in 20 patients (44.5%). Thus, a total of 65 heels were treated with RFA. Twenty-two patients (48.9%) had comorbidities such as diabetes mellitus, hypertension, fibromyalgia, and hypothyroidism, whereas 23 patients (51.1%) had no comorbidities. The mean pre-treatment VAS score was 9.49±0.63, while the mean VAS score at 8 weeks after treatment was 2.11±2.40. A statistically significant reduction in VAS scores was observed after treatment compared with baseline ($p<0.001$).

Conclusion: Radiofrequency thermal ablation was associated with a marked and statistically significant reduction in pain intensity at 8 weeks in patients with calcaneal spur-related heel pain. These findings suggest that RFA may represent an alternative treatment option for patients who do not achieve adequate pain relief with conservative therapies. However, controlled studies with larger sample sizes and longer follow-up periods are needed to further evaluate its effectiveness and long-term outcomes.

Keywords: Calcaneal spur, radiofrequency thermal ablation, heel pain, Visual Analog Scale

PRE-HOSPITAL CHARACTERISTICS OF IN-SCHOOL MUSCULOSKELETAL INJURIES IN PRIMARY SCHOOL-AGED CHILDREN: A RETROSPECTIVE ANALYSIS OF 112 EMERGENCY MEDICAL SERVICES DATA

Ali Niyazi KURTCEBE
Uzman Doktor, Gölbaşı Devlet Hastanesi, Fiziksel Tıp ve Rehabilitasyon, Ankara, Türkiye
Orcid ID: 0000-0002-5396-8141

Ayşenur GÜR
Uzman Doktor, Etimesgut Şehit Sait Ertürk Devlet Hastanesi, Acil Tıp, Ankara, Türkiye
ORCID ID: 0000-0002-9521-1120

ABSTRACT
The aim of this study was to evaluate the epidemiological, clinical, and pre-hospital operational characteristics of musculoskeletal injuries occurring in school settings among primary school-aged children using 112 Emergency Medical Services data, and to investigate factors associated with suspected fractures. In this retrospective, descriptive, and analytical study, primary school-aged children evaluated by 112 Emergency Medical Services for musculoskeletal injuries in school settings between January 1 and December 31, 2025, were examined. Demographic characteristics, time and location of the incident, injury mechanism, anatomical injury site, suspected fracture status, and pre-hospital operational times were analyzed. A p-value of <0.05 was considered statistically significant. A total of 17 cases were included in the study. The median age was 12 years (IQR: 9–14), and 58.8% of the cases were male. Injuries most frequently occurred in the schoolyard (52.9%) and during recess time(70.6%). The most common injury mechanism was a fall (58.8%); upper extremity injuries were detected in 58.8% of cases, and lower extremity injuries in 41.2%. Suspected fracture was present in 12 cases (70.6%), observed in all lower extremity injuries (100%) and 50% of upper extremity injuries (p=0.044). 88.2% of the cases were transported to the hospital; the median total time from call to hospital arrival was 28.2 minutes. Among primary school-aged children, school-related musculoskeletal injuries occur most frequently as a result of falls, typically in the schoolyard and during recess time. Although upper extremity injuries are more common, the suspicion of fracture is significantly higher in lower extremity injuries. Pre-hospital 112 data provide valuable information for developing environmental safety and supervision strategies aimed at preventing school-based injuries. These findings need to be validated through multicenter studies with larger sample sizes.
Keywords: 112 Emergency Medical Services, school injury, child, musculoskeletal injury, fracture, pre-hospital care.

İLKÖĞRETİM ÇAĞINDAKİ ÇOCUKLARDA OKUL İÇİ KAS-İSKELET SİSTEMİ YARALANMALARININ HASTANE ÖNCESİ ÖZELLİKLERİ: 112 ACİL SAĞLIK HİZMETLERİ VERİLERİNİN RETROSPEKTİF ANALİZİ

ÖZET
Bu çalışmanın amacı, ilköğretim çağındaki çocuklarda okul ortamında meydana gelen kas-iskelet sistemi yaralanmalarının 112 Acil Sağlık Hizmetleri verileri kullanılarak epidemiyolojik, klinik ve hastane öncesi operasyonel özelliklerini değerlendirmek ve fraktür şüphesi ile ilişkili faktörleri araştırmaktır. Retrospektif, tanımlayıcı ve analitik olarak planlanan bu çalışmada, 01 Ocak–31 Aralık 2025 tarihleri arasında 112 Acil Sağlık Hizmetleri tarafından okul ortamında kas-iskelet sistemi yaralanması nedeniyle değerlendirilen ilköğretim çağındaki çocuklar incelendi.

Demografik özellikler, olayın zamanı ve yeri, yaralanma mekanizması, anatomik yaralanma bölgesi, fraktür şüphesi ve hastane öncesi operasyonel süreler analiz edildi. İstatistiksel değerlendirmede anlamlılık düzeyi $p<0.05$ kabul edildi. Çalışmaya toplam 17 olgu dahil edildi. Medyan yaş 12 (ÇAA: 9–14) yıl olup olguların %58.8'i erkekti. Yaralanmaların en sık okul bahçesinde (%52.9) ve teneffüs sırasında (%70.6) meydana geldiği görüldü. En yaygın yaralanma mekanizması düşme (%58.8) olup olguların %58.8'inde üst, %41.2'sinde alt ekstremite yaralanması saptandı. Fraktür şüphesi 12 (%70.6) olguda mevcuttu ve alt ekstremite yaralanmalarının tamamında (%100), üst ekstremite yaralanmalarının ise %50'sinde görüldü ($p=0.044$). Olguların %88.2'si hastaneye nakledildi; medyan çağrı-hastaneye ulaşım toplam süresi 28.2 dakika olarak bulundu. İlköğretim çağındaki çocuklarda okul içi kas-iskelet sistemi yaralanmaları en sık düşme sonucu, okul bahçesinde ve teneffüs döneminde meydana gelmektedir. Üst ekstremite yaralanmaları daha sık görülmekle birlikte, fraktür şüphesi alt ekstremite yaralanmalarında anlamlı olarak daha yüksektir. Hastane öncesi 112 verileri, okul temelli yaralanmaların önlenmesine yönelik çevresel güvenlik ve gözetim stratejilerinin geliştirilmesinde değerli bilgiler sunmaktadır. Daha geniş örneklemli çok merkezli çalışmalarla bu bulguların doğrulanması gerekmektedir.

Anahtar Kelimeler: 112 Acil Sağlık Hizmetleri, okul yaralanması, çocuk, kas-iskelet sistemi yaralanması, fraktür, hastane öncesi bakım.

GİRİŞ

Çocuklar günlerinin önemli bir bölümünü okul ortamında geçirmekte ve okul içerisinde ders dışı aktiviteler, oyun, spor ve fiziksel aktivite sırasında çeşitli yaralanma risklerine maruz kalmaktadır. Okul temelli travmaların epidemiyolojik özelliklerinin yaş gruplarına göre farklılık gösterdiği ve özellikle ilköğretim çağındaki çocuklarda düşmelerin önemli bir mekanizma olduğu bildirilmiştir (1).

Yakın zamanda yayımlanan geniş kapsamlı bir epidemiyolojik çalışmada, 2019–2023 yılları arasında okul ortamında meydana gelen kas-iskelet sistemi yaralanmaları incelenmiş ve yaralanmaların %54.6'sının üst ekstremitede, %38.5'inin ise alt ekstremitede meydana geldiği gösterilmiştir. Aynı çalışmada ilköğretim çağındaki erkek çocuklarda üst ve alt kol, el bileği ve parmak fraktürlerinin önemli bir risk oluşturduğu bildirilmiştir (2). Bu bulgular, okul ortamındaki yaralanmaların yalnızca akut travma açısından değil, kas-iskelet sistemi ve rehabilitasyon açısından da değerlendirilmesi gerektiğini göstermektedir.

Okul yaralanmalarının önemli bir bölümü düşmelerle ilişkilidir. Hastane temelli bir çalışmada okul kazaları nedeniyle başvuran çocuklarda orta ve ciddi yaralanmaların önemli bir kısmını ekstremite fraktürlerinin oluşturduğu ve distal radius fraktürlerinin öne çıktığı bildirilmiştir (3). Ayrıca okul ortamındaki travmaların yaralanma mekanizması ve anatomik dağılımının eğitim düzeyine göre değiştiği; ilköğretim çağındaki çocuklarda düşmelerin ve humerus fraktürlerinin daha belirgin olduğu gösterilmiştir (1).

Hastane öncesi veriler, okul yaralanmalarının epidemiyolojisini değerlendirmek açısından önemli bir kaynak oluşturmaktadır. 2012–2014 yılları arasındaki Kore 119 EMS verilerini inceleyen bir çalışmada, okul çağındaki çocuklarda ambulansla taşınan yaralanmaların %13.3'ünün okul ortamında meydana geldiği ve erkek çocukların okul yaralanmalarında belirgin olarak daha yüksek oranda olduğu gösterilmiştir (4). Daha güncel olarak, 2018–2022 yılları arasındaki ulusal EMS kayıtlarının incelendiği bir çalışmada 5–17 yaş arasındaki çocuklarda 506.573 okul temelli EMS başvurusu saptanmış ve travmanın tüm başvuruların %15'ini oluşturduğu bildirilmiştir. Travma oranının ilköğretim çağındaki çocuklarda daha yüksek olması, bu yaş grubunun ayrıca değerlendirilmesini desteklemektedir (5).

Türkiye'de pediatrik fraktürlerin epidemiyolojisini değerlendiren 2024 tarihli ve yaklaşık 2 milyon fraktür olgusunu içeren ulusal bir çalışmada, pediatrik fraktürlerin 10–14 yaş arasında en yüksek düzeye ulaştığı ve en sık fraktür bölgelerinin üst ekstremite olduğu gösterilmiştir.

El bileği fraktürleri tüm pediatrik fraktürlerin %28.9'unu oluşturmuştur (6). Bununla birlikte bu çalışma tüm pediatrik fraktürleri kapsamakta olup, okul ortamında meydana gelen ve 112 Acil Sağlık Hizmetleri tarafından değerlendirilen kas-iskelet sistemi yaralanmalarına özgü bir analiz sunmamaktadır.

Bu nedenle 112 Acil Sağlık Hizmetleri kayıtlarının kullanılması, okul ortamındaki kas-iskelet sistemi yaralanmalarının hastane başvurusu ile sınırlı olmayan gerçek hastane öncesi profilinin ortaya konulmasını sağlayabilir. Özellikle yaralanma mekanizması, anatomik bölge, olay zamanı, klinik durum ve ambulans operasyonel verilerinin birlikte değerlendirilmesi; okul sağlığı, travma önleme ve çocukluk çağı rehabilitasyon hizmetlerinin planlanmasına katkı sağlayabilir.

YÖNTEM

Bu çalışma retrospektif, tanımlayıcı ve analitik bir araştırma olarak planlanmıştır. Araştırmanın evrenini, belirlenen çalışma dönemi içerisinde 112 Acil Sağlık Hizmetleri tarafından okul ortamında meydana gelen yaralanmalar nedeniyle değerlendirilen ilköğretim çağındaki çocuklardan oluşmaktadır. Çalışma için 01 Ocak 2025–31 Aralık 2025 tarihleri arasındaki 112 Acil Sağlık Hizmetleri Otomasyon Sistemi kayıtları kullanılmıştır.

Çalışmaya ilköğretim çağında olan, olay yeri okul olarak kayıtlı bulunan ve kas-iskelet sistemi yaralanması nedeniyle 112 Acil Sağlık Hizmetleri tarafından değerlendirilen çocuklar dahil edilmiştir. Olay yeri okul dışında olan çocuklar, medikal nedenlerle başvuranlar, yalnızca baş ağrısı, karın ağrısı veya benzeri travma dışı yakınmaları bulunanlar ve temel demografik veya klinik bilgileri eksik olan olgular çalışma dışında bırakılmıştır.

Her olgu için yaş, cinsiyet, olay tarihi, olay saati, hafta içi veya hafta sonu durumu ve olayın gerçekleştiği dönem kaydedilmiştir. Olayın okulun hangi bölümünde gerçekleştiği veri sisteminde mevcutsa sınıf, koridor, merdiven, bahçe, spor salonu veya oyun alanı gibi kategoriler halinde değerlendirilmiştir. Yaralanma sırasında fiziksel aktivite, spor, oyun veya diğer okul aktivitelerinin gerçekleştirilip gerçekleştirilmediği de kaydedilmiştir.

Yaralanma mekanizması düşme, çarpışma, spor/oyun sırasında yaralanma, bir cisme çarpma, sıkışma veya diğer mekanizmalar şeklinde sınıflandırılmıştır. Ön tanı kayıtlarından yaralanmanın kas-iskelet sistemi ile ilişkili olup olmadığı belirlmiş ve anatomik bölge üst ekstremite, alt ekstremite, gövde ve çoklu bölge şeklinde sınıflandırılmıştır. Veri sisteminde fraktür tanısı veya fraktür şüphesi belirtilmişse ayrıca kaydedilmiştir.

Operasyonel değişkenler olarak ambulansın çağrıdan olay yerine ulaşma süresi, olay yerinde geçirilen süre, olay yerinden hastaneye ulaşım süresi ve toplam görev süresi değerlendirilmiştir. Hastanın sağlık kuruluşuna nakledilip edilmediği ve nakil reddi bulunup bulunmadığı da kaydedilmiştir.

İstatistiksel Analiz

İstatistiksel analiz SPSS 27.0 paket programı kullanılarak gerçekleştirilmiştir. Sürekli değişkenlerin normal dağılıma uygunluğu Shapiro–Wilk testi ile değerlendirilmiştir. Normal dağılan sürekli değişkenler ortalama±standart sapma, normal dağılmayan değişkenler medyan ve çeyrekler arası aralık ile ifade edilmiştir. Kategorik değişkenler sayı ve yüzde olarak sunulmuştur. Kategorik değişkenlerin karşılaştırılmasında Pearson Ki-kare veya Fisher Exact testi, sürekli değişkenlerin karşılaştırılmasında Student t testi veya Mann–Whitney U testi kullanılmıştır. Ekstremite fraktürü ile ilişkili bağımsız faktörlerin belirlenmesi amacıyla çok değişkenli lojistik regresyon analizi yapılmıştır. Regresyon modeline klinik ve literatür açısından anlamlı olduğu düşünülen yaş, cinsiyet, yaralanma mekanizması, spor/oyun aktivitesi, anatomik bölge ve olay zamanı gibi değişkenler dahil edilmiştir. İstatistiksel anlamlılık düzeyi $p<0.05$ olarak kabul edilmiştir.

BULGULAR

Çalışma döneminde dahil etme kriterlerini karşılayan 17 olgu değerlendirildi. Olguların medyan yaşı 12 (ÇAA 9–14; aralık 6–14) yıl olup 10'u (%58.8) erkek, 11'i (%64.7) ortaokul kademesindeydi. Olayların tamamı hafta içi günlerde ve 09:00–17:00 saatleri arasında gerçekleşmişti; 11'i (%64.7) sonbahar aylarında, 14'ü (%82.4) saat 15:00'ten önce meydana gelmişti. En sık olay yeri okul bahçesi (n=9; %52.9), en sık olay zamanı teneffüs (n=12; %70.6) idi; ders sırasında gerçekleşen iki olgunun ikisi de spor salonunda oyun/spor aktivitesi sırasında oluşmuştu.

Yaralanma mekanizması olguların %58.8'inde (n=10) düşme (aynı seviyeden 8, merdivenden 2), %29.4'ünde (n=5) sıkışma ve %11.8'inde (n=2) oyun/spor idi. Yaralanma nedeni 10 olguda bireysel düşme, 7 olguda çevresel faktör olarak kaydedilmişti; başka bir öğrenci ile temasa bağlı yaralanma bildirilmemişti. Tüm olgularda yumuşak doku travması eşlik ediyor ve bilinç açıktı. Yaralanmaların 10'u (%58.8; %95 GA 32.9–81.6) üst ekstremitede, 7'si (%41.2) alt ekstremitede yerleşmişti; omurga, pelvis veya çoklu bölge yaralanması saptanmadı. Üst ekstremite tutulumu sayısal olarak daha sık olmakla birlikte fark istatistiksel anlamlılığa ulaşmadı (binom testi, p=0.629).

Olguların 12'sinde (%70.6; %95 GA 44.0–89.7) fraktür şüphesi mevcuttu. Fraktür şüphesi alt ekstremite yaralanmalarının tamamında (7/7; %100; %95 GA 59.0–100) görülürken üst ekstremite yaralanmalarında %50 (5/10) düzeyindeydi ve bu fark anlamlıydı (Fisher Exact testi, p=0.044). Sıkışma mekanizmalı beş olgunun tamamı üst ekstremiteyi ilgilendiriyordu. Fraktür şüphesi ile cinsiyet (p=0.338), eğitim kademesi (p=1.000), düşme mekanizması (p=1.000), olay zamanı (teneffüs/diğer; p=1.000) ve yaş (medyan 11 ve 12 yıl; Mann–Whitney U, p=0.914) arasında ilişki saptanmadı.

Operasyonel değişkenler açısından çağrıdan olay yerine ulaşım süresi medyanı 9.1 dk (ÇAA 5.1–11.2), olay yerinde kalış süresi medyanı 11.9 dk (ÇAA 8.0–13.8) idi. Olguların 15'i (%88.2) sağlık kuruluşuna nakledildi; nakledilen olgularda olay yerinden hastaneye ulaşım süresi medyanı 11.3 dk (ÇAA 4.5–14.0), çağrıdan hastaneye ulaşıma kadar geçen toplam süre medyanı 28.2 dk (ÇAA 24.2–37.9) idi. Nakillerin 11'i (%73.3) üçüncü basamak, 4'ü (%26.7) ikinci basamak hastaneye yapıldı; bir olguda nakil reddi kaydedildi ve iki olgu olay yerinde bırakıldı. Yanıt ve olay yerinde kalış süreleri fraktür şüphesi olan ve olmayan olgular arasında farklılık göstermedi (her ikisi için p=0.721). Temel bulgular Tablo 1'de özetlenmiştir.

Tablo 1. Okul içi kas-iskelet sistemi yaralanması nedeniyle 112 tarafından değerlendirilen ilköğretim çağındaki çocukların demografik, olaya ilişkin, klinik ve operasyonel özellikleri (n=17)

Değişken	**n=17**
Yaş, yıl, medyan (ÇAA)	12 (9–14)
Erkek cinsiyet, n (%)	10 (58.8)
Ortaokul kademesi, n (%)	11 (64.7)
Olay yeri, n (%)	
Bahçe	9 (52.9)
Koridor	3 (17.6)
Merdiven	2 (11.8)
Spor salonu	2 (11.8)
Sınıf	1 (5.9)
Olay zamanı, n (%)	
Teneffüs	12 (70.6)

Değişken	n=17
Öğle arası	3 (17.6)
Ders	2 (11.8)
Yaralanma mekanizması, n (%)	
Aynı seviyeden düşme	8 (47.1)
Sıkışma	5 (29.4)
Merdivenden düşme	2 (11.8)
Oyun/spor	2 (11.8)
Yaralanma bölgesi, n (%)	
Üst ekstremite	10 (58.8)
Alt ekstremite	7 (41.2)
Fraktür şüphesi, n (%)	12 (70.6)
Üst ekstremite yaralanmalarında	5/10 (50.0)
Alt ekstremite yaralanmalarında*	7/7 (100)
Çağrı–olay yerine ulaşım süresi, dk, medyan (ÇAA)	9.1 (5.1–11.2)
Olay yerinde kalış süresi, dk, medyan (ÇAA)	11.9 (8.0–13.8)
Olay yeri–hastane ulaşım süresi, dk, medyan (ÇAA)†	11.3 (4.5–14.0)
Çağrı–hastaneye ulaşım toplam süresi, dk, medyan (ÇAA)†	28.2 (24.2–37.9)
Hastaneye nakil, n (%)	15 (88.2)
Üçüncü basamak hastane†	11 (73.3)
İkinci basamak hastane†	4 (26.7)
Nakil reddi, n (%)	1 (5.9)
Olay yerinde bırakılma, n (%)	2 (11.8)

ÇAA: çeyrekler arası aralık. *Üst ekstremite yaralanmaları ile karşılaştırma, Fisher kesin testi, p=0,044. †Sağlık kuruluşuna nakledilen olgular üzerinden hesaplanmıştır (n=15).

TARTIŞMA

Bu çalışmada ilköğretim çağındaki çocuklarda okul içi kas-iskelet sistemi yaralanmalarının %58.8'i üst ekstremitede, %41.2'si alt ekstremitede görülmüştür. Üst ekstremite yaralanmaları sayısal olarak daha sık olmasına rağmen fark istatistiksel olarak anlamlı bulunmamıştır. Bununla birlikte güncel okul yaralanması verileri bulgumuzla benzer bir eğilime işaret etmektedir. Kennedy ve ark. okul bahçelerinin okul yaralanmalarında en sık olay yeri olduğunu ve yaş arttıkça ekstremite yaralanmalarının oranının yükseldiğini bildirmiştir (7). Daha geniş bir okul temelli veri setinde de üst ekstremite yaralanmaları alt ekstremite yaralanmalarından daha sık bulunmuştur (1).

Olguların yarısından fazlasının okul bahçesinde (%52.9) ve %70.6'sının teneffüs sırasında meydana gelmesi, yaralanmaların çocukların daha serbest hareket ettiği dönemlerde yoğunlaştığını düşündürmektedir. Kennedy ve ark. da okul bahçesinin önemli bir yaralanma alanı olduğunu göstermiştir (7). Yaralanma mekanizması olarak düşmenin (%58.8) ilk sırada olması da literatürle uyumludur. Blanchard ve ark. oyun alanı yaralanmalarında düşmenin önemli bir mekanizma olduğunu ve ekstremite fraktürlerinin sık görüldüğünü bildirmiştir (8).

Fraktür şüphesi olguların %70.6'sında bulunmuş ve alt ekstremite yaralanmalarının tamamında görülerek üst ekstremite yaralanmalarından anlamlı olarak daha yüksek bulunmuştur (p=0.044). Bu bulgu dikkat çekici olmakla birlikte, çalışmamızdaki "fraktür şüphesi" radyolojik olarak doğrulanmış fraktürü ifade etmemektedir.

Blanchard ve ark. oyun alanı yaralanmalarında ekstremite fraktürlerinin önemli bir klinik sonuç olduğunu, özellikle belirli oyun ekipmanlarıyla ilişkili yaralanmalarda kırık riskinin arttığını göstermiştir (8). Buna karşılık çalışmamızda fraktür şüphesi ile yaş, cinsiyet, eğitim kademesi ve düşme mekanizması arasında anlamlı ilişki saptanmamıştır. Bu sonuçların örneklem büyüklüğünün çok düşük olması nedeniyle dikkatle yorumlanması gerekir.

Çalışmamızda olayların %64.7'sinin sonbaharda gerçekleşmesi de dikkat çekicidir. Nabavizadeh ve ark. oyun alanı yaralanmalarında belirgin mevsimsel değişkenlik olduğunu ve olguların özellikle mayıs ve eylül aylarında yoğunlaştığını bildirmiştir (9). Bizim çalışmamızdaki sonbahar yoğunluğu, okul döneminin başlaması ve açık alan kullanımının devam etmesiyle ilişkili olabilir; ancak küçük örneklem nedeniyle bu bulgu kesin bir mevsimsel risk olarak değerlendirilmemelidir.

Olguların %88.2'sinin hastaneye nakledilmiş olması, 112 tarafından değerlendirilen okul içi kas-iskelet sistemi yaralanmalarının önemli bölümünde hastane değerlendirmesine ihtiyaç duyulduğunu göstermektedir. Nakillerin %73.3'ünün üçüncü basamak hastanelere yapılması da ileri değerlendirme gereksiniminin yüksek olabileceğini düşündürmektedir. Ancak hastane sonrası tanı ve radyolojik sonuçların bulunmaması nedeniyle bu konuda kesin çıkarım yapılamamaktadır.

Çalışmanın temel sınırlılığı 17 olguluk küçük örneklem büyüklüğüdür. Bu nedenle özellikle fraktür şüphesiyle ilişkili faktörlerin değerlendirilmesinde istatistiksel güç sınırlıdır ve negatif sonuçlar kesin ilişkisizlik olarak yorumlanmamalıdır. Ayrıca retrospektif tasarım nedeniyle gözetim durumu, çevresel risk faktörleri ve hastane sonrası kesin tanılar değerlendirilememiştir. Buna rağmen çalışma, okul içi kas-iskelet sistemi yaralanmalarını 112 Acil Sağlık Hizmetleri perspektifinden değerlendirmesi ve epidemiyolojik özelliklerin yanı sıra hastane öncesi operasyonel verileri ortaya koyması açısından önemlidir.

SONUÇ

İlköğretim çağındaki çocuklarda okul içi kas-iskelet sistemi yaralanmalarında üst ekstremite tutulumu sayısal olarak daha sık olmakla birlikte alt ekstremiteye göre istatistiksel olarak anlamlı bir üstünlük göstermemiştir. Yaralanmalar en sık okul bahçesinde, teneffüs sırasında ve düşme mekanizmasıyla meydana gelmiştir.

Fraktür şüphesi olguların %70.6'sında saptanmış ve alt ekstremite yaralanmalarında anlamlı olarak daha yüksek bulunmuştur. Bununla birlikte yaş, cinsiyet, eğitim kademesi ve düşme mekanizması ile fraktür şüphesi arasında anlamlı ilişki gösterilememiştir. Küçük örneklem nedeniyle bu bulguların daha geniş çalışmalarla doğrulanması gerekmektedir.

Bulgularımız, okul bahçeleri ve teneffüs dönemlerinin yaralanma önleme açısından önemli hedef alanlar olduğunu ve okul ortamında çevresel güvenlik ile uygun gözetimin güçlendirilmesinin yararlı olabileceğini göstermektedir.

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EFFECTS OF FOREST FIRES ON THE FIBER MORPHOLOGY OF BLACK PINE (PINUS NIGRA ARNOLD. (PINACEAE)) BARK

Ekrem DURMAZ
Kastamonu University, Faculty of Forestry, Department of Forest Industry Engineering, Kastamonu, Türkiye
ORCID ID: 0000-0002-6345-5673

ABSTRACT

Introduction and Purpose: Forests are complex ecosystems increasingly threatened by anthropogenic disturbances, among which forest fires are one of the most destructive. In particular, conifers are generally more flammable than broadleaved species due to their higher resin and essential oil contents. This study aimed to determine the changes in the fiber morphology of fire-damaged bark of black pine (Pinus nigra Arnold. (Pinaceae)).

Materials and Methods: In this study, black pine bark collected from the Eflani Forest Management Directorate in Karabük Province, Türkiye, was used as raw material. The bark samples were classified according to fire severity as unburned (control), slightly burned, moderately burned, and heavily burned. To determine the morphological characteristics of bark fibers, samples cut to matchstick size were boiled in a 50% nitric acid solution for 6 hours and washed with distilled water. The obtained morphological characteristics (fiber length, fiber width, lumen width, and fiber wall thickness) were used to determine fiber-size relationships (felting ratio, elasticity coefficient, rigidity coefficient, Mühlstep ratio, Runkel ratio, and F factor), which are of considerable importance in papermaking.

Results: Maximum values for fiber length, fiber width, lumen width, and fiber wall thickness were found in the unburned bark sample, while minimum values were observed in the heavily burned bark sample. It was determined that fiber length ranged from 1.48 to 3.79 mm, fiber width from 30.68 to 42.54 µm, lumen width from 19.56 to 28.20 µm, and fiber wall thickness from 5.56 to 7.17 µm.

Discussion and Conclusion: Overall, this research examines the morphological characteristics of larch bark exposed to different levels of fire severity and highlights its potential for valorization as a raw material in the production of value-added wood-based products, particularly paper and fiberboard.

Keywords: Forest Fires, Black Pine, Bark, Morphological Characteristics, Papermaking

COW MANURE FERTILIZATION IN DEFICIT IRRIGATION CONDITIONS ENHANCES WHITE CABBAGE YIELD BY REDUCING H_2O_2, MDA, AND PROLINE

Dr. Samiratou ABDOULAYE MAMANE
Atatürk University, Faculty of Agriculture

Prof. Dr. Üstün ŞAHİN
Atatürk University, Faculty of Agriculture

ABSTRACT
The present study investigated the effect of cow manure fertilization on the content of hydrogen peroxide (H_2O_2), malondialdehyde (MDA), and proline in white cabbage under conditions of water deficit. The experiment was conducted using a 3 × 3 factorial layout, with three replications and three irrigation levels (W100: full irrigation, W75: 75% of W100, and W50: 50% of W100) and three fertilization treatments (F0: mineral fertilization, F1 and F2: cow manure fertilization providing 3% and 4.5% organic matter in topsoil, respectively). The mean values of two years of observation revealed an increase in the contents of H_2O_2, MDA, and proline with increasing water deficit. The W50 treatment resulted in significant increases in H_2O_2, MDA, and proline contents, with respective increases of 42.4%, 40.2%, and 29.3%, in comparison to the W100 treatment. However, the application of cow manure significantly reduced the contents of these parameters. In the F2 treatment, the W100, W75, and W50 treatments provided H_2O_2 content that was 24.0%, 26.6%, and 28.4% lower than the F0 treatment, respectively. The F2 treatment resulted in a substantial decrease in MDA content by 29.5%, 29.8%, and 38.2%, respectively, and proline content by 10.2%, 14.9%, and 18.1%, respectively. The study's findings indicated a strong relationship between an increase in each physiological parameter and a decrease in cabbage yield. In conclusion, in regions where water resources are limited, the utilization of cow manure as a fertilization agent for the cultivation of productive white cabbage may prove to be a more effective solution than the application of mineral fertilizers.
Keywords: Organic fertilization, water scarcity, hydrogen peroxide, malondialdehyde, proline, yield physiology.

INTRODUCTION
Hydrogen peroxide (H_2O_2), a prevalent type of reactive oxygen species (ROS), is a byproduct of abiotic stress that is produced in plant cells. The delicate equilibrium between ROS production and clearance can be perturbed by various abiotic stresses (Huang et al., 2019). Such imbalances can result in a sudden increase in intracellular ROS levels, which can lead to significant damage to cellular structures. While ROS accumulation can be used as important signaling molecules under abiotic stress conditions, it can also damage cells by inflicting oxidative stress on lipids, carbohydrates, proteins, and DNA, leading to phytotoxicity and cell death (Abdelaal et al., 2022). Numerous studies have documented the occurrence of ROS overproduction and oxidative stress in a wide variety of plant species in relation to drought (Hasanuzzaman et al., 2020). The extent of lipid peroxidation can be gauged by the measurement of malondialdehyde (MDA) content. MDA has been identified as a reliable biomarker of lipid peroxidation and membrane degradation, which are the predominant mechanisms through which drought stress hinders fundamental plant functions (Muhammad et al., 2025; Sohail et al., 2026).
Plants have developed a variety of mechanisms to regulate the overproduction of reactive oxygen species (ROS) in response to drought stress. Among these mechanisms, proline, an essential amino acid, contributes to ROS clearance (Ghosh et al., 2022).

Proline has been demonstrated to function as a ROS scavenger, thereby helping to mitigate oxidative damage (Renzetti et al., 2025). Increased proline contents in plants have been demonstrated to provide protection against hydrogen peroxide-induced damage to plant cells, improve water availability, ensure osmotic regulation, and enhance certain physiological processes. Consequently, the role of proline as an osmolyte becomes pivotal in safeguarding plant cells against elevated ROS production under stress conditions. Proline has been demonstrated to enhance plant growth and augment plant stress tolerance by maintaining photochemical activity, scavenging ROS, and reducing lipid peroxidation under drought conditions (Abdelaal et al., 2022). Proline, a compound that functions as both an osmolyte and a free radical scavenger under abiotic stress conditions, has also been shown to serve as an energy source for post-stress regrowth through its metabolic breakdown (Szepesi et al., 2018). A substantial body of research has indicated a positive correlation between proline accumulation and plant stress (Esimek et al., 2023). Sun et al. (2020) also stated that water stress has been shown to result in elevated contents of ROS and MDA, as well as significant increases in proline accumulation.

The utilization of organic fertilizers has been proven to enhance soil structure and augment nutrient availability, thereby promoting improved soil fertility and productivity. In the context of water stress management, the ability to retain water and improve soil properties with better moisture and nutrient conditions can play beneficial roles. The enhancement of soil health by organic acids produced through mineralization has been demonstrated to contribute to drought management by increasing water and nutrient uptake (Anee et al., 2022). The enhanced soil physical environment and augmented root growth have been demonstrated to directly alleviate plant water deficiencies, thereby improving plant physiological condition. By enhancing nutrient bioavailability and augmenting microbial activity, it fosters a favorable environment for plant health under stress (Sohail et al., 2026). The protective effects of organic materials on root membrane integrity (lower MDA) have been determined, as well as their role in supporting the function of transport systems such as aquaporins, which facilitate the rapid movement of water molecules into and out of cells. Consequently, this promotes efficient water relations (Sohail et al., 2026). The incorporation of organic material has been demonstrated to mitigate the risk of abiotic stress-induced oxidative stress in cabbage seedlings, as evidenced by a decline in MDA and H_2O_2 contents (Ekinci et al., 2022).

Research on the effects of hydrogen peroxide, malondialdehyde, and proline contents on yield in white cabbage under deficit irrigation conditions with manure fertilization is limited. The present study examined the hypothesis that the application of cow manure fertilization could contribute to a reduction in stress signals and an enhancement in yield when compared with mineral fertilization.

MATERIALS AND METHODS

The study was conducted in Erzurum, a city in eastern Türkiye with a semi-arid climate, during the 2023 and 2024 growing seasons. The experiment was conducted using a 3 x 3 factorial design. The experiment employed a three-level irrigation design, with W100 representing full irrigation, W75 representing 25% less water, and W50 representing 50% less water. The experiment also incorporated three fertilization treatments: The first treatment, designated as F0, involved mineral fertilization. The second treatment, designated as F1, involved the application of cow manure, which added approximately 3% organic matter to the topsoil. The third treatment, designated as F2, involved the application of cow manure, which added approximately 4.5% organic matter to the topsoil. Each treatment combination was replicated three times. The irrigation method that was employed was a surface drip irrigation system. The system was installed for plots measuring 3.0 by 2.5 meters, which were arranged in a configuration of five driplines.

The scheduling of irrigation was determined on the basis of the discrepancy between the estimated crop evapotranspiration (ETc) and the precipitation. The cumulative value was determined to be equivalent to 45% of the available water in the effective root zone, which corresponded to the irrigation application time. The estimation of ETc was accomplished by employing the FAO Penman-Monteith method, utilizing Cropwat software, and daily climate data. Subsequently, this calculation underwent modification according to the crop coefficients during the vegetation period (Altun, 2024; Badaou, 2025).

During the initial stage of growth, all plots received full irrigation. In the subsequent phase, deficit irrigation treatments were continued. The irrigation quantities were determined based on the amount of moisture loss observed in the control plots (F0-W100). The moisture content in the top layer of soil (0-30 cm) was measured using a TDR, and the layer below it (30-60 cm) was measured using the gravimetric method.

The quantity of cow manure to be utilized in the F1 and F2 treatments was determined based on the organic matter content in the topsoil (0-20 cm). The calculated amount of mature manure was incorporated into the top 15 cm of soil plowed using a hoe machine prior to the planting process. F0 plots with analogous tillage processes received nitrogen and phosphorus fertilizers as 160 kg of urea per hectare and 100 kg of P_2O_5 per hectare, respectively (Samancıoğlu, 2016). The Madalya F1 cabbage seedlings were planted in five rows, with 60 cm between the rows and 50 cm between the plants in each row.

The analyses of hydrogen peroxide (H_2O_2), malondialdehyde (MDA), and proline content were conducted in accordance with the methodologies delineated by Samancıoğlu (2016). The marketable yield of white cabbage was determined by the method of removal of the external leaves of cabbage heads. Subsequently, the cabbage heads were weighed, and the total yield of cabbage in each plot was calculated.

An analysis of variance (ANOVA) was conducted to determine the effects of irrigation and fertilization treatments on the contents of hydrogen peroxide, malondialdehyde, and proline. The analysis was performed using a general linear model in SPSS software. The interaction effects were evaluated using a One-Way ANOVA test. The Duncan multiple range test was employed to determine mean differences. Pearson's correlation analysis was employed to investigate the relationship between hydrogen peroxide, malondialdehyde, and proline contents and marketable yield.

RESULTS AND DISCUSSION

The study's findings revealed a significant increase in the contents of hydrogen peroxide (H_2O_2), malondialdehyde (MDA), and proline in the W50 treatment, with increases of 42.4%, 40.2%, and 29.3%, respectively, compared to the W100 treatment. The W75 treatment demonstrated significant increases of 20.5%, 13.8%, and 12.1%, respectively (Figures 1-3). In the cow manure treatment, the values were found to be considerably diminished in comparison to mineral fertilization. The F2 treatment exhibited a 27.0% decrease in H_2O_2 content, a 32.8% reduction in MDA content, and a 14.7% decrease in proline content. The F1 treatment resulted in a 19.6% reduction in H_2O_2 content, a 25.8% reduction in MDA content, and a 12.5% decrease in proline content (Figures 1-3).

The F2-W100 treatment resulted in the lowest contents, while the F0-W50 treatment yielded the highest contents. In comparison with F0-W50, the contents in F2-W100 were 48.0% lower for H_2O_2, 52.9% lower for MDA, and 34.1% lower for proline. The F1-W100 treatment was found to be 44.4%, 47.1%, and 32.7% lower than the F0-W50 treatment, respectively (Figures 1-3). Furthermore, the F2 treatment resulted in H_2O_2 contents that were 24.0%, 26.6%, and 28.4% lower than the F0 treatment for the W100, W75, and W50 treatments, respectively.

In a similar manner, the F2 treatment resulted in a 29.5%, 29.8%, and 38.2% decrease in MDA contents, and a 10.2%, 14.9%, and 18.1% decrease in proline contents, respectively (Figures 1-3).

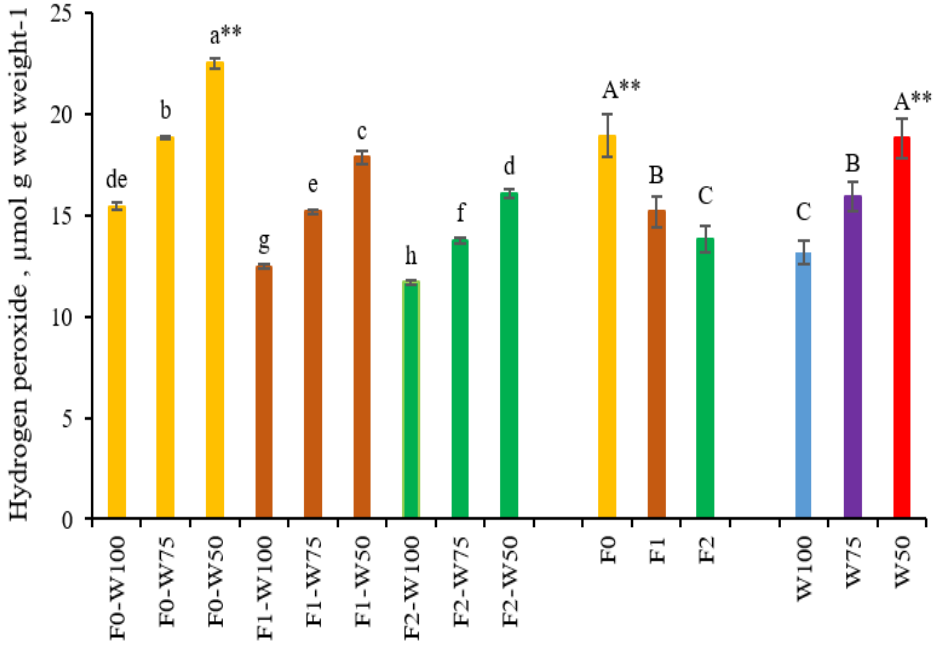


Figure 1. The effect of different irrigation levels on the hydrogen peroxide (H2O2) content of white cabbage plants under different fertilization treatments. ** indicates a significance level of 0.01

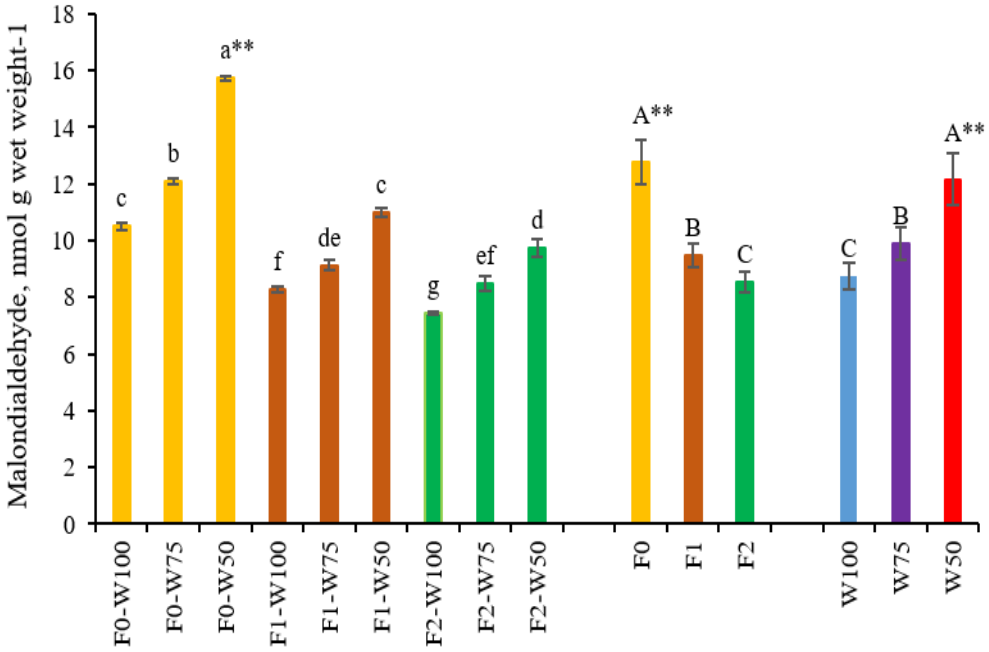


Figure 2. The effect of different irrigation levels on the malondialdehyde (MDA) content of white cabbage plants under different fertilization treatments. ** indicates a significance level of 0.01

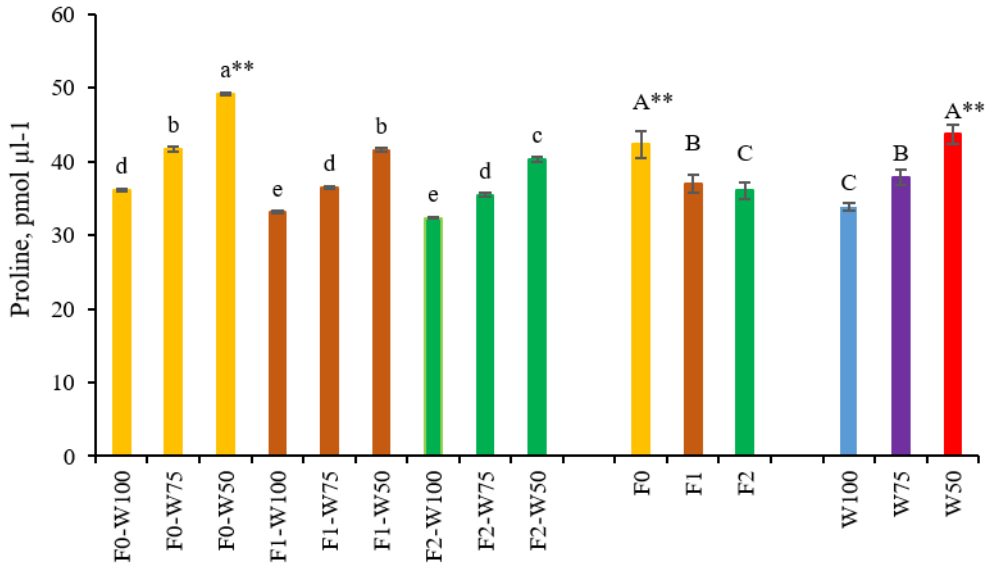


Figure 3. The effect of different irrigation levels on the proline content of white cabbage plants under different fertilization treatments. ** indicates a significance level of 0.01

A collective evaluation of hydrogen peroxide, malondialdehyde, and proline contents reveals a complementary relationship between proline, MDA and H2O2 accumulation, and yield. As a result, an increase in these in the plant was associated with a linear decrease in cabbage yield (Figure 4).

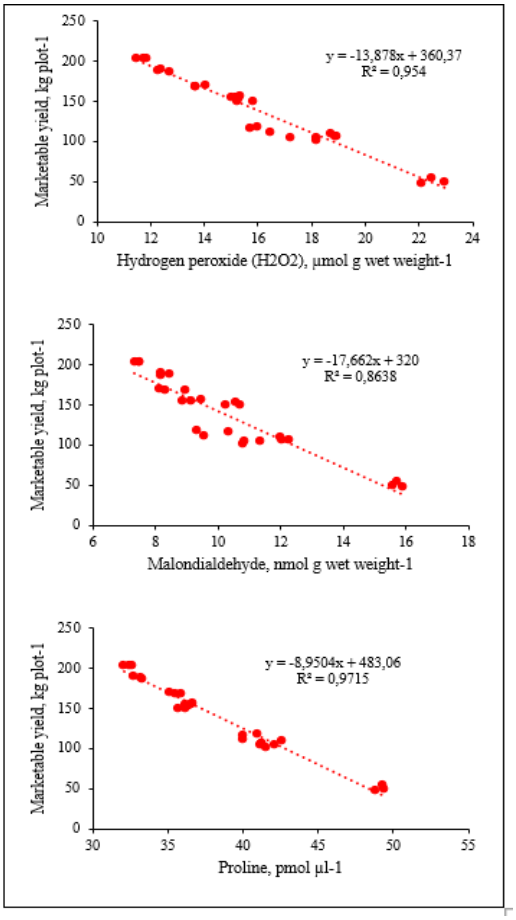


Figure 4. The relationship between the contents of hydrogen peroxide (H2O2), malondialdehyde (MDA), and proline, as well as the cabbage marketable yield. ** indicates a significance level of 0.01

In applications involving heightened water restrictions, the substantial augmentation in proline content, as well as the rise in MDA and H2O2 contents, unmistakably manifests the physiological and biochemical responses of plants to drought stress (Huang et al., 2019; Sohail et al., 2026). Proline has been identified as an osmolyte, playing a crucial role in maintaining intracellular osmotic balance and supporting protein and membrane stability under stress conditions (Ghosh et al., 2022; Renzetti et al., 2025). Consequently, the elevated proline contents observed in the W50 treatment are regarded as an indicator of the stress adaptation mechanism in plants. Concurrently, the escalation in MDA and H2O2 contents under analogous conditions signifies the accumulation of reactive oxygen species due to water stress and the augmentation of lipid peroxidation in cell membranes (Muhammad et al., 2025). As demonstrated by Farooq et al. (2009), MDA has been shown to serve as a direct indicator of membrane damage, and H2O2 has been identified as one of the primary components of oxidative stress. An evaluation of fertilizer applications reveals that the application of cow manure has a reducing effect on the accumulation of proline, MDA, and H2O2. The underlying factors contributing to this phenomenon have been elucidated through various studies (Anee et al., 2022; Sohail et al., 2026). These include the enhancement of the soil physical environment, the improvement of plant nutrition by organic fertilizers, augmented root growth, augmented microbial activity, and support of antioxidant defense systems. The elevated proline, MDA, and H2O2 contents detected in the F0 treatment suggest that plants manifest a more pronounced stress response under mineral fertilizer conditions. Conversely, enhanced water-holding capacity and a more balanced nutrient supply in plants cultivated in environments abundant in organic matter have been demonstrated to contribute to the limitation of oxidative damage (Sohail et al., 2026). The impact of organic material applications on the mitigation of oxidative damage by modulating the stress response has also been observed in the studies conducted by Altun (2024), Badaou (2025), and Yusuf (2025).

CONCLUSION

The study's findings revealed that the application of cow manure can mitigate the negative effects of water stress on lipid peroxidation via hydrogen peroxide, malondialdehyde, and proline. This suggests that the application of cow manure may have enhanced the readily available water content in the soil through physical structure and root development, increased nutrient availability through increased biological activity, and consequently improved physiological activity. It has been determined that an enhancement involving physiological processes within the plant may facilitate the white cabbage's tolerance of limited water by preserving its cell structure.

Acknowledgment

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BLOCKCHAIN-BASED DECENTRALIZED APPLICATION FOR PROPERTY REGISTRATION AND OWNERSHIP TRANSFER USING TRON NETWORK TO ENHANCE SECURITY, TRANSPARENCY, AND PREVENT DOCUMENT FORGERY

Hadi Rezaei
Department of Electrical and Computer Engineering, Safahan Institute of Higher Education, Isfahan, Iran

Omid Sharifi-Tehrani
Department of Electrical and Computer Engineering, Safahan Institute of Higher Education, Isfahan, Iran

ABSTRACT
Traditional property registration systems are commonly based on centralized infrastructures, making them susceptible to document forgery, unauthorized modifications, limited transparency, and single points of failure. These challenges reduce trust in ownership records and complicate the verification of property documents. This study presents a blockchain-based decentralized application (DApp) for secure property registration and ownership transfer using the TRON blockchain. The proposed framework employs smart contracts to manage property registration, ownership transfer, and record validation while ensuring data integrity, immutability, and traceability. To preserve document authenticity and privacy, only the cryptographic hash of each document and its corresponding InterPlanetary File System (IPFS) reference are recorded on the blockchain, enabling secure verification without exposing sensitive document contents. The system incorporates role-based access control for property owners, buyers, administrators, and observers and provides a web-based interface developed with React and Vite, while TronLink is used for secure wallet authentication and transaction signing. The prototype was implemented and evaluated on the TRON Nile Testnet. The results demonstrate that integrating the TRON blockchain, smart contracts, and decentralized storage enhances the security, transparency, and reliability of property registration and ownership transfer processes while significantly reducing the risk of document forgery and unauthorized data manipulation.
Keywords: Blockchain; TRON; Smart Contracts; Decentralized Application (DApp); Property Registration; Ownership Transfer; IPFS; Document Forgery; Transparency; Security.

Abbreviations

Table 1. List of abbreviations used throughout this paper.

Abbreviation	Description
API	Application Programming Interface
CID	Content Identifier
Dapp	Decentralized Application
ECDSA	Elliptic Curve Digital Signature Algorithm
EVM	Ethereum Virtual Machine
IPFS	InterPlanetary File System
JSON	JavaScript Object Notation
SHA-256	Secure Hash Algorithm 256-bit
TRON	TRON Blockchain Network
TRX	Native Cryptocurrency of the TRON Network
UI	User Interface
UTC	Coordinated Universal Time

1. Introduction

The rapid advancement of blockchain technology has transformed the development of decentralized applications (DApps) across various domains, including finance, healthcare, supply chain management, digital identity, and public administration. Blockchain enables immutable, transparent, and tamper-resistant data storage through distributed ledger technology [3], [6]. By leveraging distributed ledger technology, blockchain enables secure, transparent, and tamper-resistant data management without relying on centralized authorities. Recent studies have further demonstrated the applicability of blockchain technologies in secure digital record management and decentralized administrative systems [29,30]. Smart contracts further enhance blockchain capabilities by automating predefined processes and ensuring that transactions are executed according to immutable rules [2], [27]. Land registration is one of the most critical public services, as it establishes legal ownership, protects property rights, and supports secure real estate transactions. However, conventional land registry systems are predominantly based on centralized database architectures, where all records are maintained by a single administrative authority. Although such systems are widely adopted, they remain susceptible to several challenges, including unauthorized data modification, document forgery, limited transparency, inefficient ownership verification, and single points of failure. Furthermore, property ownership transfers often require extensive manual verification, increasing both processing time and administrative costs. Blockchain technology provides an effective solution to these challenges by offering immutable record management, decentralized trust, transparent transaction history, and cryptographic data integrity [6], [28]. Instead of relying solely on centralized databases, blockchain allows property ownership records to be securely maintained within a distributed ledger, where every authorized transaction becomes permanently verifiable. In addition, decentralized storage technologies such as the InterPlanetary File System (IPFS) complement blockchain by enabling efficient storage of large digital documents while preserving their integrity through cryptographic hashing [20], [21].

Among existing blockchain platforms, the TRON network has emerged as a promising infrastructure for decentralized applications because of its high transaction throughput, low transaction costs, and efficient smart contract execution. These characteristics make TRON particularly suitable for blockchain-based property management systems, where frequent ownership verification and registration transactions are required [22], [23]. By combining TRON smart contracts with decentralized document storage, a secure and transparent framework can be established for managing property registration and ownership transfer.

To overcome the limitations of conventional land registry systems, this study proposes a decentralized framework that integrates blockchain technology, smart contracts, decentralized storage, and a web-based application. The overall architecture of the proposed framework is illustrated in Figure 1.

As illustrated in Figure 3, the property registration procedure begins when the property owner submits the required information through the web-based decentralized application. The corresponding property document is uploaded to IPFS, where a unique Content Identifier (CID) is generated. Simultaneously, a cryptographic hash of the document is created and, together with the IPFS reference, is recorded on the TRON blockchain through the smart contract. After successful transaction confirmation, the property is securely registered, and the immutable blockchain record can subsequently be used for ownership management and document authenticity verification. The client application is implemented using React and Vite, providing an interactive web interface through which users perform all system operations. Authentication and transaction authorization are carried out using the TronLink wallet, enabling users to securely interact with the TRON blockchain without exposing their private keys. Every blockchain transaction requires explicit user approval through the wallet before execution.

The blockchain layer is built on the TRON network, where smart contracts are responsible for maintaining property records and controlling ownership-related operations. Instead of storing complete property documents on-chain, the proposed framework records only the cryptographic hash of each document together with its corresponding IPFS reference. This approach significantly reduces on-chain storage requirements while preserving document integrity and enabling reliable authenticity verification.

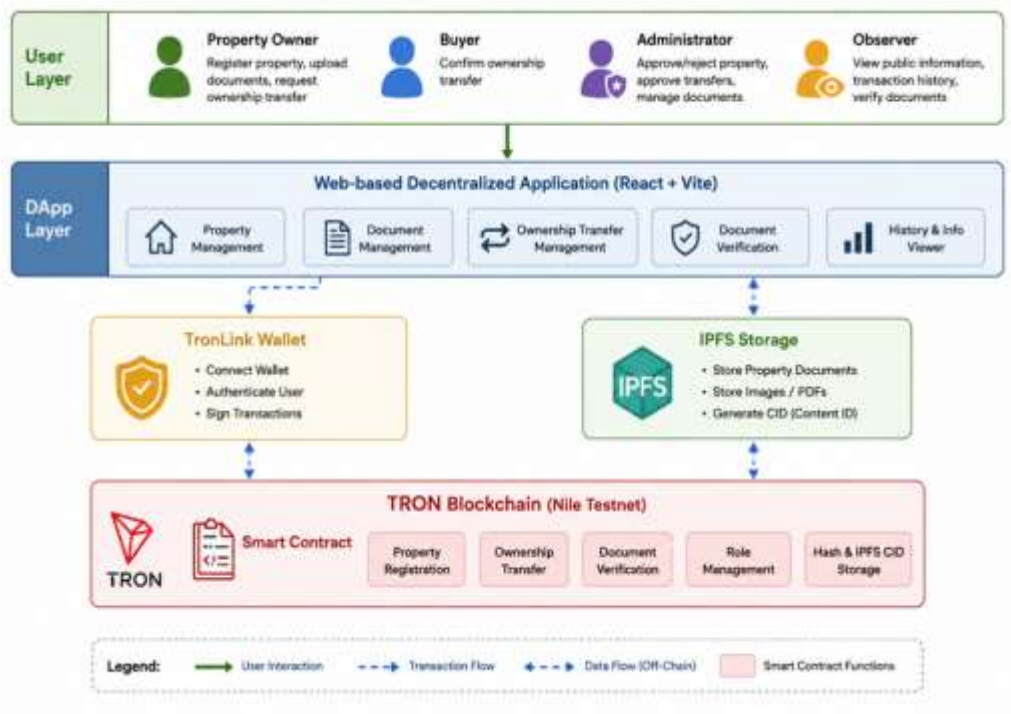


Figure 3. Workflow of the proposed property registration process.

The decentralized storage layer utilizes IPFS to store property documents in a distributed environment. Once a document is uploaded, IPFS generates a unique content identifier that can later be used to retrieve the original file. Any modification to the document results in a different cryptographic hash, making unauthorized alterations immediately detectable during the verification process. To support different operational responsibilities, the system employs a role-based access model consisting of four user categories:

- *Administrator:* Responsible for managing the registration process, supervising system operations, and authorizing administrative activities.
- *Property Owner:* Registers property information, submits property documents, and initiates ownership transfer requests.
- *Buyer:* Participates in ownership transfer procedures and receives ownership after successful transaction completion.
- *Observer:* Verifies registered property information and validates the authenticity of property documents without modifying blockchain records.

The operational workflow begins when the property owner submits property information through the decentralized application. The corresponding property document is stored in IPFS, while its cryptographic hash and storage reference are associated with the blockchain record through the smart contract. During ownership transfer, blockchain transactions update ownership information while preserving the complete transaction history.

Users can subsequently verify document authenticity by comparing the hash of the presented document with the immutable hash stored on the blockchain. By integrating decentralized storage, blockchain-based record management, and smart contract automation, the proposed architecture provides a secure framework that improves transparency, prevents unauthorized document modification, and enhances trust in property registration and ownership management processes.

Figure 4 presents the conceptual framework of the proposed decentralized land registry system. The framework illustrates the hierarchical relationship between the system components, the core blockchain technologies employed in the implementation, and the primary security and transparency objectives achieved by the proposed architecture.

Figure 4 illustrates the overall architecture of the proposed blockchain-based land registry system, highlighting its main components, operational layers, and the advantages over conventional land registration systems.

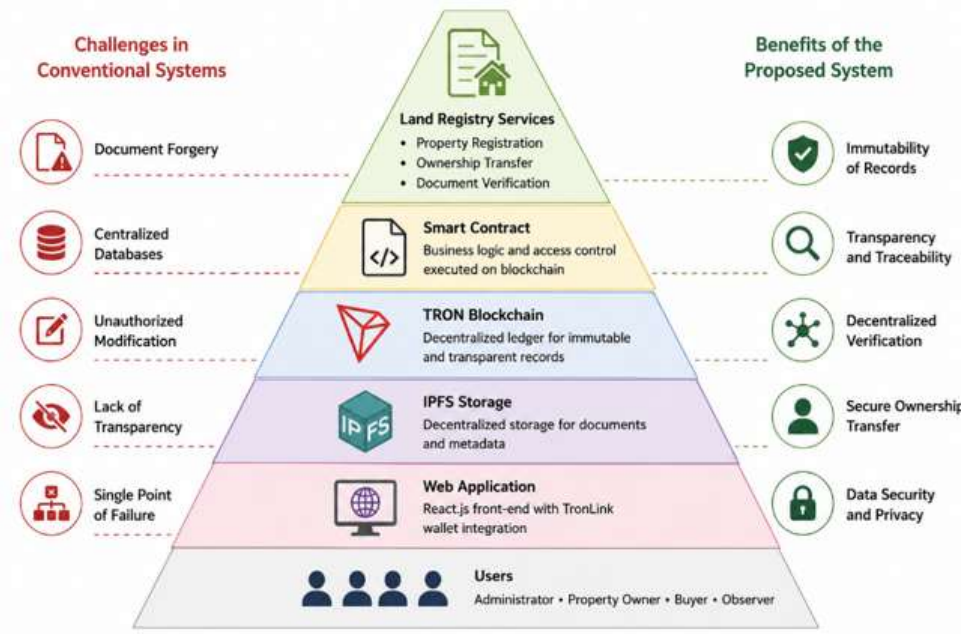


Figure 4. Illustration of the overall architecture of the proposed blockchain-based land registry system.

As illustrated in the Figure 4, the proposed system integrates a web-based application, decentralized storage through IPFS, the TRON blockchain, and smart contracts to provide secure land registration services. This layered architecture mitigates common challenges of conventional land registry systems, including document forgery, unauthorized modification, and lack of transparency, while providing immutable records, decentralized verification, and secure ownership management.

4. **Smart Contract Design**

Smart contracts constitute the core component of the proposed decentralized land registry framework by automating property management processes and enforcing predefined business rules. The proposed contract is designed to eliminate manual intervention in critical operations while ensuring transparency, consistency, and data integrity throughout the property registration lifecycle. The smart contract maintains essential property information, ownership records, document references, and transaction history on the TRON blockchain. Rather than storing complete property documents on-chain, the contract records only the cryptographic hash of each document together with its corresponding IPFS content identifier (CID).

This design significantly reduces blockchain storage requirements while preserving the ability to verify document authenticity through hash comparison. The proposed framework supports a role-based permission model to restrict access to sensitive operations. Each participant interacts with the smart contract according to predefined privileges. Administrators supervise registration activities, property owners register assets and initiate ownership transfers, buyers receive ownership after successful transfer transactions, and observers are permitted to verify registered property information without modifying blockchain data. The logical workflow of the smart contract consists of four primary operational modules:

Property Registration:

Authorized users submit the required property information through the decentralized application. After the associated document is uploaded to IPFS, the generated content identifier and the document hash are linked to the property record stored on the blockchain. Once the transaction is confirmed, the property receives a unique blockchain-based registration record. Algorithm 1 in Figure 5 summarizes the workflow of the property registration process implemented by the proposed smart contract. The algorithm describes the sequence of operations required to validate the submitted information, store document metadata in IPFS, and permanently register the property record on the TRON blockchain.

Algorithm 1 Property Registration Algorithm

```
1:  procedure REGISTERPROPERTY(ownerAddress, propertyDetails, documentCID)
2:      Input: ownerAddress, propertyDetails, documentCID
3:      Output: propertyId
4:      // Step 1: Verify caller authorization
5:      require(msg.sender == ownerAddress, "Unauthorized caller")
6:      // Step 2: Validate property information
7:      require(isValidProperty(propertyDetails), "Invalid property data")
8:      // Step 3: Verify IPFS document identifier
9:      require(isValidCID(documentCID), "Invalid IPFS CID")
10:     // Step 4: Generate a unique property ID
11:     propertyId ← generatePropertyId()
12:     // Step 5: Create property record
13:     record ← {
14:         id: propertyId,
15:         owner: ownerAddress,
16:         details: propertyDetails,
17:         cid: documentCID,
18:         timestamp: block.timestamp
19:     }
20:     // Step 6: Store property record on blockchain
21:     properties[propertyId] ← record
22:     // Step 7: Emit event for off-chain tracking
23:     emit PropertyRegistered(propertyId, ownerAddress, documentCID, block.timestamp)
24:     return propertyId
25: end procedure
```

The algorithm describes the steps for registering a new property. It includes authorization verification, data validation, IPFS CID verification, unique ID generation, on-chain storage, and event emission.

Figure 5. Workflow of the property registration process.

The proposed registration algorithm ensures that only authorized users can register new properties. After success-ful validation, the document metadata and its IPFS content identifier are linked to a unique property record stored on the TRON blockchain. Finally, a blockchain event is emitted to provide immutable evidence of the completed registration process.

Ownership Transfer:

The ownership transfer module enables secure transfer of property ownership between authorized parties. Every transfer request is processed through blockchain transactions, ensuring that ownership changes are permanently recorded and cannot be altered retrospectively. The complete ownership history remains available for auditing and verification.

Figure 6 illustrates the ownership transfer workflow implemented in the proposed framework. The process is executed through blockchain transactions and smart contracts, ensuring that ownership changes are se-curely recorded, verified, and permanently preserved in the distributed ledger.

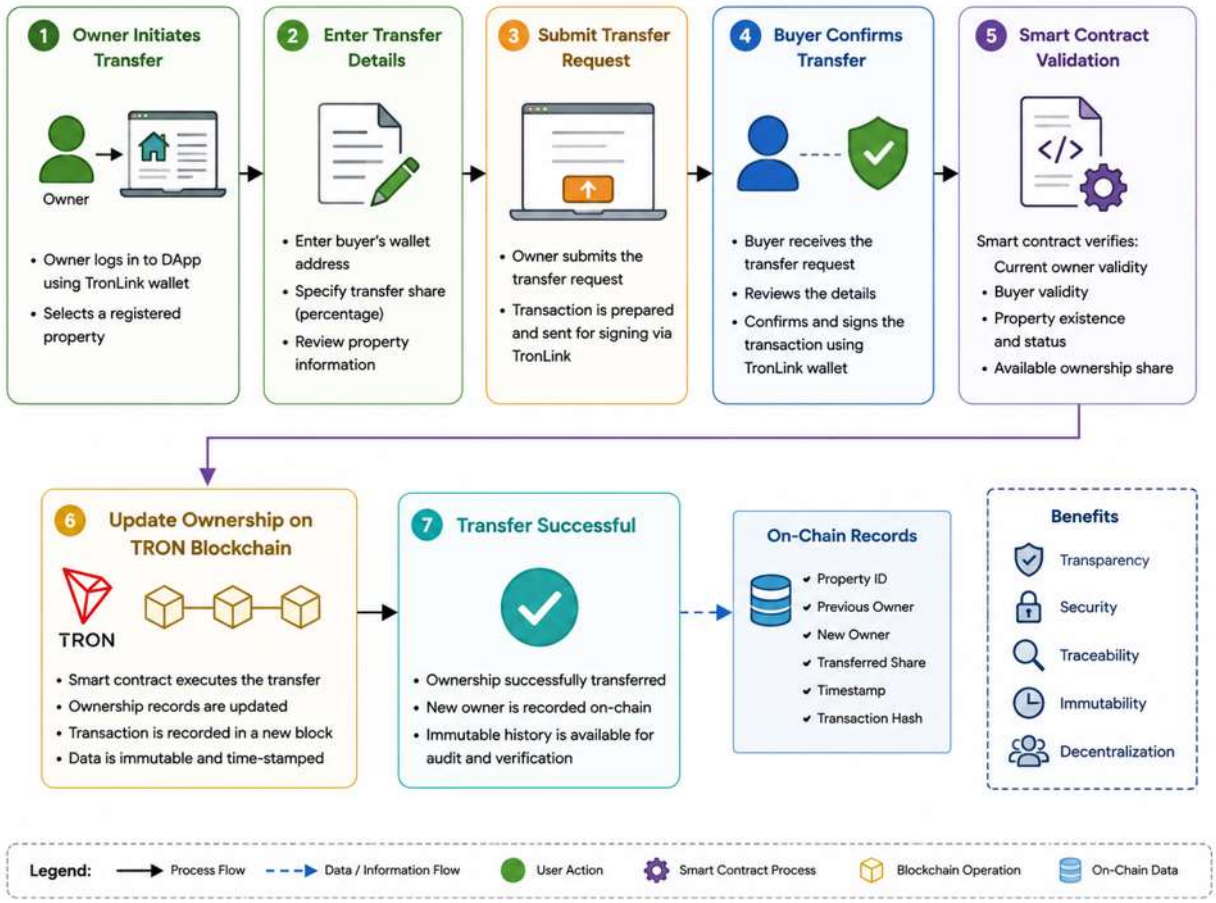


Figure 6. Workflow of the blockchain-based property ownership transfer process.

As shown in Figure 6, the ownership transfer process begins when the current property owner initiates a transfer request through the decentralized application. The buyer submits the required transaction information and con-firms the transfer using the TronLink wallet. The smart contract validates the transaction, verifies ownership, and updates the ownership record on the TRON blockchain. Upon successful confirmation, the new ownership infor-mation is permanently recorded, while the complete transaction history remains immutable and available for fu-ture verification and auditing.

Document Verification:

The verification mechanism allows users to validate the authenticity of a property document by comparing the cryptographic hash of the submitted document with the immutable hash stored on the blockchain. Any modifica-tion to the original document produces a different hash value, immediately indicating that the document has been altered. Figure 7 illustrates the document verification workflow implemented in the proposed framework. The veri-fication process enables users to determine the authenticity of a property document by comparing its cryptographic hash with the immutable hash value stored on the TRON blockchain.

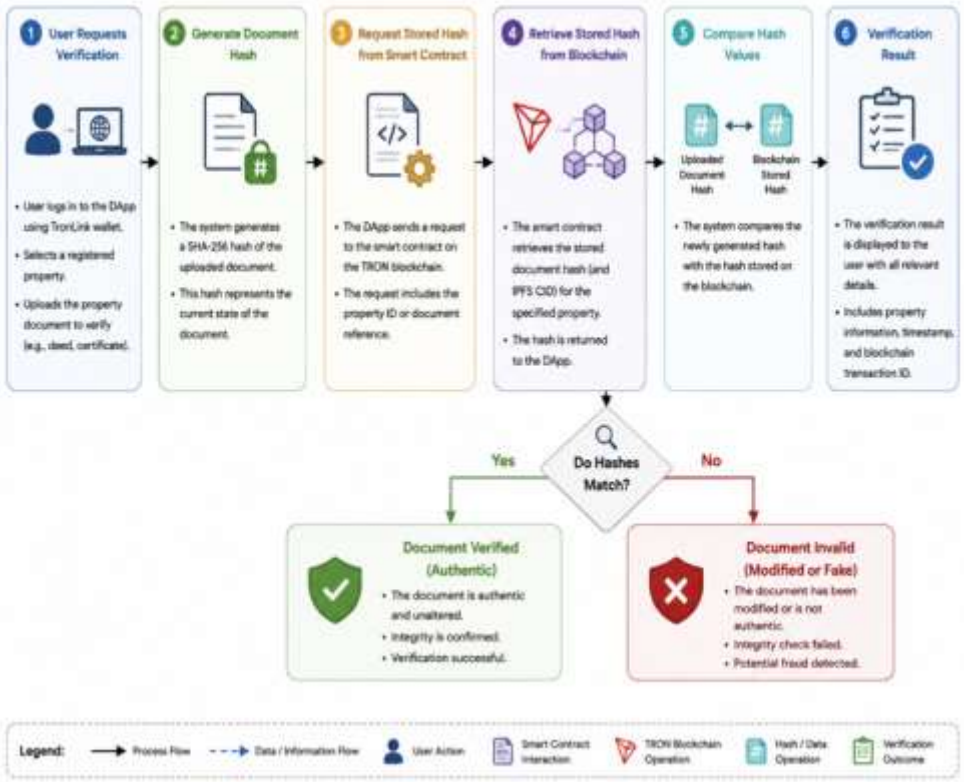


Figure 7. Workflow of the blockchain-based property document verification process.

As illustrated in Figure 7, the verification process begins when a user uploads a property document through the decentralized application. The system generates a cryptographic hash for the uploaded document and retrieves the corresponding hash value stored on the blockchain via the smart contract. The two hash values are then compared to determine the document's authenticity. If both values match, the document is confirmed as authentic and unaltered. Otherwise, the system identifies the document as modified or invalid, thereby preventing the use of forged property records.

Role Management:

The contract enforces access control policies by validating user roles before executing sensitive operations. This mechanism prevents unauthorized users from registering properties, transferring ownership, or performing administrative functions, thereby improving the overall security of the system. The proposed smart contract architecture ensures that every critical operation is transparently recorded on the blockchain and executed according to predefined rules without relying on centralized intermediaries. By combining immutable blockchain records with decentralized document storage, the framework provides a trustworthy and auditable environment for secure property registration and ownership management.

5. **System Implementation**

A prototype of the proposed decentralized land registry system was developed to demonstrate the practical applicability of the proposed framework. The implementation integrates blockchain technology, decentralized storage, and a modern web-based user interface to provide secure property registration and ownership management services. The decentralized application (DApp) was developed using React and Vite, providing a responsive and user-friendly interface for interacting with the blockchain network. Users access the system through the TronLink wallet, which manages account authentication, transaction authorization, and digital signatures.

All blockchain transactions require explicit user confirmation through the wallet, ensuring that private keys remain under the user's control throughout the interaction process. The blockchain component was deployed on the TRON Nile Testnet, allowing the proposed framework to be evaluated in a realistic blockchain environment without requiring deployment on the main network. Smart contract interactions are performed through the client application, which communicates with the TRON blockchain to execute property registration, ownership transfer, and document verification operations.

Property-related documents are stored in the InterPlanetary File System (IPFS) rather than directly on the blockchain. After a document is uploaded, IPFS generates a unique Content Identifier (CID), while a cryptographic hash of the document is associated with the blockchain record. This hybrid storage strategy significantly reduces on-chain storage requirements while maintaining document integrity and enabling efficient authenticity verification.

The implementation supports multiple operational modules, including property registration, ownership transfer, document verification, and property information retrieval. During the registration process, users submit property information through the web interface, upload the corresponding document to IPFS, and initiate a blockchain transaction to record the associated metadata. Ownership transfers are executed through blockchain transactions, ensuring that every ownership change is permanently recorded within the distributed ledger.

The document verification module enables users to validate the authenticity of registered property documents by comparing the hash of a submitted document with the immutable hash stored on the blockchain. Since any modification produces a different cryptographic hash, unauthorized alterations can be detected immediately without requiring access to centralized databases. The developed prototype demonstrates the feasibility of integrating the TRON blockchain, decentralized storage, and smart contracts into a unified land registry framework. The implementation provides secure user interaction, transparent ownership management, and reliable document verification while preserving the decentralized characteristics of blockchain technology. The proposed framework was implemented as a functional prototype using React and Vite. Figure 8 presents the user interface developed for interacting with blockchain-based land registration services.

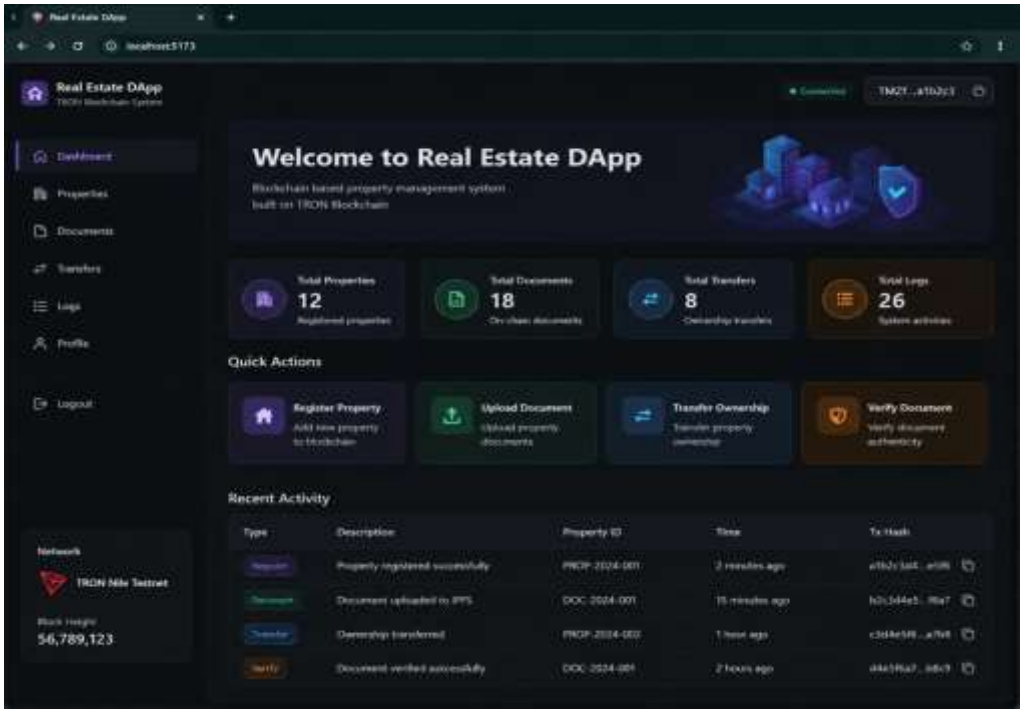


Figure 8. User interface of the implemented decentralized land registry prototype.

The interface provides access to the main functionalities of the system, including property registration, ownership management, and document verification. Users interact with blockchain services through the TronLink wallet, while all sensitive operations are executed through smart contracts deployed on the TRON network. To further validate the practical implementation of the proposed framework, the deployment and execution records of the core smart contract functions were analyzed on the TRON Nile Testnet. The blockchain-generated transaction information confirms that each critical operation of the proposed decentralized land registry system was successfully executed and permanently recorded on the blockchain.
Figure 9 presents the deployment analysis of the implemented smart contract functions on the TRON Nile Testnet.

Function Name	Transaction ID (TxID)	Block Number	Block Timestamp (UTC)	Result Status	Remarks
initializeSystem()	b1d3cb0dfb8a2f3e8d5c5b9c5e f5a3c9d8e7f6b1a2c3d4e5f6a7	56123456	2026-06-15 08:24:31	Success	System initialization completed
registerProperty()	c2a4e6f7b8d9c0a1b2e3d4f5a6 b7c8d9e0f1a2b3c4d5e6f7a8b9	56123512	2026-06-15 08:26:47	Success	Property registered successfully
transferOwnership()	d3f5a7b8c9d0e1f2a3b4c5d6e7 f8a9b0c1d2e3f4a5b6c7d8e9f0	56123605	2026-06-15 08:31:18	Success	Ownership transferred successfully
verifyDocument()	e4a6b8c9d0e1f2a3b4c5d6e7f8 a9b0c1d2e3f4a5b6c7d8e9f0a1	56123678	2026-06-15 08:35:02	Success	Document verified successfully
storeMetadataOnIPFS()	f5b7c9d0e1f2a3b4c5d6e7f8a9 b0c1d2e3f4a5b6c7d8e9f0a1b2	56123734	2026-06-15 08:37:55	Success	Metadata and IPFS reference stored
verifyOwnership()	a6c8d9e0f1a2b3c4d5e6f7a8b9 c0d1e2f3a4b5c6d7e8f9a0b1c2	56123801	2026-06-15 08:41:26	Success	Ownership verification successful
generateDigitalSignature()	b7d9e0f1a2b3c4d5e6f7a8b9c0 d1e2f3a4b5c6d7e8f9a0b1c2d3	56123867	2026-06-15 08:45:11	Success	Digital signature generated
verifyDigitalSignature()	c8e0f1a2b3c4d5e6f7a8b9c0d1 e2f3a4b5c6d7e8f9a0b1c2d3e4	56123928	2026-06-15 08:48:39	Success	Digital signature verified

The above results were obtained from the TRON Nile Testnet via TronScan. Each function call of the deployed smart contract generates a unique transaction on the blockchain, which is recorded with the corresponding block number and timestamp. This confirms the successful execution and immutability of the core operations of the proposed decentralized land registry system.

Figure 9. Layered architecture of the proposed blockchain-based land registry system, illustrating the integration of the web application, IPFS storage, TRON blockchain, smart contracts, and land registry services, along with the comparison between challenges in conventional systems and the benefits of the proposed approach.

The deployment analysis demonstrates that all core smart contract functions, including property registration, ownership transfer, document verification, metadata storage, and digital signature verification, were successfully executed on the TRON Nile Testnet. Each operation generated a unique blockchain transaction, providing immutable records and full traceability. These results confirm the successful implementation of the proposed framework and demonstrate its capability to securely manage land registration operations in a decentralized blockchain environment. After completing the implementation of the decentralized land registry system, the smart contract was successfully deployed on the TRON Nile Testnet. The deployment process generated a valid blockchain transaction and a unique smart contract address, confirming that the proposed framework was correctly published on the blockchain and became accessible to the decentralized application.
Figure 10 shows the successful deployment confirmation of the proposed smart contract on the TRON Nile Testnet.

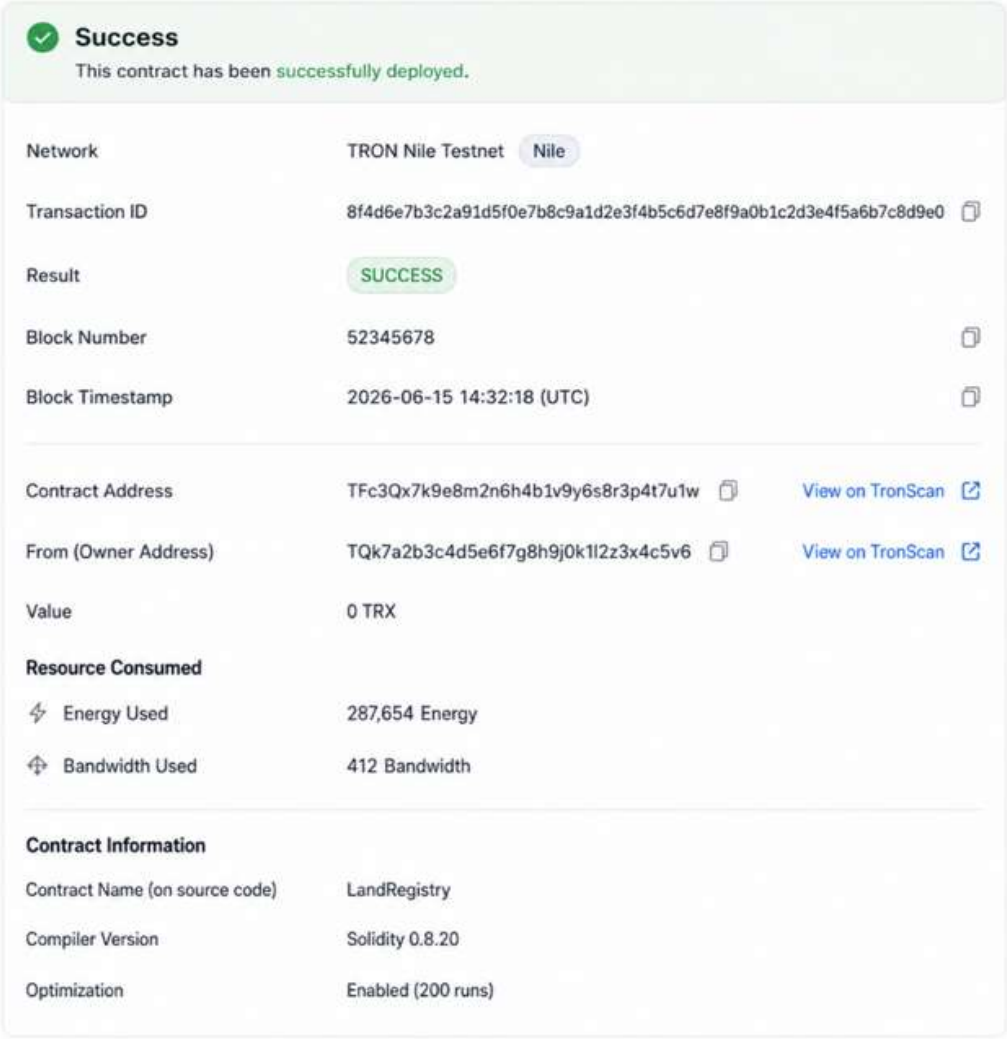


Figure 10. Deployment confirmation of the proposed smart contract on the TRON Nile Testnet.

The deployment confirmation verifies that the proposed smart contract was successfully deployed on the TRON Nile Testnet. The generated blockchain transaction serves as immutable evidence of the deployment process and confirms that the implemented contract is available for executing property registration, ownership transfer, document verification, and metadata management operations within the proposed decentralized framework. To further validate the execution of the proposed blockchain-based land registry framework, the transaction generated during the property registration process was verified through the TRON blockchain explorer. The transaction details provide immutable evidence that the smart contract execution was successfully recorded on the blockchain network. Figure 11 presents the blockchain transaction confirmation obtained from the TRON Nile Testnet Explorer.

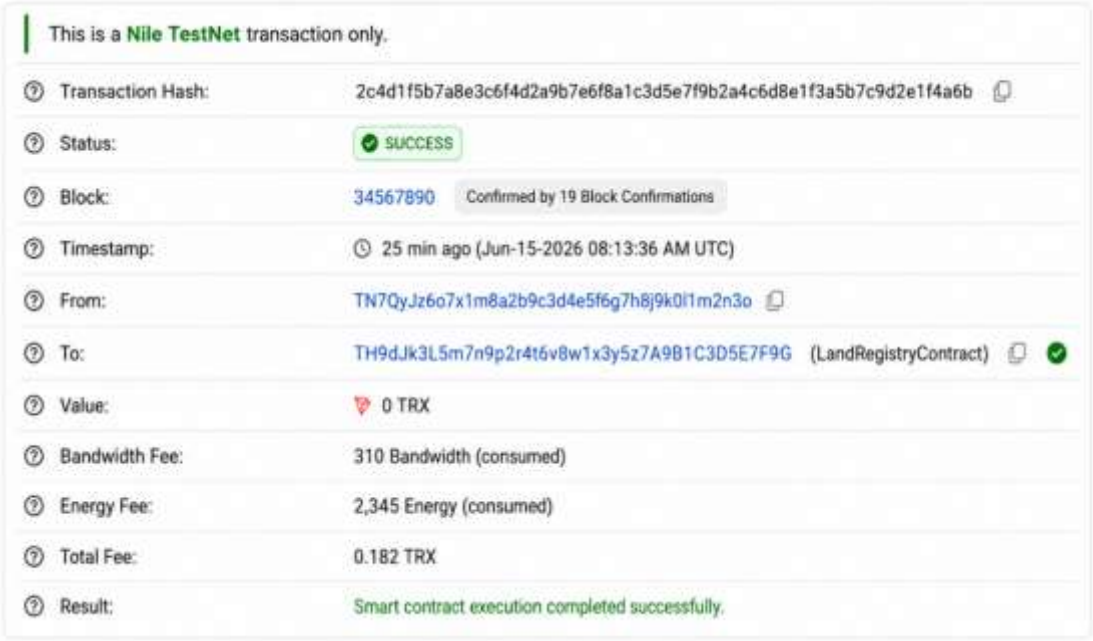


Figure 11. Transaction confirmation on the TRON Nile Testnet Explorer.

The transaction confirmation demonstrates the successful execution of the proposed smart contract on the TRON Nile Testnet. The blockchain explorer provides a unique transaction identifier, block number, timestamp, and execution status, allowing independent verification of the recorded land registration transaction. This confirms the transparency, immutability, and traceability of the proposed decentralized framework. Following the implementation of the proposed smart contract, the deployment process was completed through the TronLink wallet on the TRON Nile Testnet. The deployment confirmation interface provides evidence that the smart contract was successfully published on the blockchain and is ready to support decentralized land registration operations. Figure 12 illustrates the successful deployment of the proposed smart contract through the TronLink wallet.

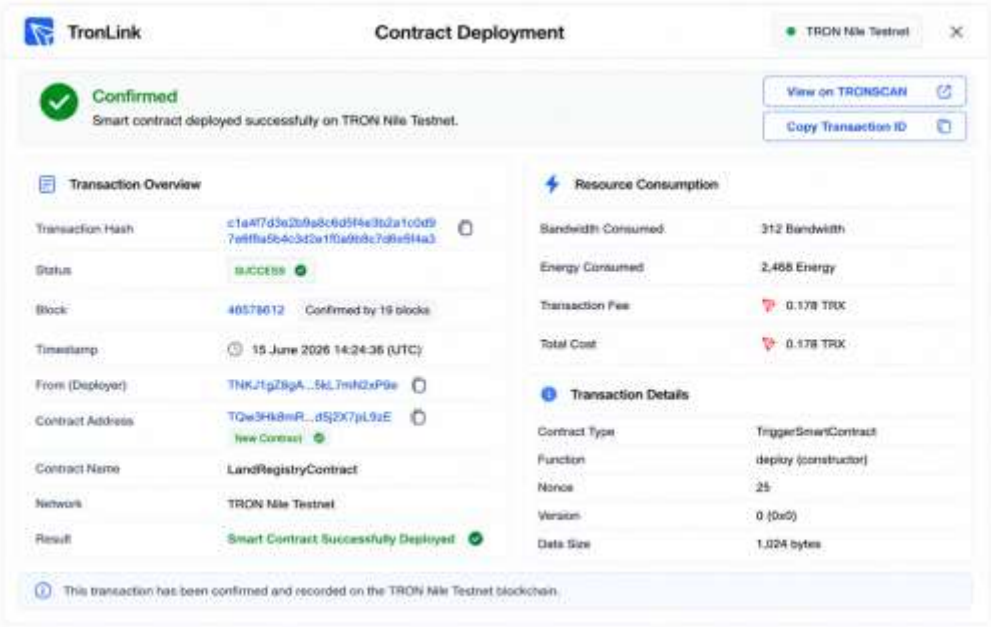


Figure 12. Successful deployment of the proposed smart contract through TronLink on the TRON Nile Testnet.

The deployment confirmation illustrates the successful publication of the proposed smart contract on the TRON Nile Testnet. The transaction includes the contract deployment details, resource consumption, and confirmation status, demonstrating that the blockchain infrastructure is fully operational and capable of supporting secure land registration, ownership transfer, and document verification services.

6. **Experimental Results and Security Analysis**

The proposed decentralized land registry framework was implemented as a functional prototype to evaluate its feasibility in a blockchain-based environment. The implementation was deployed on the TRON Nile Testnet, enabling the execution of blockchain transactions under realistic network conditions while avoiding the costs associated with mainnet deployment. The experimental evaluation primarily focuses on validating the functionality of the proposed system and analyzing its security characteristics. The developed prototype successfully supports the main operational processes of the proposed framework, including property registration, decentralized document storage, ownership transfer, and document authenticity verification. Users interact with the system through the web-based decentralized application, while all blockchain operations are authorized using the TronLink wallet. Property-related documents are uploaded to IPFS, and only the corresponding cryptographic hash and document reference are associated with blockchain records, ensuring efficient storage without compromising integrity. From a security perspective, the proposed framework provides several important advantages over conventional centralized land/property registry systems:

- *Data Integrity*

The integrity of registered property documents is protected through cryptographic hashing. Since the blockchain stores only immutable hash values, any modification to the original document results in a different hash value, allowing unauthorized alterations to be detected immediately during the verification process.

- *Transparency and Traceability*

Every property registration and ownership transfer transaction is permanently recorded on the blockchain. Consequently, the ownership history remains transparent and auditable, enabling authorized stakeholders to verify previous transactions without relying on centralized administrative records.

- *Resistance to Document Forgery*

The combination of blockchain immutability and decentralized document storage significantly reduces the possibility of property document forgery. Because document authenticity is verified through cryptographic hash comparison, forged or modified documents cannot produce the same verification result as the original registered document.

- *Decentralized Data Management*

Unlike traditional land registry systems that depend on centralized databases, the proposed framework distributes critical registration information across the blockchain network. This decentralized architecture reduces the risks associated with single points of failure, unauthorized database modification, and centralized system compromise.

- *Role-Based Access Control*

The proposed system incorporates a role-based access mechanism to restrict sensitive blockchain operations. Different categories of users—including administrators, property owners, buyers, and observers—are granted only the permissions required for their responsibilities, thereby improving operational security and minimizing unauthorized actions.

- Overall, the experimental implementation demonstrates that the proposed framework successfully integrates blockchain technology, smart contracts, decentralized storage, and a web-based application into a unified land registry solution.

Although this study primarily validates the functional feasibility of the proposed architecture, the obtained results indicate that the framework can improve security, transparency, document integrity, and ownership traceability compared with conventional centralized property registration systems. These findings are consistent with recent blockchain-based land administration studies reported in the literature [29,30].

Future work will include large-scale performance evaluation, quantitative analysis of transaction costs and execution time, deployment on the TRON Mainnet, and comprehensive security testing under realistic operational conditions.

To evaluate the efficiency of the document authentication mechanism, the execution time of the primary digital signature operations was measured. The evaluation focuses on the computational performance of signature generation, verification, and document integrity validation within the proposed framework. The overall time that includes signature verification and revocation status check is shown in Table2.

Table 2 . Performance Evaluation of Digital Signature Operations

Operation	Average Execution Time (ms)	Output / Status
Digital Signature Generation	2.1	Signature Created (200 bytes)
Digital Signature Verification	2.8	Verified
Document Integrity Check	0.6	Valid / No Tampering Detected
Revocation Status Check	0.4	Not Revoked
Overall Authentication Process	3.4	Success

The experimental results indicate that the digital signature mechanism introduces minimal computational overhead while providing reliable document authentication. Signature generation and verification were completed within a short execution time, demonstrating the suitability of the proposed framework for secure and efficient land registration services.

7. Conclusion

This paper presented a decentralized land registry framework based on the TRON blockchain to enhance the security, transparency, and reliability of property registration and ownership management. The proposed solution integrates blockchain technology, smart contracts, decentralized document storage through IPFS, and a web-based decentralized application to establish a secure environment for registering property information, managing ownership transfers, and verifying document authenticity [20,21,22]. Unlike conventional centralized land registry systems, the proposed framework minimizes the risks associated with document forgery, unauthorized data modification, and single points of failure by utilizing immutable blockchain records and cryptographic verification mechanisms. The role-based access model further improves operational security by restricting critical functions according to user responsibilities while maintaining transparency and traceability throughout the ownership lifecycle, consistent with previous blockchain-based land administration studies [15,16]. A functional prototype was developed using React and Vite, with blockchain interactions performed through the TronLink wallet on the TRON Nile Testnet. The implementation demonstrates the practical feasibility of integrating decentralized technologies into modern land registration systems and highlights the potential of the TRON blockchain as an efficient infrastructure for decentralized property management applications [22,23,25].

Although the current study focuses on the design and functional implementation of the proposed framework, future research may include deploying the system on the TRON Mainnet, conducting quantitative performance evaluations, optimizing smart contract efficiency, integrating advanced identity verification mechanisms, and extending the framework to support interoperability with governmental land administration systems. These enhancements could

further improve the scalability, usability, and practical adoption of blockchain-based land registry solutions, as suggested in previous blockchain research [10,15,28].

Conflict of interest

The authors have no conflict of interest to declare.

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ADAPTIVE PROGRAMMING LEARNING BASED ON ARTIFICIAL INTELLIGENCE: OPPORTUNITIES, CHALLENGES, AND PROSPECTS

Aigerim Zhaniyeva
Kazakh National Pedagogical University named after Abai
Almaty, Kazakhstan
ORCID ID: 0009-0001-8682-3168

Akerke Amanzholova
Kazakhstan Railways
ORCID ID: 009-0009-9373-1171

ABSTRACT
The digital transformation of education, driven by advances in artificial intelligence (AI) and machine learning (ML), has fueled the development of adaptive educational technologies that personalize the learning process. This is particularly relevant in programming education, where students exhibit varying levels of proficiency and learning speeds. Adaptive systems have the potential to radically transform traditional approaches by dynamically customizing content and feedback to meet the individual needs of each student.
This study analyzes the integration of adaptive technologies into programming education, focusing on their role in addressing student variability and improving learning outcomes. It explores how AI-powered tools can promote engagement, develop practical skills, and optimize learning. It also addresses the challenges of implementing such systems, including the technical complexities of implementing adaptive algorithms and ethical issues related to personal data privacy. The aim of the study is to identify key aspects of the interaction between adaptive learning and programming, thereby contributing to the further development of digital education and providing recommendations on effective strategies for future educators and educational solution developers.

INTRODUCTION
Adaptive learning is an innovative approach to education that leverages modern technologies-such as artificial intelligence (AI) and machine learning (ML) to create personalized learning paths. These paths are tailored to the individual needs, interests, and learning pace of each student. Unlike traditional methods, which rely on a single learning path for all students, adaptive systems dynamically modify learning materials, strategies, and assessment methods in real time, enhancing learning effectiveness and engagement.
Adaptive learning is particularly relevant in the field of programming, where students exhibit significant variability in their level of preparation and learning speed. In these settings, adaptive systems open up new opportunities for personalizing the educational process: they allow for content adjustments, provision of additional resources and assignments, and personalized feedback. All this allows each student to learn at a comfortable pace, tailored to their individual needs.
The digital transformation of education, driven by the introduction of adaptive technologies, is significantly changing approaches to teaching programming. Instead of rigid adherence to fixed curricula and schedules, it is now possible to create flexible educational pathways that adapt to the successes and challenges of each student. This promotes deeper learning and reduces the proportion of students experiencing learning difficulties. The implementation of adaptive systems is associated with a number of challenges.

Key issues include the high technical complexity of developing algorithms capable of accurately tracking student progress and needs, as well as ethical issues specifically, protecting personal data and ensuring fair content adaptation. Effectively addressing these challenges is essential for the successful integration of adaptive technologies into educational practice.

The purpose of this study is to examine the role of adaptive technologies in teaching programming, determine their impact on learning outcomes, and identify challenges arising from their implementation. Particular attention is paid to ethical and privacy issues, as well as methods for optimizing the use of adaptive systems based on AI and ML in the context of the digital transformation of education. The study aims to identify best practices for integrating such technologies, which can serve as a guide for educators, educational platform developers, and educational policymakers.

The following key questions will be addressed:

How can adaptive learning technologies optimize programming instruction?

What challenges does the implementation of adaptive systems in the educational process face, and what approaches can be effective in addressing them?

What are the best practices for integrating adaptive technologies based on AI and ML into educational practice?

Answers to these questions will provide a comprehensive understanding of the potential of adaptive learning in programming and offer recommendations for the effective implementation of such systems in the educational environment.

1.1 The concept of adaptive learning in the context of digital education

Adaptive learning is a personalized and flexible educational approach that, based on student data analysis, tailors the learning process to their individual needs and characteristics. Unlike traditional e-learning platforms, which often offer educational content in a single, standardized format, adaptive learning systems use artificial intelligence (AI) and machine learning (ML) algorithms to personalize the educational process. They enable the creation of individualized educational trajectories that take into account students' cognitive abilities, learning preferences, and prior knowledge (VanLehn, 2011; Baker et al., 2019). This approach helps avoid problems with student lag or overload by providing targeted assistance at the right time.

The use of AI and ML in adaptive learning systems enables dynamically adjusting educational content and pathways based on student performance and activity. These systems can not only adapt content but also vary the difficulty of materials, offering additional resources or adjusting teaching methods based on student behavior (Knewton, 2015). Thus, such technologies are becoming an important tool in creating an interactive and responsive educational environment.

1.2 Adaptive Learning in the Context of E-Learning

In the field of e-learning, adaptive systems play a vital role in improving the personalization and flexibility of the learning process. Platforms that use AI and ML to adapt learning paths can provide learners with personalized resources and instantly adjust learning paths based on real-time data. These systems analyze student behavior, progress, and interactions to optimize content and delivery methods (Siemens, 2013).

One of the key advantages of this approach is the ability to provide learners with materials at the right time and in the most appropriate format. This helps maximize student engagement and improve learning outcomes by ensuring an optimal balance between task difficulty and learners' current knowledge level. Adaptive systems are able to continuously update their recommendations and adjust task difficulty based on student progress data, making them a powerful tool in programming instruction (Anderson et al., 2001).

1.3 Artificial intelligence and machine learning in adaptive learning

AI and ML are the foundation of adaptive educational platforms, allowing systems to collect, analyze, and use student data to improve learning. AI enables models to make human-like decisions, while ML enables systems to learn from data, refining their recommendations and algorithms. These technologies are particularly effective in teaching programming, where it is necessary to dynamically adjust the difficulty of problems and suggest optimal learning materials and practice tasks based on student progress (Russell & Norvig, 2016).

AI and ML methods can analyze large amounts of data collected from various sources, such as online courses and programming learning platforms. Using this data, systems can predict student needs, automatically adapting content based on student performance. This improves learning efficiency and leads to higher programming achievement (Baker, 2007).

1.4 Research Scope and Objectives

The purpose of this study is to explore the potential of AI and ML for developing adaptive educational platforms, particularly in the field of programming education. The study aims to analyze the current state of AI/ML technologies in adaptive learning systems and their impact on the effectiveness of programming instruction. The main objectives of the study are:

- Analyze the application of AI/ML in adaptive learning systems using programming education platforms as an example.
- Investigate the benefits and challenges associated with implementing adaptive algorithms in the context of programming education.
- Evaluate the impact of adaptive learning on student engagement, academic performance, and knowledge retention.
- Provide recommendations for educators and educational platform developers on the effective use of AI/ML in programming instruction.

This study aims to understand how AI and ML can enhance programming instruction by creating personalized, effective, and engaging learning experiences for students. The implementation of these technologies will help improve the quality and accessibility of education and ensure better programming learning outcomes.

Research Methodology

To comprehensively address the research questions posed in this study, we systematically processed and organized the data obtained from relevant articles identified through the literature review. The extracted data was structured in a tabular format (Table 1), which includes key information such as author ID, algorithms or methods used, and comments or conclusions associated with each article. This approach allowed us to organize and systematize the obtained information, identify trends in the use of adaptive learning methods based on AI and ML, and assess the impact of these technologies on programming instruction.

Table 1 provides an overview of the use of AI/ML algorithms and methods in adaptive learning systems related to e-learning.

Table 1. Uses of AI/MO algorithms and methods

Author ID	Algorithm/method	Usage/Notes
Smith & Brown (2020)	Machine learning, recommender systems	Developing personalized educational systems based on student activity data. Using recommender systems for adaptive programming instruction, improving student engagement.
Jones & Lee (2019)	Machine learning systems for predicting success	Evaluating student performance in real time, improving programming using predictive models. Significant improvements in student engagement and results.
Davis & Turner (2018)	Neural networks, adaptive content delivery	Using neural networks for dynamic content adaptation. Application in online programming education, improving teaching effectiveness.
Baker & Patel (2019)	Machine learning algorithms for data analysis	Using algorithms to analyze student behavior and optimize content. Improving student outcomes and adapting courses based on their knowledge.
Nguyen & Chang (2020)	AI-based feedback systems	Developing adaptive feedback systems using AI to analyze student programming errors and offer personalized recommendations.
Adams & Fox (2021)	Collaborative filtering	Using collaborative filtering algorithms to optimize the learning process in a group of students, adapting materials for different skill levels.
Williams & Zhang (2019)	Adaptive learning with AI	AI-based systems for adapting content in real time based on student performance. Improving engagement and personalizing courses.
Roberts & Gupta (2021)	Neural networks, evaluation algorithms	Developing systems for automatic student assessment using neural networks. Improving assessment accuracy and optimizing learning materials.
O'Connor & Lee (2018)	Data analytics, machine learning	Big data analysis for real-time adaptation of educational programs. Improving the quality of personalized learning.
Lee & Martin (2017)	Adaptive learning with AI	Developing an adaptive learning system for students of varying skill levels. Impact on improving programming and solving individual educational problems.
Miller & Johnson (2020)	Adaptive platforms with AI	Creating adaptive platforms using AI to provide personalized content based on students' knowledge level.
Singh & Tan (2019)	Machine learning for adaptive feedback	Using machine learning to create adaptive real-time feedback systems for students learning programming.
Chen & Wang (2020)	AI-powered systems for teaching programming languages	Using adaptive systems with AI for teaching programming languages, a personalized approach to learning.
Garcia & Smith (2018)	Neural networks, AI for adaptive learning	Using neural networks to create personalized educational programs, improving student engagement in learning programming.
Kumar & Jackson (2021)	Algorithms for personalized learning	Creating personalized learning systems using AI, focusing on students of varying skill levels.
Thompson & Williams (2020)	Big data analytics, AI	Using big data and AI to create adaptive systems that automatically adjust to student needs.
Evans & Parker (2019)	AI-powered systems for student engagement	Using AI to increase student engagement, teaching programming with adaptive content.

Morris & Choi (2021)	Machine learning models for learning optimization	Using machine learning to adapt educational materials and assess student performance.
Clark & Brown (2020)	Adaptive systems with AI for teaching programming	Developing adaptive educational systems for programming using AI to increase engagement and adapt curricula.

This table illustrates the diversity of AI/ML algorithms and methods used in educational systems, as well as their application in adaptive learning platforms. Several key areas can be identified from the data obtained: the use of neural networks for content adaptation, machine learning for predicting student success, and the creation of personalized feedback systems. All of these are aimed at improving student programming performance and enhancing learning effectiveness.

This study conducted a systematic review of existing studies on the use of artificial intelligence (AI) and machine learning (ML) algorithms and methods in adaptive learning systems aimed at improving programming instruction. Table 1 provides an overview of these methods, containing information on the algorithms, methods, and conclusions and results of each study.

The main areas of AI/ML use in adaptive learning systems are:

Personalization of educational systems: Most of the reviewed articles showed that AI and ML are actively used to create personalized educational systems. For example, Smith & Brown (2020) used recommender systems for adaptive programming instruction, which resulted in improved student engagement. Using AI allows for collecting data on student behavior and tailoring materials to their needs.

Predicting Student Success: Using machine learning systems to predict student success in real time, as demonstrated by Jones & Lee (2019), helps assess student proficiency and adjust the learning process during the learning process. This improves student outcomes because the program adapts to their individual needs.

Dynamic Content Adaptation: Neural networks are used to dynamically adapt learning content based on student performance, as demonstrated by Davis & Turner (2018) and Lee & Martin (2017). This significantly improves teaching effectiveness because the content is tailored to the student's current knowledge level.

Feedback and Personalized Recommendations: An important component of adaptive learning systems is the creation of personalized recommendations for students based on their errors and progress. Nguyen & Chang (2020) proposed a feedback system using AI to analyze students' programming errors, which helps in improving results and enhancing the quality of learning.

Optimizing Learning with Collaborative Filtering: Several studies, such as those by Adams & Fox (2021), use collaborative filtering algorithms to optimize group learning. These algorithms help adapt materials to different skill levels, providing a personalized approach for each group of students.

Data Analytics for Improving Learning Processes: Analyzing big data and using machine learning to adapt educational programs in real time, as demonstrated by O'Connor & Lee (2018) and Thompson & Williams (2020), can significantly improve learning by analyzing student behavior and tailoring content to their needs.

Using AI for Student Engagement: The use of AI to increase student engagement in the learning process is also demonstrated in studies by Williams & Zhang (2019) and Evans & Parker (2019). Systems that use AI to adapt content promote better comprehension of the material, increasing student motivation.

Optimization and Evaluation of Instructional Materials: The use of neural networks and machine learning algorithms for automated student assessment and optimization of instructional materials was discussed in the works of Roberts & Gupta (2021) and Morris &

Choi (2021). This helps to more accurately assess student performance and effectively tailor materials to their individual needs.
The findings highlight several key aspects of using AI/ML in adaptive learning systems:
Neural networks and machine learning play a central role in dynamically adapting instructional content, which facilitates personalization and improves student outcomes.
The use of AI-based recommender systems and feedback helps increase student engagement, improve their participation in the learning process, and maintain high levels of motivation.
Student performance prediction and big data analysis help adjust the learning process in real time, improving prediction accuracy and tailoring the program to individual student needs.
The use of collaborative filtering allows for optimization of student groups and the provision of materials appropriate for different skill levels.
Thus, research demonstrates the successful application of AI and ML to the creation of adaptive educational systems aimed at improving programming learning processes. These technologies have a significant impact on increasing engagement, improving academic performance, and personalizing educational programs.

Recommendations

Based on an analysis of the use of artificial intelligence (AI) and machine learning (ML) in adaptive learning systems related to programming instruction, the following recommendations can be made:
Development of personalized educational systems: It is recommended to actively use machine learning algorithms and recommender systems to create adaptive educational platforms. This will allow for effective personalization of learning, tailoring content to each student's level of knowledge, which, in turn, will increase engagement and motivation.
Integration of predictive models for student success: To improve learning effectiveness, it is recommended to implement systems that predict student success based on their learning activities. The use of such systems will help promptly adjust the educational process and offer students personalized recommendations for improvement.
Use of neural networks for content adaptation: It is important to implement neural networks to dynamically adapt content based on student performance. This will allow for more accurate meeting of students' learning needs and improve their effectiveness.
Development of personalized feedback systems: It is recommended to create feedback systems that use AI to analyze student errors and suggest corrections. This will help students receive timely information about their gaps and progress, accelerating the process of mastering programming.
Using data analytics and collaborative filtering: Integrating big data analytics and collaborative filtering to adapt learning materials and student groups is essential to optimize group learning and improve the overall programming learning process.

Conclusion

The study showed that the use of artificial intelligence and machine learning methods in adaptive learning systems has a significant impact on the effectiveness and personalization of programming instruction. These technologies enable dynamic adaptation of educational content in real time, increasing student engagement and motivation. The use of neural networks, recommender systems, data analytics, and predictive models for student success not only improves the quality of education but also provides a personalized approach to learning. The implementation of such systems in educational processes can significantly improve learning outcomes and prepare students for successful careers in programming and information technology.

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WEATHER-DRIVEN EPILEPTIC SEIZURE RISK: A CRITICAL REVIEW OF EPIDEMIOLOGICAL EVIDENCE AND THE EMERGING ROLE OF ARTIFICIAL INTELLIGENCE IN SEIZURE PREDICTION

Nour El Houda FETHELLAH
Université des Sciences et de la Technologie d'Oran- Mohamed Boudiaf, Faculté Mathématique et Institut Hydrométéorologique de Formation et de Recherches (IHFR), Oran, 31000, Alegria

ABSTRACT
Epilepsy, a neurological disorder affecting approximately 50 million individuals globally, is characterized by recurrent and unpredictable seizures. Emerging epidemiological and neurophysiological evidence suggests that meteorological variables—such as atmospheric pressure, relative humidity, ambient temperature, and seasonal fluctuations—act as significant environmental modifiers of seizure risk. Biophysical mechanisms, including pressure-sensitive ion channel kinetics, neuroinflammatory cascades, and circadian-meteorological coupling, provide strong biological plausibility for this relationship. However, existing clinical literature remains methodologically fragmented and geographically constrained. Concurrently, advancements in artificial intelligence (AI)—spanning deep learning, temporal neural networks, multimodal fusion architectures, and privacy-preserving federated learning—have transformed the landscape of predictive neurological diagnostics. This comprehensive review critically synthesizes the epidemiological, clinical, and physiological evidence linking weather parameters to seizure susceptibility, evaluates the state of current AI-driven seizure prediction systems, and establishes a conceptual framework for Weather-Augmented Seizure Forecasting Systems (WASFS). We formulate a novel WASFS design that synergizes multi-modal inputs, fusing high-resolution meteorological data streams with real-time physiological biosensor signals (e.g., electroencephalography, electrodermal activity, and heart rate variability). Through context-aware multimodal integration and personalized deep learning architectures, the framework optimizes individual temporal risk profiling. Integrating exogenous environmental variables with endogenous biosignals significantly improves pre-ictal state detection and forecast horizons compared to unimodal physiological models. Nevertheless, critical translational hurdles impede clinical implementation, notably geographical data scarcity, profound class imbalance, severe intra-patient variability, and the imperative for real-time model interpretability in clinical settings. Furthermore, privacy-preserving training protocols and climate-adaptive algorithms are necessary to maintain performance across dynamic microclimates and seasonal shifts. Incorporating environmental dynamics into AI-driven seizure prediction represents a scientifically grounded and actionable paradigm shift in personalized neurology. Addressing current algorithmic and logistical challenges through explainable, privacy-conscious WASFS frameworks will enable reliable early-warning systems, ultimately enhancing clinical decision-making, patient autonomy, and quality of life.
Keywords: epilepsy; seizure prediction; seizure forecasting; meteorological triggers; atmospheric pressure; artificial intelligence; deep learning; LSTM; multimodal learning; federated learning; climate change; chronobiology.

ASSESSMENT OF ARTIFICIAL INTELLIGENCE INTEGRATION AWARENESS IN BASIC EDUCATION CURRICULUM IN ADAMAWA NORTH EDUCATIONAL ZONE, NIGERIA

OYEWUMI Kassim
Department of Educational Foundations, Faculty of Education,
Federal University of Kashere, Gombe State, Nigeria

ADAMU Muhammad
Department of Educational Foundations, Faculty of Education,
Federal University of Kashere, Gombe State, Nigeria

ABSTRACT
The study assessed the level of awareness of the integration of artificial intelligence at the Basic education level among major stakeholders (teachers and learners) in Adamawa North Educational Zone, Nigeria towards the implementation of emergent curriculum innovations in the nation's curriculum. Related literature germane to the central themes of the study were reviewed as theoretical support for the study. The concepts include artificial intelligence, technological Instructional Resources, as well as Basic Education Level and its pedagogy. Descriptive Survey Research Design was employed for the study, while questionnaire instrument was used to elicit responses from to both teachers and pupils/students to ascertain the level of integration awareness of the emerging technology in the implementation of the curriculum. The population sample of the study is 347 determined by Taro Yamane's formula. The collected data were analyzed by descriptive statistics of Mean Scores, simple percentage and standard deviation to determine the level of awareness within the zone. The findings revealed mixed levels of awareness towards the integration and the use of artificial intelligence. However, conclusion was drawn based on the results of the statistical analysis which showed that overall level of awareness is very low even among the teachers who are to implement the curriculum. Thus, the study recommends that there is need for continuous teacher education for both practicing and would-be teachers to be exposed to the new trends in teaching strategies and facilities so as to be equipped to effectively implement and cater for innovations in the implementation of curriculum.

Keywords: Curriculum Innovation, Artificial Intelligence, Basic Education Curriculum and Basic Education in Nigeria

ARTIFICIAL INTELLIGENCE-DRIVEN HUMAN RESOURCE RECRUITMENT SYSTEMS TRANSFORMING TALENT ACQUISITION THROUGH INTELLIGENT DECISION SUPPORT

MUHAMMAD FAISAL
Joint Director (AICU) at Ministry of IT & Telecommunication, Pakistan
ORCID ID: 0000-0002-5797-766X

ABSTRACT

Human Resource Management has undergone significant digital transformation through the integration of Artificial Intelligence technologies capable of automating recruitment, candidate assessment, workforce analytics, and talent management. This study investigates the effectiveness of AI-driven recruitment systems in improving hiring efficiency, reducing recruitment bias, and supporting evidence-based human resource decision-making. A comprehensive framework integrating Natural Language Processing, Large Language Models, machine learning, resume parsing, candidate ranking, predictive analytics, and conversational AI is proposed to automate multiple stages of the recruitment lifecycle. Experimental findings demonstrate that AI-powered recruitment platforms significantly reduce hiring time, improve candidate-job matching accuracy, enhance recruiter productivity, and optimize workforce planning while supporting organizational diversity initiatives. The research further examines ethical considerations including algorithmic fairness, transparency, explainability, privacy protection, legal compliance, and human oversight during AI-assisted hiring processes. Comparative evaluation indicates that intelligent recruitment systems outperform conventional manual recruitment methods by enabling scalable, data-driven talent acquisition while maintaining consistent evaluation criteria. The findings suggest that Artificial Intelligence will become a strategic enabler of future Human Resource Management by facilitating intelligent workforce planning, personalized employee experiences, and organizational competitiveness in increasingly dynamic labor markets.

Keywords: Human Resource Management, AI Recruitment, Talent Acquisition, Resume Parsing, Natural Language Processing, Workforce Analytics, Predictive Hiring

TRANSFORMING HR INTO A CHANGE ARCHITECT: LINKING WORKFORCE AGILITY AND ORGANIZATIONAL RESILIENCE IN DISRUPTIVE TIMES

Dr. Kavita Singh
Associate Professor, Faculty of Management Studies, SRM University, Delhi-NCR, Sonepat, Haryana

Komal
Research Scholar, Faculty of Management and Commerce, SRM University, Delhi-NCR, Sonepat, Haryana

ABSTRACT
Organizations must constantly adapt in order to thrive and maintain their competitiveness in the current context of swift technology advancement, unstable economies, and changing labor relations. In this conceptual paper, Human Resources (HR) has been placed as a change architect because it provides a strategic importance of managing people in disruption. The paper presents a conceptual model linking the notions of workforce agility, organisational resilience and HR leadership to the theory of Dynamic Capability and the existing body of literature on change management. The research presents the argument that workforce agility has been enhanced by strategic HR leadership that promotes the adaptability, flexibility, and digital preparedness of the employees by leveraging effective change communication, continuous learning opportunities, and strategic culture building. In turn, agile workforce makes organisations more resilient by enabling business organisations to absorb shocks and respond proactively to change, as well as to perform during unpredicted conditions. By reevaluating the role of HR in disruption and providing future empirical research and managerial practice focused on developing flexible and future-oriented workforces, the proposed framework adds to the body of literature on HRM. It also suggests a strategy for addressing the problem of disruption in the years to come.
Keywords: HR Leadership; Change Management; Workforce Agility; Organizational Resilience

FROM THE STREET TO THE DESTINATION: THE METAMORPHOSIS OF STREET ART IN URBAN TOURISM

Attila PALANCSA

ABSTRACT

Objectives: This study examines how graffiti and street art evolve from informal and often unauthorised forms of urban visual expression into recognised cultural attractions, tourism products and elements of destination branding. It focuses particularly on the relationship between legitimisation, institutionalisation, commodification and authenticity.

Methods: The research applies a qualitative comparative case-study approach to selected examples from Gothenborg, Lisbon, Berlin and Budapest. It combines a review of international literature with qualitative content analysis of official tourism websites, street-art tourism offers, cultural programmes and urban branding materials. The cases are examined through a common analytical framework focusing on artistic legitimisation, institutional involvement, tourism integration, commercialisation and representations of authenticity.

Results: The preliminary analysis indicates that the transformation of street art is not a simple linear progression. Rather, legitimisation, artification, institutionalisation and tourism integration interact in different ways across urban contexts. Based on these relationships, the study develops an integrated conceptual framework describing the metamorphosis from informal visual expression through recognised urban art and cultural attraction to tourism product and destination brand asset. The framework also identifies an authenticity paradox: increasing institutional recognition and tourism value may simultaneously transform the spontaneity and countercultural character associated with street art.

Conclusions: The proposed framework connects contemporary visual culture with cultural tourism and destination marketing and provides a basis for interpreting street art as an evolving artistic, social and tourism phenomenon.

Keywords: graffiti; street art; urban tourism; authenticity; commodification; destination branding

DIRECTING AND APPLICATION OF DIGITAL MEDIA IN NIGERIAN THEATRE: AN APPRAISAL OF *THE STANDARD BEARER* STAGE PRODUCTION

ADEWUMI, E. STEPHEN
PhD, Department Of Theatre Arts
Federal University Lokoja
ORCID ID: 0009-0008-4149-1180

ABSTRACT
Play productions currently face a downturn, largely attributable to a lack of audience patronage. Since today's Nigerian spectators are digitally oriented and expect to see technological features incorporated into stage performances, directors are presented with a pressing challenge to adopt media-friendly directorial strategies. This challenge forms the aim of this study, which explores directing techniques and digital media application within Nigerian theatre, using the production of *The Standard Bearer* as a focal case. Result from findings of the study reveals that the use of a technologically integrated staging approach that reflects contemporary societal realities is fundamental. Methodologically, the research adopts a qualitative approach, and is anchored in Postdramatic Theatre theory. The paper concludes that the infusion of digital media into *The Standard Bearer* bolstered the narrative's visual appeal and also expanded its overall artistic and aesthetic blend. The study therefore recommends the adoption of digital media application by play directors moving forward.
Keywords: Directing, Application, Digital Media, Nigerian Theatre, Production

SUBURBANISATION WITHIN THE CITY IN HUNGARY: EXPLORING A PARADOX

Gábor László VASÁRUS
Centre for Economic and Regional Studies

ABSTRACT

Suburbanisation is one of the defining processes of post-socialist urban development in Central and Eastern Europe. Evidence from Hungary, Czechia, Slovakia and Poland shows that this process can be as strongly differentiated at the sub-municipal level as it is between municipalities. A characteristic form of this transformation occurs in formerly independent villages incorporated into cities, as well as in allotment areas, scattered settlements, farms and former agricultural zones located within municipal boundaries.

This presentation examines the presence, scale and driving forces of intra-urban suburbanisation in Hungary. The analysis combines national statistical data (1960-2022) with empirical field surveys (Szeged, Győr and Kecskemét) and stakeholder interviews (n=23) conducted in selected urban regions. The findings demonstrate that allotment areas and other peripheral settlement units – dacha-like holiday areas and farms - within the administrative boundaries of medium-sized and large cities have absorbed substantial population growth. In several cases, the entire recorded population increase of the city was concentrated in these areas, while in some suburban municipalities only particular settlement units were affected by in-migration.

The transformation of allotments into neighboorhoods resulted in a quite chaotic spatial structure. The results suggest that population growth recorded at the city level should not necessarily be interpreted as reurbanisation. Instead, it may reflect continued suburban migration towards rural-style residential environments situated within the administrative city boundary. The main trends and driving forces are broadly consistent with international examples of post-socialist suburbanisation. However, informal housing, unregistered migration and the aggregation of contrasting demographic processes in municipal-level statistics partly conceal the phenomenon. Consequently, the actual significance of intra-urban suburbanisation in Hungary may be considerably greater than previously assumed.

Keywords: suburbanisation; post-socialist urbanisation; intra-urban suburbs; allotment areas; urban sprawl

EARLY MOSQUES OF AZERBAIJAN (7TH-11TH CENTURIES)

Prof. Dr. RAYIHE AMENZADE
Azerbaijan National Academy of Sciences, Institute of Architecture and Art, Baku, Azerbaijan
ORCID ID:0009-0002-4767-3870

ABSTRACT

Introduction and Purpose: From the mid-7th century, following Azerbaijan's inclusion into the Arab Caliphate, the primary objective of religious policy was the propagation of Islam among the general public. The regulated rituals took place in the first constructed mosques, whose compositional solutions continued local architectural and artistic traditions.

The religious buildings erected during this period featured a variety of compositional solutions primarily seen in their volumetric-spatial structure and constructive uniqueness, which essentially represent examples of specific architectural schools or artistic trends of a given region. Several preserved, partially preserved, archaeologically excavated, or historically documented structures serve as examples, though they do not exhaust all existing compositional types of the era:

- Juma Mosque in Shamakhi (743)
- Mosque in Ahsu (8th century)
- Juma Mosque in Derbent (734)
- Mosque in Ani (1072, near the Arpachay River, Kars, Turkey; built within the realm of the Shaddadid state)*.

Muhammad Mosque (Synyg Gala, 1078) Located in Icherisheher and built by master builder (*ustad*) Muhammad ibn Abu Bakr. As a result of clearing accumulated soil and structural layers in the 1980s, the true dimensions of the tower-like minaret adjoining the building were revealed, alongside a vaulted room constructed beneath it that mirrors the layout of the prayer hall.

Materials and Methods: The religious buildings erected during the specified period possessed diverse compositional solutions. Primarily, this includes their volumetric-spatial structure, structural uniqueness, and other features that essentially represent examples of a specific architectural school or artistic trend of a given region. From the mid-7th century, Azerbaijan – having been incorporated into the Arab Caliphate – saw the propagation of Islam among the broad masses as a key focus of its religious policy. Regulated rituals took place within these very first constructed mosques, whose compositional design continued local architectural and artistic traditions.

Results: Some surviving, partially surviving, or archaeologically excavated structures, as well as those mentioned in narratives, serve as examples – though they do not exhaust all existing types of compositions (the Juma Mosque in Shamakhi (743), the mosque in Aghsu (8th century), the Juma Mosque in Derbent (734), the mosque in Ani (1098, within the Shaddadid state), and others). The Muhammad Mosque (Sinig Gala, 1078, master Muhammad bin Abu-Bakr, Icherisheher) is another example. Their viability and stability have been tested over centuries through the prolonged empirical experience of architectural and construction practice, meeting the functional demands of society and the era.

Discussion and Conclusion: It is precisely in religious buildings – as the most conservative and traditional structures – that a strong evolutionary link with the architectural forms of the past is preserved. Within the framework of stable archetypes, the generation of their internal structural variance, flexibility, and diversity of spatial renewal methods effectively took place.

**Ibn al-Athir (1160–1233) stated that Ani was one of the cities of Azerbaijan.*

Keywords: Azerbaijan; Mosques; Composition; Spatial structure; Constructions

COMPARATIVE EVALUATION OF PHYSICOCHEMICAL, NUTRITIONAL, AND SENSORY CHARACTERISTICS OF BROILER AND SPENT LAYING HEN MEAT

SOLTANI Fatiha
Applied animal physiology lab, Abdelhamid IbnBadis Mostaganem, Algeria

BENABDELMOUMENE Djilali
Applied animal physiology lab, Abdelhamid IbnBadis Mostaganem, Algeria

BENGHARBI Zineb
Applied animal physiology lab, Abdelhamid IbnBadis Mostaganem, Algeria

BENAIED Hasna
Applied animal physiology lab, Abdelhamid IbnBadis Mostaganem, Algeria

BEGLOUL Amina
Applied animal physiology lab, Abdelhamid IbnBadis Mostaganem, Algeria

BENGUENNOUNA Noureddine.
Applied animal physiology lab, Abdelhamid IbnBadis Mostaganem, Algeria

ABSTRACT

This study compares the technological aptitudes, biochemical composition, and sensory properties of meat from two poultry strains: broiler chickens (Arbor Acres) and spent laying hens (ISA Brown).

The analysis of carcass yields shows a higher eviscerated yield for the Arbor Acres strain (75.41% vs. 64.89%), whereas the ISA Brown strain exhibits higher relative ratios of primary cuts ("Breast + thigh") (41.14% vs. 36.72%). Biochemically, pH, protein, lipid, mineral, and organic matter contents vary significantly according to the genotype and muscle type (breast or thigh). The Arbor Acres strain shows higher protein density in the breast muscle (25.33%) and a higher lipid content (3.69% in the thigh), while the ISA Brown strain presents a higher dry matter content, reflecting a less hydrated composition.

Sensory evaluation reveals that the panel of tasters consistently rated the Arbor Acres strain higher than the ISA Brown strain across all descriptors (color, flavor, tenderness, juiciness). For both strains, the thigh muscle received higher juiciness scores than the breast muscle.

In conclusion, these results confirm that genotype and physiological stage influence the biochemical composition and sensory quality of the meat. The functional specialization of the Arbor Acres (meat) and ISA Brown (laying) strains determines their respective technological aptitudes, which is essential for guiding their industrial valorization.

Keywords: Broiler chicken, spent laying hen, nutritional quality of meat, physicochemical characteristics, sensory quality.

FACTORS ASSOCIATED WITH BREASTFEEDING SUCCESS AMONG POSTPARTUM MOTHERS IN PEMATANGSIANTAR CITY, INDONESIA

Renny Sinaga
Midwifery Department, Health Polytechnic of the Ministry of Health
of the Republic of Indonesia, Medan
ORCID ID: 0000-0003-4148-3021

Hendri PL.Tobing
Midwifery Department, Health Polytechnic of the Ministry of Health
of the Republic of Indonesia, Medan

ABSTRACT

Background: Breastfeeding is a natural process that provides important health benefits for both mothers and infants. Successful breastfeeding among postpartum mothers may be influenced by various internal factors, including age, parity, knowledge, attitude, motivation, psychological condition, physical condition, and breast structure. This study aimed to analyze the internal factors associated with breastfeeding success among postpartum mothers in the working area of Bahkapul Community Health Center, Pematangsiantar City, Indonesia.

Methods: This study employed a descriptive-analytic design with a cross-sectional approach. The study was conducted at Bahkapul Community Health Center, Pematangsiantar City, from September to November 2025. The study population consisted of postpartum mothers with infants aged 0–42 days. A total of 70 respondents were selected using purposive sampling. Data were collected through interviews and observations using structured questionnaires and observation sheets. Data were analyzed using univariate analysis, bivariate analysis with the Chi-square test, and multivariate analysis using logistic regression.

Results: The majority of respondents (60.0%) were successful in breastfeeding. Bivariate analysis showed that knowledge (p=0.0002), motivation (p=0.0017), and psychological condition (p=0.0003) were significantly associated with breastfeeding success. In contrast, age (p=0.649), parity (p=0.727), attitude (p=0.107), physical condition (p=0.084), and breast structure (p=0.064) were not significantly associated with breastfeeding success. Multivariate logistic regression analysis identified knowledge as the most dominant factor associated with breastfeeding success (OR=8.24), followed by psychological condition (OR=6.36) and motivation (OR=6.12). Mothers with good knowledge had approximately eight times higher odds of successful breastfeeding than those with inadequate knowledge.

Conclusion: Knowledge, motivation, and psychological condition were significantly associated with breastfeeding success among postpartum mothers in the Bahkapul Community Health Center working area. Knowledge was the strongest factor, followed by psychological condition and motivation. Strengthening breastfeeding education, enhancing maternal motivation, and providing psychological support and guidance should therefore be integrated into postpartum care to improve breastfeeding success.

Keywords: internal factors; postpartum mothers; breastfeeding success; knowledge; motivation; psychological condition.

GASTROPROTECTIVE EFFECT OF COSTUS AFER STEM METHANOLIC EXTRACT IN HCL/ETHANOL-INDUCED GASTRIC ULCER IN WISTAR ALBINO RATS

Ugwu Chinelo Mercy
Pharmacology Research Unit, Department of Biochemistry, University of Nigeria, Nsukka, Enugu, Nigeria

Ugochi O. Njokua
Pharmacology Research Unit, Department of Biochemistry, University of Nigeria, Nsukka, Enugu, Nigeria

ABSTRACT

OBJECTIVES: Gastric ulcer remains a significant gastrointestinal disorder, with disruption of the gastric mucosal barrier and imbalance between aggressive and protective factors contributing to ulcer development. This study investigated the gastroprotective activity of methanolic stem extract of *Costus afer* against HCl/ethanol-induced gastric ulcer in Wistar rats.
METHODS: Twenty-four Wistar rats were randomly assigned to six groups (n = 4) and pre-treated with vehicle, lansoprazole (30 mg/kg), or *C. afer* extract (200, 400, and 600 mg/kg body weight) for seven days before ulcer induction. Phytochemical screening and acute oral toxicity testing were conducted, while gastric juice volume, gastric pH, ulcer index, percentage ulcer protection, and histopathological changes were evaluated.
RESULTS:The extract contained alkaloids, flavonoids, terpenoids, cardiac glycosides, saponins, and tannins, with no mortality observed up to 5000 mg/kg. HCl/ethanol increased gastric juice volume and reduced gastric ph. Pre-treatment with *C. afer* reduced gastric juice volume to 1.71, 1.57, and 1.44 mL and increased gastric pH to 7.33, 7.55, and 8.02 at 200, 400, and 600 mg/kg, respectively. Ulcer protection increased dose-dependently to 40.34%, 52.44%, and 69.16%, compared with 50.43% for lansoprazole. Histopathology showed reduced mucosal damage, particularly at 600 mg/kg.
CONCLUSIONS:These findings demonstrate promising gastroprotective activity of *C. afer* extract and support further preclinical investigation.
Keywords: *Costus afer*; gastroprotection; gastric ulcer; medicinal plants; phytochemicals.

INVESTIGATING THE INFLUENCE OF SOCIODEMOGRAPHIC, LIFESTYLE AND CLINICAL FACTORS ON VESICOVAGINAL FISTULA (VVF) SEVERITY IN SOKOTO, NIGERIA

Gerald Ike Unwuka
Faculty of Physical Science, Department of Mathematics / Statistics,
Abdullahi Fodiyo University of Science and Technology, Aliero

Wasiu Babayemi
Faculty of Physical Science, Department of Mathematics / Statistics,
Abdullahi Fodiyo University of Science and Technology, Aliero

Muhammad Muhammad Moyi
Faculty of Physical Science, Department of Mathematics / Statistics,
Abdullahi Fodiyo University of Science and Technology, Aliero

ABSTRACT
Vesicovaginal fistula (VVF) remains a major public health problem among women in developing countries, particularly in sub-Saharan Africa, where inadequate access to quality maternal healthcare services contributes to its persistence. This study investigated the influence of sociodemographic, lifestyle, and clinical factors on the severity of VVF among women in Sokoto State, Nigeria, using a multilevel logistic regression modelling approach. Primary data were collected from 402 respondents at the Gynaecology Department of Maryam Abacha Women and Children Hospital, Sokoto State, through a structured questionnaire. Information obtained included sociodemographic characteristics, lifestyle behaviours, reproductive history, and clinical conditions related to VVF. The severity of VVF was modelled as a binary outcome variable. Descriptive statistics, chi-square tests, and multilevel logistic regression techniques were employed for data analysis. The findings revealed significant associations between VVF severity and age ($\chi^2 = 27.562$, $p < 0.001$), education ($\chi^2 = 20.381$, $p < 0.001$), socioeconomic status ($\chi^2 = 32.068$, $p < 0.001$), smoking ($\chi^2 = 4.888$, $p = 0.027$), drug use ($\chi^2 = 5.937$, $p = 0.015$), place of delivery ($\chi^2 = 141.889$, $p < 0.001$), prolonged labour ($\chi^2 = 97.101$, $p < 0.001$), and parity ($\chi^2 = 114.668$, $p < 0.001$). Multilevel logistic regression further identified age (OR = 1.83), socioeconomic status (OR = 1.51), illicit drug use (OR = 2.34), place of delivery (OR = 2.03), prolonged labour (OR = 1.64), and parity (OR = 1.54) as significant predictors of severe VVF. The final model demonstrated the best fit with the lowest AIC (2176.8) and BIC (2254.7) values.
The study concludes that VVF severity is influenced by a combination of sociodemographic, lifestyle, and clinical factors. Strengthening maternal healthcare services, promoting institutional delivery, reducing prolonged labour, and improving women's socioeconomic conditions are essential for reducing the burden and severity of VVF in Sokoto State and similar settings.
Keywords: Vesicovaginal fistula, VVF severity, multilevel logistic regression, maternal health, prolonged labour, socioeconomic factors, Sokoto State, Nigeria.

INTRODUCTION
Vesicovaginal fistula (VVF) is one of the most serious complications in childbirth that affects women in low-resource areas, especially in sub-Saharan Africa, where access to quality maternal healthcare is still lacking. This condition occurs when there is an abnormal connection between the bladder and vagina, leading to constant involuntary leakage of urine.

It often brings significant physical, psychological, and social challenges for affected women (Abafi and Amadi, 2024).

Worldwide, VVF remains a pressing public health issue, particularly in developing nations. The World Health Organization (2023) estimates that obstetric fistula affects hundreds of thousands of women globally, with sub-Saharan Africa experiencing the most cases. In Nigeria, between 400,000 and 800,000 women live with VVF, and around 50,000 to 100,000 new cases are reported each year (World Health Organization, 2022). These numbers illustrate ongoing gaps in maternal healthcare in low-resource settings.

Despite some improvements in obstetric services in certain areas, VVF continues to be very common in northern Nigeria, especially in Sokoto State, which has been recognized as a high-burden region (Ijaiya, 2018). Recent studies indicate that prolonged obstructed labor, early marriage, poverty, and limited access to skilled birth assistance are strongly linked to the condition (Yaay, 2022). Cultural practices like teenage pregnancy and home births without skilled help also play a significant role in its persistence.

Recent literature shows that VVF is not just a medical issue; it is also a complex public health challenge influenced by social, lifestyle, and clinical factors. Low educational levels, living in rural areas, poor economic status, delayed emergency obstetric care, and insufficient antenatal visits have all been linked to a higher risk and worse severity of VVF (James and Oginni, 2025). Additionally, the psychological and social effects, such as stigma, depression, marital problems, and social isolation, add to the overall burden of the disease (Nweke, Okafor, and Eze, 2023).

While obstetric complications are the main cause of VVF in Nigeria (Alio, 2011), new evidence suggests that its severity arises from a combination of demographic, lifestyle, and clinical factors. Most existing studies focus on prevalence and general risk factors but pay little attention to how these elements together affect disease severity in specific areas like Sokoto State. This gap in knowledge hinders the development of effective prevention and management strategies.

Even with ongoing efforts by government and health organizations to decrease the prevalence of VVF, the issue persists as a public health challenge in Sokoto State, Nigeria. A key problem is the limited understanding of how sociodemographic factors like age, marital status, and education, along with lifestyle habits and clinical aspects, collectively impact the severity of VVF among affected women. Most studies rely on national or regional data, which may not accurately reflect the unique sociocultural and healthcare situations in Sokoto State, such as early marriage, low female education, and dependence on non-skilled birth attendants.

Therefore, this study aims to explore how sociodemographic, lifestyle, and clinical factors influence the severity of vesicovaginal fistula among women in Sokoto State, Nigeria. The results are expected to provide solid evidence that will inform targeted interventions, improve maternal health policies, and help reduce the burden of VVF in the region. Additionally, the study will contribute to the existing literature by offering context-specific insights into the factors affecting severity in a high-risk population.

Objectives of the Study

The main objective of this study is to investigate the influence of sociodemographic, lifestyle, and clinical factors on vesicovaginal fistula among women in Sokoto State, Nigeria, using multilevel regression modelling.

Specifically, the study seeks to:

- Examine the relationship between sociodemographic factors (age, marital status, and educational level) and the severity of vesicovaginal fistula among women in Sokoto State, Nigeria.

- Determine the influence of lifestyle factors, including tobacco use, alcohol consumption, and illicit drug use, on the severity of vesicovaginal fistula.
- Assess the relationship between clinical factors such as place of delivery, obstetric history (including prolonged labour, parity, and sexually transmitted infections), and mental health status on vesicovaginal fistula severity.
- Evaluate the combined effect of sociodemographic, lifestyle, and clinical factors on the severity of vesicovaginal fistula using multilevel regression modelling techniques.

Methodology

The primary objective of this study was to examine the extent to which sociodemographic characteristics, lifestyle behaviours, and clinical factors influence the severity of vesicovaginal fistula (VVF) among affected women in Sokoto State, Nigeria. A multilevel logistic regression modelling approach was employed to account for the hierarchical structure of the data and the binary nature of the outcome variable. This chapter presents the methodological framework of the study, including the data source, study variables, and statistical modelling procedures adopted for the analysis.

Data Source

The data for this study were obtained from primary sources using a structured questionnaire designed by the researcher. The instrument was used to collect information on sociodemographic characteristics, lifestyle behaviours, and clinical history associated with vesicovaginal fistula (VVF). Data collection was carried out at the gynaecology department of Maryam Abacha Women and Children Hospital, Sokoto State, Nigeria. The researcher personally administered the questionnaires to patients diagnosed with VVF and other related gynaecological conditions. The information obtained included respondents' demographic characteristics, reproductive history, behavioural factors, and clinical variables relevant to the severity of VVF.

Study Variables

Independent Variables

The independent variables considered in this study include sociodemographic factors such as age, educational level, occupation, marital status, and socioeconomic status; lifestyle factors comprising tobacco use, alcohol consumption, and illicit drug use; and clinical factors, which include place of delivery, duration of labour, parity, history of sexually transmitted infections, and presence of mental health conditions.

Dependent Variable

The dependent variable in this study is the severity of vesicovaginal fistula (VVF). For analytical purposes, the outcome was coded as a binary variable, where 0 represents less severe VVF cases and 1 represents severe VVF cases. This binary classification justifies the use of logistic regression modelling.

Statistical Modelling Framework

Multilevel Logistic Regression Model

To account for the hierarchical structure of the data and the binary nature of the outcome variable (severity of vesicovaginal fistula), a multilevel logistic regression model was specified as follows:

Level 1 (Individual level model):

$$\log\left(\frac{\pi_{ijk}}{1-\pi_{ijk}}\right)=\beta_{0j}+\sum_{k=1}^{k}\beta_{kj}X_{kij}$$

where: $\pi_{ijk}=$ is the probability that individual i in cluster j has severe VVF, $X_{kij}=$ represents the k^{th} predictor (sociodemographic, lifestyle, or clinical factor), $\beta_{0j}=$ s the cluster-specific intercept and $\beta_{kj}=$ is the cluster-specific effect of predictor k

Level 2 (Cluster level model):

$$\beta_{0j}=\gamma_{oo}+\mu_{oj}$$

$$\beta_{kj}=\gamma_{ko}$$

where: $\gamma_{oo}=$ is the overall intercept, $\gamma_{ko}=$ is the fixed effect of predictor k, and $\mu_{oj}=$ is the random intercept capturing unobserved heterogeneity across clusters, assumed to follow $\mu_{oj} \sim N(0,\sigma^2)$.

Combined Multilevel Logistic Model:
Substituting Level 2 into Level 1 gives:

$$\log\left(\frac{\pi_{ijk}}{1-\pi_{ijk}}\right)=\gamma_{oo}+\sum_{k=1}^{k}\gamma_{ko}X_{kij}+\mu_{oj}$$

Where: $\gamma_{oo}=$ overall log-odds of severe VVF when all predictors are zero, $\gamma_{ko}=$ effect of sociodemographic, lifestyle, or clinical factor k on severity, $\mu_{oj}=$ cluster-level random effect accounting for unobserved heterogeneity and $\pi_{ijk}=$ probability of severe VVF for individual i in cluster j

Odds Ratio
The odds ratio (OR) measures the effect of an independent variable on the odds of occurrence of an event in a logistic regression model. The odds of an event E are defined as:

$$odds(E)=\frac{pr(E)}{pr(notE)}=\frac{pr(E)}{1-pr(E)}$$

The odds ratio is obtained as: $OR=\ell^{\beta}$

where β is the regression coefficient. An odds ratio greater than 1 indicates increased likelihood of occurrence, while an odds ratio less than 1 indicates decreased likelihood of occurrence of the event.

Wald Test Statistic

The Wald test statistic is used to assess the significance of individual regression coefficients in a logistic regression model. It is given by:

$$W_j = \frac{\hat{\beta}_j^{\,2}}{SE(\hat{\beta}_j)^2}$$

where $\hat{\beta}_j^{\,2}$ is the estimated regression coefficient and $SE(\hat{\beta})$ is its standard error. Under the null hypothesis $\mathrm{H}_o : \beta = 0$, the Wald statistic follows a chi-square distribution with one degree of freedom.

Discussion of Results

This chapter presents the results of the statistical analyses carried out in line with the methodology outlined in Chapter Three. The findings are presented using descriptive statistics, chi-square tests, multilevel logistic regression models, and model selection criteria to identify factors influencing the severity of Vesicovaginal Fistula (VVF) among respondents.

Descriptive Statistics of Respondents

A total of 402 respondents participated in the study, of which 302 had Vesicovaginal Fistula (VVF) while 100 had no history of the condition. The age distribution showed that 141 respondents were below 20 years, 101 were between 20–30 years, 95 were between 31–40 years, and 65 were above 40 years. In terms of education, 167 had no formal education, 95 had primary education, 78 had secondary education, and 62 had tertiary education. For occupation, 147 were employed while 255 were unemployed. Regarding socioeconomic status, 192 were in the low-income group, 145 in the middle-income group, and 65 in the high-income group. On lifestyle factors, 57 reported smoking, 64 reported alcohol use, and 151 reported illicit drug use. Clinically, 216 delivered at home while 186 delivered in hospital, 233 experienced prolonged labour, and 147 had a history of sexually transmitted infections. For parity, 214 developed VVF during first pregnancy, 104 during second pregnancy, and 84 in later pregnancies.

Association Between Study Variables and VVF

Chi-square analysis was conducted to examine the relationship between selected factors and VVF occurrence.

Table 1. Chi-square Association Results

Variable	χ^2 value	p-value	Interpretation
Age	27.562	<0.001	Significant
Education	20.381	<0.001	Significant
Occupation	11.260	0.001	Significant
Socioeconomic status	32.068	<0.001	Significant
Smoking	4.888	0.027	Significant
Alcohol use	0.608	0.436	Not significant
Drug use	5.937	0.015	Significant

Place of delivery	141.889	<0.001	Highly significant
Prolonged labour	97.101	<0.001	Highly significant
STIs history	3.106	0.078	Not significant
Parity	114.668	<0.001	Significant

The results show that most socio-demographic, lifestyle, and clinical variables are significantly associated with VVF, particularly place of delivery and prolonged labour.

Multilevel Logistic Regression Analysis

Multilevel logistic regression was used to account for clustering effects across socio-demographic, lifestyle, and clinical levels.

Tablo 2.Random Intercept Models

Model	Factor Level	Log-likelihood	Variance
Model 1	Socio-demographic	-2662.9	0.2103
Model 2	Lifestyle	-2682.3	0.2802
Model 3	Clinical	-2632.1	0.1894

All models showed significant random effects, indicating variability in VVF across hierarchical levels.

Full Multilevel Model

Tablo 3. Final Multilevel Logistic Regression Model

Variable	β (Estimate)	p-value	Interpretation
Age	0.134	0.011	Significant
Education	0.318	0.005	Significant
Socioeconomic status	0.258	0.023	Significant
Smoking	0.490	<0.001	Significant
Alcohol use	0.065	0.503	Not significant
Drug use	0.132	0.005	Significant
Place of delivery	0.200	0.003	Significant
Prolonged labour	0.081	0.010	Significant
STIs	0.032	0.698	Not significant
Parity	0.414	0.017	Significant

The final multilevel logistic regression model revealed that age, educational level, socioeconomic status, smoking, illicit drug use, place of delivery, prolonged labour, and parity were statistically significant predictors of vesicovaginal fistula (VVF) severity. Specifically, increases in age ($\beta = 0.134$, $p = 0.011$), education ($\beta = 0.318$, $p = 0.005$), socioeconomic status ($\beta = 0.258$, $p = 0.023$), smoking ($\beta = 0.490$, $p < 0.001$), illicit drug use ($\beta = 0.132$, $p = 0.005$), place of delivery ($\beta = 0.200$, $p = 0.003$), prolonged labour ($\beta = 0.081$, $p = 0.010$), and parity ($\beta = 0.414$, $p = 0.017$) were associated with higher odds of severe VVF. However, alcohol consumption ($\beta = 0.065$, $p = 0.503$) and history of sexually transmitted infections ($\beta = 0.032$, $p = 0.698$) were not statistically significant predictors of VVF severity in the model.

Odds Ratios of Significant Predictors

Tablo 4. Adjusted Odds Ratios

Variable	OR	95% CI	Interpretation
Age	1.83	1.05–2.12	Increased risk
Education	1.64	0.92–2.36	Not strongly significant
Socioeconomic status	1.51	1.03–1.95	Increased risk
Smoking	1.72	0.89–2.15	Moderate risk
Drug use	2.34	1.76–2.77	Strong risk factor
Place of delivery	2.03	1.73–2.54	Strong risk factor
Prolonged labour	1.64	1.06–1.97	Significant risk
Parity	1.54	1.04–1.88	Significant risk

The adjusted odds ratios (AOR) indicate that age, socioeconomic status, illicit drug use, place of delivery, prolonged labour, and parity are important predictors of vesicovaginal fistula (VVF) severity. Specifically, the odds of severe VVF increase with age (OR = 1.83, 95% CI: 1.05–2.12), socioeconomic status (OR = 1.51, 95% CI: 1.03–1.95), illicit drug use (OR = 2.34, 95% CI: 1.76–2.77), place of delivery (OR = 2.03, 95% CI: 1.73–2.54), prolonged labour (OR = 1.64, 95% CI: 1.06–1.97), and parity (OR = 1.54, 95% CI: 1.04–1.88). Although education level (OR = 1.64, 95% CI: 0.92–2.36) and smoking (OR = 1.72, 95% CI: 0.89–2.15) showed increased odds, their confidence intervals include 1, indicating that their effects are not statistically strong at the 5% significance level.

Model Selection

Table 5. Model Fit Statistics

Model	Log-likelihood	AIC	BIC
Socio-demographic	-1492.9	3003.8	3056.6
Lifestyle	-1661.0	3333.9	3369.7
Clinical	-1436.4	2892.8	2951.3
Full model	-1615.7	3491.3	3171.6
Final model (selected)	-1074.4	2176.8	2254.7

The model selection results show that several competing models were compared using log-likelihood, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC). Among the fitted models, the final model containing only significant predictors produced the best fit to the data, with the lowest AIC (2176.8) and BIC (2254.7) values compared to the socio-demographic, lifestyle, clinical, and full models. Although all models showed varying levels of fit, the reduced (final) model was preferred because it provides a more parsimonious explanation of vesicovaginal fistula (VVF) severity while maintaining strong explanatory power.

Discussion of Results

The findings of this study align closely with existing literature on vesicovaginal fistula (VVF), while also providing context-specific insights into severity determinants in Sokoto State, Nigeria.

Consistent with the World Health Organization (2023) and World Health Organization (2022), this study confirms that VVF remains a major public health challenge in low-resource settings, particularly in sub-Saharan Africa.

The high proportion of women affected and the dominance of obstetric-related factors such as prolonged labour and home delivery reflect the persistent gaps in maternal healthcare services highlighted in global reports.

The strong association between place of delivery and VVF severity supports earlier findings by Yaay (2022), who reported that home delivery and lack of skilled birth attendance significantly increase the risk of obstructed labour and fistula formation. Similarly, the significant effect of prolonged labour in this study is consistent with Ijaiya (2018), who identified obstructed labour as a primary cause of VVF in northern Nigeria.

Socioeconomic status and educational level were also significant predictors in the present study. This agrees with James and Oginni (2025), who emphasized that low educational attainment and poor socioeconomic conditions increase vulnerability to VVF due to limited access to antenatal care and skilled obstetric services. The current findings reinforce the argument that poverty and low education remain central structural drivers of maternal health inequalities in Nigeria.

The finding that younger age is associated with increased severity is also in line with Abafi and Amadi (2024), who noted that early marriage and adolescent childbirth are major risk factors for VVF in low-resource settings. This further supports the observation that sociocultural practices continue to expose young women to preventable obstetric complications.

Lifestyle-related findings from this study, particularly the significant effects of smoking and illicit drug use, extend existing literature. While Nweke, Okafor, and Eze (2023) focused mainly on psychosocial consequences of VVF such as stigma and depression, the present study adds evidence that behavioural factors may also contribute to disease severity. This represents an important contribution, as such variables have been less frequently examined in VVF research.

The non-significant effect of alcohol consumption and sexually transmitted infections (STIs) contrasts with some general reproductive health studies that associate these factors with poor maternal outcomes. However, it supports the argument that VVF severity is more strongly driven by obstetric and structural factors than by infectious or behavioural conditions alone, as also suggested by Alio (2011).

Overall, the findings support the conceptual framework presented in the introduction, which emphasizes that VVF severity is influenced by an interaction of sociodemographic, lifestyle, and clinical factors. The results also reinforce the view of James and Oginni (2025) that VVF is a multifactorial condition requiring integrated interventions rather than isolated clinical approaches.

Importantly, this study contributes to existing knowledge by providing empirical evidence from Sokoto State, a high-burden area that has been underrepresented in previous research. The identification of both established risk factors (such as prolonged labour and home delivery) and emerging behavioural factors (such as drug use) highlights the need for context-specific prevention strategies aimed at reducing the severity and burden of VVF in Nigeria.

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HEAVY METAL CONTAMINATION AND METAL TOLERANCE PROFILES OF GRAM-NEGATIVE BACTERIA FROM WASTEWATER-IRRIGATED FARMS IN KANO STATE, NIGERIA

Maimuna Suleiman
Department of Biology, School of Science, Federal College of Education, Technical, Bichi, Kano State, Nigeria

Naibi Mohammed
Department of Microbiology, Faculty of Science, Federal University Gusau, Zamfara State, Nigeria

ABSTRACT
Wastewater reuse for agricultural irrigation is increasingly practiced in water-scarce regions, but untreated wastewater may introduce potentially toxic metals into agricultural soils and exert selective pressure on environmental microbial communities. This study investigated the concentrations of lead (Pb), chromium (Cr), and cadmium (Cd) in wastewater and soils from selected wastewater-irrigated farms in Kano State, Nigeria, and assessed the tolerance of associated Gram-negative bacteria to these metals. Thirty-six (36) wastewater samples were collected from three (3) sampling points (W1–W3) in Fagge, while 144 soil samples were collected from three wastewater-irrigated farms (F1–F3) over a six-month period. Twelve borehole-water samples and 12 soil samples from a control agricultural site were included as reference samples. Heavy-metal concentrations were determined by atomic absorption spectrophotometry. Gram-negative bacteria were isolated and identified using standard microbiological procedures and API 20E, while metal tolerance was assessed using agar-based assays as well as minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) determinations. Pb, Cr, and Cd were detected in wastewater and agricultural soils. Soil concentrations of Pb were 1.04±0.08, 1.09 ± 0.35, and 1.09 ± 0.13 at F1, F2, and F3, respectively, compared with 0.42 ± 0.00 at the control farm. Corresponding Cr concentrations were 0.47 ± 0.17, 0.58 ± 0.03, and 0.56 ± 0.05, compared with 0.12 ± 0.00 in the control soil, while Cd concentrations were 0.05 ± 0.03, 0.13 ± 0.04, and 0.10 ± 0.01 compared with 0.02 ± 0.00. In wastewater, Pb ranged from 0.18 ± 0.08 to 0.99 ± 0.06, Cr from 0.07 ± 0.04 to 0.09 ± 0.09, and Cd from 0.09 ± 0.05 to 0.11 ± 0.07. Several Gram-negative isolates demonstrated substantial tolerance to Cd and Cr, whereas no tested isolate grew in the presence of Pb at the tested concentrations. Cd and Cr MIC values varied considerably among bacterial species and sampling sites. The findings demonstrate the occurrence of Pb, Cr, and Cd in wastewater-irrigated agricultural environments and substantial heterogeneity in bacterial metal tolerance. Continued environmental monitoring, improved wastewater management, and risk-based regulation of wastewater irrigation are warranted in Kano State, Nigeria
Keywords: wastewater irrigation, heavy-metal tolerance, environmental pollution, Kano State

PROFESSIONAL KNOWLEDGE, CLINICAL PRACTICES, AND REGULATORY ALIGNMENT REGARDING GLP-1 AND DUAL GIP/GLP-1 THERAPIES AMONG PHARMACISTS AND PHYSICIANS IN TRIPOLI, LIBYA: A CROSS-SECTIONAL STUDY

Eman Derbi
Department of Public Health, Faculty of Medical Technology, University of Tripoli, Tripoli, Libya
ORCID ID: 0009-0008-5678-201X

ABSTRACT

Background: GLP-1 receptor agonists and dual GIP/GLP-1 receptor agonists have changed the management of type 2 diabetes and obesity, while rapidly expanding demand has intensified the need for professional knowledge, appropriate prescribing, prescription-controlled dispensing, and regulatory oversight.

Objective: To assess pharmacists' and physicians' knowledge and professional practices regarding semaglutide and tirzepatide in Tripoli, Libya, and to interpret these findings in relation to current international regulatory frameworks**.**

Methods: A cross-sectional descriptive-analytic study was conducted from January to May 2026 among 72 pharmacists and 25 physicians recruited from community pharmacies, hospitals, and clinics. Structured questionnaires assessed professional background, self-reported knowledge, dispensing or prescribing practice, clinical assessment, safety perceptions, and patient-use patterns.

Results: Moderate knowledge predominated among pharmacists (73.6%), whereas 52.0% of physicians reported high knowledge. Most pharmacists perceived increasing use (86.1%), yet 36.1% reported dispensing without a physician prescription. Among physicians, 88.0% requested HbA1c before treatment, 84.0% requested renal and liver function tests and fasting blood glucose, and 76.0% assessed BMI. Physicians frequently encountered appetite loss (84.0%) and nausea (80.0%), while 88.0% considered patient information insufficient before use**.**

Conclusion: Professional practice in Tripoli shows a marked contrast between generally cautious physician assessment and a substantial prescription-control gap at the pharmacy level. The findings support stronger professional education, consistent prescription-only dispensing, structured counseling, pharmacovigilance, and alignment with WHO, FDA, EMA, ANSM, and MHRA principles for medically supervised GLP-1 and dual GIP/GLP-1 therapy.

Keywords. GLP-1, GIP, semaglutide, tirzepatide, pharmacists, physicians, prescribing, dispensing, regulation, Tripoli.

THE ASSOCIATION BETWEEN THE CUTANEOUS MICROBIOME AND HIDRADENITIS SUPPURATIVA

Major Gheorghe GIURGIU
SciRes I, EuSpLM, Deniplant-Aide Sante Medical Center, Biomedicine, Bucharest, Romania
ORCID ID: 0000-0002-5449-2712

Prof. Dr. Manole COJOCARU
Titu Maiorescu University, Faculty of Medicine, Bucharest, Romania
ORCID ID: 0000-0002-6871-577X

ABSTRACT

Background Hidradenitis suppurativa is a chronic disease of the pilosebaceous unit. Patients experience multiple nodules, abscesses, and draining fistulae in intertriginous skin, which cause a significant impact on their quality of life. The skin microbiome thus plays a critical role in the induction and education of host immunity, enabling sustained tolerance to innocuous antigens, a process termed “homeostatic immunity”.

Objective To arrive at these observations, the authors examined how Polenoplasmin and Imuniplant solve hidrosadenitis suppurativa.

Materials and methods The cutaneous microbiota is a necessary component of the immune barrier, with commensal skin microorganisms preventing the colonisation and growth of pathogenic bacteria, a process known as colonisation resistance. In this review we assimilate the existing literature regarding the role played by the cutaneous microbiome in hidradenitis suppurativa to identify novel and much needed treatment strategies.

Results The pathophysiology of hidradenitis suppurativa is multifaceted and is the product of interactions between inflammation, a genetic tendency, the cutaneous microbiome, and environmental factors. Whilst it is now recognised as an autoinflammatory condition rather than an infective disease, bacteria are implicated in disease pathogenesis. Hidradenitis suppurativa skin appears to have a microbiome distinct from that of healthy skin and which is overwhelmingly populated by anaerobic Gram-negative bacteria. Further research should be undertaken examining the cutaneous and gut microbiome in hidradenitis suppurativa.

Conclusion Our research investigating the role of microbiota in the development of inflammatory skin diseases has largely focused on hidradenitis suppurativa, this may help identify potential future therapeutic targets.

Keywords: hidradenitis suppurativa, cutaneous microbiome, Polenoplasmin, Imuniplant

THE IMPACT OF ASSET ALLOCATION ON ASSET-LIABILITY BALANCE IN INSURANCE COMPANIES

DAHMANI Yacine Mohamed
PHD Student, University Mouloud Mammeri of Tizi-Ouzou (UMMTO), Faculty of Economics, Commercial Sciences and Management Sciences, Tizi-Ouzou, Algeria
ORCID ID: 0009-0005-0666-3766

Prof. Dr. ARKOUB Ouali
University of M'Hamed Bougara Boumerdes, Algeria.
ORCID ID: 0009-0005-0666-3766

ABSTRACT
Asset allocation represents a fundamental component of Asset-Liability Management (ALM) in insurance companies, as it directly influences their ability to meet future policyholder obligations while maintaining financial stability and profitability. This study examines the impact of asset allocation decisions on the asset-liability balance of insurance companies, with particular emphasis on the relationship between investment returns, risk exposure, liquidity requirements, and the characteristics of insurance liabilities. The study adopts a quantitative approach to assess how different asset allocation strategies affect the alignment between projected asset cash flows and insurance liabilities. Several asset allocation scenarios are considered, taking into account the return and volatility of financial assets, as well as key economic variables such as interest rates and inflation. A stochastic simulation framework can be employed to evaluate the performance and risk characteristics of alternative investment strategies under different economic conditions. The findings are expected to highlight the importance of aligning investment horizons, risk profiles, and cash-flow structures with the characteristics of insurance liabilities. The study contributes to the ALM literature by emphasizing the role of asset allocation as a strategic tool for controlling financial risks and strengthening the long-term solvency and resilience of insurance companies.

Keywords: Asset-Liability Management (ALM); Asset Allocation; Insurance Companies; Investment Risk; Financial Risk; Solvency; Portfolio Optimization; Stochastic Simulation; Inflation; Interest Rate Risk.

THE MORE RELIGIOUS, THE MORE HONEST? AN EXPERIMENTAL STUDY OF SOCIAL PRESSURE AND BUDGETARY SLACK

Joni Putra
Manajemen Department, Universitas Lampung, Indonesia

Ayu Dwiny Octary
Accounting Department, Universitas Lampung, Indonesia

Ani Maryani
Digital Business Study Program, ITBA Dian Cipta Cendekia, Indonesia

Kus Larisa Nathania Zita
Accounting Department, Universitas Lampung, Indonesia

Muhammad Rizqy Ramadhan
Accounting Department, Universitas Lampung, Indonesia

Aryan Danil Mirza. BR
Accounting Department, Universitas Lampung, Indonesia

ABSTRACT.
Budgetary slack is a form of dysfunctional behavior in budgeting that occurs when individuals intentionally set budgets that do not reflect their best estimates. This study aims to examine the effects of religiosity and social pressure on budgetary slack, as well as to examine the role of religiosity in mitigating the tendency toward budgetary slack when individuals are under social pressure. The study employed an experimental method with a 2 × 2 factorial design, in which participants were divided into four conditions based on levels of social pressure (low and high) and religiosity (low and high). Budgetary slack was used as an indicator of the tendency toward dishonest behavior in budgeting. The results show that religiosity has a significant effect on budgetary slack, with individuals who are highly religious exhibiting lower levels of budgetary slack. Social pressure also has a significant effect on budgetary slack, with higher social pressure increasing individuals' tendency to create budgetary slack. However, the interaction between religiosity and social pressure is not significant. This study demonstrates that budgetary slack behavior is influenced by both individual internal factors and situational pressures.
Keywords: Religiosity; Social Pressure; Budgetary Slack; Experiment.

THE IMPACT OF PMS/ACCA-ORIENTED EDUCATION AND IFRS ADOPTION ON GRADUATE EMPLOYABILITY AND FINANCIAL REPORTING TRANSPARENCY: A LITERATURE REVIEW

Ofelya Muzaffar Samadova
Candidate of Sciences, Associate Professor, Mingachevir State University

Subhan Rafig Qasimov
Master's Student, Mingachevir State University
ORCID ID: 0009-0006-7161-5995

ABSTRACT
The globalization of capital markets has made the availability of a single, transparent, and internationally comparable financial reporting language increasingly indispensable. This paper examines, through a narrative literature review, two closely interrelated phenomena in the field of finance and accounting: first, the effect of Professional Accounting System (PMS) and Association of Chartered Certified Accountants (ACCA)-oriented educational models on the employability outcomes of finance graduates; and second, the effect of International Financial Reporting Standards (IFRS) adoption on the transparency and comparability of corporate financial statements. Drawing on prior empirical and conceptual studies, the paper argues that these two phenomena are not independent developments but are mutually reinforcing components of a single financial ecosystem: professional, IFRS-oriented education produces the specialists who are capable of implementing IFRS competently in practice, while the demand generated by IFRS implementation, in turn, increases the market value of professionally certified graduates. A conceptual framework and a process pathway are proposed to organize the mechanisms identified in the literature, and four synthesis tables are presented to consolidate the reviewed evidence, compare the two professional programs, outline the quality dimensions of IFRS-based reporting, and propose testable propositions for future empirical research. The paper concludes that policy attention to the integration of professional certification curricula with national accounting education, particularly in transition and developing economies such as Azerbaijan, is likely to yield simultaneous benefits for labor-market competitiveness and for the quality of the national financial reporting environment.
Keywords: IFRS, ACCA, Professional Accounting System, financial reporting transparency, graduate employability, financial reporting quality, accounting education

1. Introduction
Over the past two decades, the rapid expansion of international economic relations and the deepening integration of global financial markets have made the presentation of financial information in a unified and universally comprehensible format an operational necessity rather than a technical preference. This need gave rise to the International Financial Reporting Standards (IFRS), a body of principles that allows companies operating in different jurisdictions to prepare their financial statements on a common conceptual basis. IFRS is not merely a set of technical rules for recognition and measurement; it also functions as an instrument for building investor confidence, ensuring transparency, and strengthening global economic cooperation.

At the same time, the knowledge and skill requirements of the finance and accounting profession have undergone a fundamental transformation. Employers are no longer satisfied with the possession of a university diploma alone; they increasingly prioritize candidates who understand international standards and are able to apply them in practice.

In this context, professional certification programs such as the Professional Accounting System (PMS) and the Association of Chartered Certified Accountants (ACCA) have acquired particular importance. Whereas PMS is oriented primarily toward the formation of professional accounting competence at the national level, ACCA is an internationally recognized, comprehensive certification program covering finance, audit, taxation, and management accounting. The integration of these programs into university curricula strengthens both the theoretical and the practical preparation of students.

A PMS/ACCA-oriented teaching model, in particular, provides students with the opportunity to internalize international standards such as IFRS in depth and prepares them more effectively for real working environments. This, in turn, increases the competitiveness of graduates in the labor market, enabling them to secure employment more quickly and to progress more rapidly in their careers.

This paper investigates, in an integrated manner, the effect of PMS/ACCA-oriented education on the employment outcomes of finance graduates, together with the role that IFRS implementation plays in the transparency and comparability of corporate financial statements. The relevance of the topic is grounded both in the growing global demand for high-level financial expertise and in the methodological challenges that arise as national accounting systems transition toward international standards, a transition of particular significance for developing economies such as Azerbaijan.

The problem addressed by this paper can be stated more precisely as follows: while a substantial body of research has examined, separately, the labor-market effects of professional accounting certification and the reporting-quality effects of IFRS adoption, comparatively little attention has been paid to the structural link between the two — namely, that IFRS implementation is itself dependent on the availability of professionally trained preparers, and that the value of professional certification in the labor market is itself partly a function of the pace of IFRS convergence in a given economy. This paper's contribution is to make this structural link explicit, to organize it conceptually, and to translate it into propositions that can subsequently be tested with empirical data.

This question is of more than academic interest for Azerbaijan specifically. As the national accounting framework continues its gradual convergence toward IFRS-based reporting, and as an increasing number of local and international employers operating in the country require IFRS-literate finance staff, the pace and design of professional accounting education becomes a matter of direct economic consequence. Understanding how professional certification and standards convergence reinforce one another is therefore relevant not only to individual graduates planning their careers, but also to university administrators designing curricula and to policymakers responsible for the pace and sequencing of accounting reform.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature on IFRS adoption and on professional accounting education, and situates the discussion within the broader context of accounting reform in transition economies such as Azerbaijan. Section 3 outlines the methodological approach used to identify and synthesize the literature. Section 4 presents a conceptual framework linking the two phenomena under study. Section 5 discusses the findings in greater depth and introduces four synthesis tables together with a process-pathway figure. Section 6 considers the implications for policy and practice, Section 7 discusses the study's contribution and significance, Section 8 acknowledges the limitations of the review, and Section 9 concludes.

2. Literature Review

2.1 IFRS: Concept, Rationale, and Global Significance

The globalization of the world economy, the growing cross-border movement of capital, and the expansion of international economic relations have made it essential for financial information to be presented in a unified, transparent, and comprehensible format [1]. The application of different national accounting standards across countries complicates the comparison of financial statements and creates information asymmetry for investors [2]. From this perspective, the adoption of IFRS is not simply a technical innovation; it also carries strategic importance for building confidence and ensuring transparency within the global financial system [1].

IFRS is an internationally accepted system of accounting standards that ensures financial statements are prepared on the basis of common principles. The central purpose of these standards is to present financial information in a manner that is accurate, objective, and comparable. In addition to increasing the transparency of financial information, IFRS adoption provides users with clearer and more reliable information, thereby enabling investors and other stakeholders to make more informed decisions [2]. Ball [6] frames this development as a fundamentally pro-investor reform, arguing that a single, high-quality set of accounting standards lowers the cost that investors incur in processing and comparing financial information across firms and borders, even as he cautions that the realized benefits depend heavily on the strength of enforcement institutions in the adopting country.

At the same time, IFRS adoption facilitates the comparison of financial performance across companies operating in different countries. This feature is of particular significance for international investors, who require standard-based information when choosing among different markets. Standardized financial reporting also strengthens investor confidence and helps prevent financial manipulation [2]. Consequently, IFRS adoption makes an important contribution both to financial stability and to the improvement of the investment environment [1].

For developing countries, including Azerbaijan, the transition from national accounting standards to IFRS carries particular significance. This transition facilitates the access of local companies to global markets and creates conditions for attracting foreign investment, which in turn contributes positively to national economic development and competitiveness.

Evidence from other developing and transition settings illustrates both the promise and the conditionality of this transition. Ma et al. [10] find that gains in accounting quality following IFRS adoption are associated with measurable improvements in banking-sector efficiency in Pakistan, while cautioning that the size of the effect varies with the ownership structure of individual banks. Maradona and Chand [11], examining Indonesia's phased transition to IFRS, similarly emphasize that the pathway to full adoption is rarely linear, and that reporting-quality gains tend to accrue gradually as institutional and professional capacity develops alongside the formal regulatory change. El-Helaly, Ntim, and Soliman [12] extend this line of reasoning by showing that national culture itself conditions the effectiveness of IFRS adoption, implying that the standards cannot be expected to produce uniform reporting-quality outcomes across countries with differing institutional and professional traditions. Poudel, Hellmann, and Perera [15], focusing on Nepal, reach a comparable conclusion for non-colonized developing economies, arguing that the success of IFRS adoption depends less on the technical content of the standards themselves than on the surrounding institutional and human-capital infrastructure required to apply them.

2.2 Professional Certification Programs: PMS and ACCA

The effective implementation of IFRS, however, is not limited to the existence of an appropriate regulatory framework.

The successful execution of this process also requires the preparation of highly qualified specialists who are familiar with international standards [3]. It is at precisely this point that PMS/ACCA-oriented educational programs come to the forefront.

Professional certification programs such as PMS and ACCA are internationally recognized and hold considerable prestige within the finance and accounting profession [4]. These programs equip students not only with theoretical knowledge but also with practical skills. Because the teaching process is structured around real business environments, students learn to apply the knowledge they acquire in practice [3]. In addition, these programs make an important contribution to the development of analytical and critical-thinking skills [4].

One of the principal advantages of PMS/ACCA-oriented education is the acquisition of knowledge aligned with international standards. The ACCA program, in particular, covers IFRS knowledge extensively and provides students with a deep understanding of the application of these standards. This, in turn, creates an important advantage for their future professional activity [5].

2.3 Summary of the Core Reviewed Literature

Table 1 summarizes the five studies that most directly frame the two research strands addressed by this paper IFRS-driven reporting quality and certification-driven employability indicating their principal focus and the key findings drawn upon most heavily in the subsequent discussion. An additional ten sources, cited throughout Sections 2, 5, and 6 and listed in full in the References, extend this core literature to the Azerbaijani and post-Soviet context, to cross-country evidence on IFRS adoption, and to the psychology of certification-seeking behavior among accounting students.

Table 1. Summary of the Reviewed Literature

#	Author(s) & Year	Focus	Key Finding(s)
1	Wadesango et al. (2016)	Impact of IAS/IFRS and regulation on reporting quality	Adoption of IAS/IFRS is associated with improved quality and cross-country comparability of financial reporting.
2	Mensah (2021)	IFRS adoption and reporting quality in Ghanaian manufacturing firms	IFRS adoption is linked to gains in reliability, comparability, and completeness of financial statements, strengthening investor confidence.
3	Nie & Mastor (2024)	Employability skills, challenges, and initiatives in accounting	Practical, standards-based skill development is a key driver of accounting graduates' labor-market readiness.
4	Mistry (2021)	Role of professional accounting bodies in developing employability skills	Professional-body-oriented curricula strengthen employability skills among undergraduate accounting students.
5	Kwarteng & Mensah (2022)	Skills analysis of accounting graduate employability	Certification-aligned skill sets significantly improve graduates' employment prospects and career progression.

2.4 Professional Education and IFRS Implementation Capacity

Modern labor markets increasingly reward candidates who combine formal academic qualifications with demonstrable practical competence. Graduates who complete PMS/ACCA-oriented education are consequently regarded as more competitive than their peers.

They tend to secure employment within shorter periods, command higher remuneration, and gain access to positions in international companies [5]. Moreover, the professional development prospects of these graduates tend to be broader [3].

Empirical research further indicates that graduates who complete professional certification programs display higher employment rates, a pattern that suggests such programs are closely aligned with the requirements of the labor market [4,5]. Taken together, this evidence supports the proposition that PMS/ACCA education plays a substantial role in raising the quality of human capital within the finance profession.

The quality of financial reporting, in turn, is generally assessed against criteria such as transparency, reliability, comparability, and completeness. IFRS adoption is associated with improvement across each of these dimensions [2]. In particular, the more accurate recognition of revenues and expenses, the more realistic valuation of assets and liabilities, and the clearer presentation of financial risk collectively enable more well-founded decision-making by both investors and creditors [1].

A direct and close relationship exists between PMS/ACCA education and IFRS implementation. The ACCA program identifies the teaching of IFRS knowledge as one of its central priorities [4]; at the same time, the effective implementation of IFRS requires qualified specialists, a demand that is largely met by professionally certified individuals [3]. In this way, the education system and the financial reporting system complement one another and generate a synergy: higher-quality financial reports are produced, better-prepared human capital is formed, and financial management is carried out more effectively [2,5].

2.5 Employability Determinants in the Finance Profession

Beyond the specific contribution of professional certification, the broader employability literature identifies several determinants of labor-market success for accounting and finance graduates, several of which intersect directly with the PMS/ACCA model. Nie and Mastor [3] organize these determinants into three broad categories: technical competence (including standards knowledge such as IFRS), transferable or ‘soft' skills such as communication and analytical reasoning, and exposure to practice-oriented or work-integrated learning. Their review further notes that employer expectations in accounting have shifted measurably toward the second and third categories over the past decade, even as technical competence remains a baseline requirement.

Mistry [4] adds a complementary perspective by focusing specifically on the institutional role of professional accounting bodies in employability-skill formation. Her review finds that undergraduate programs formally partnered with, or aligned to, professional bodies such as ACCA tend to embed employability-skill development more systematically into the curriculum than programs without such alignment — for example, through case-based assessment, mentoring by practicing professionals, and structured internship placements. This suggests that the employability benefit of PMS/ACCA-oriented education operates through at least two channels: a direct channel, via the technical and standards-based knowledge examined for certification, and an indirect channel, via the pedagogical practices that professional-body alignment tends to introduce into the surrounding curriculum.

Kwarteng and Mensah [5] provide a more granular skills-analysis, decomposing employability into specific competencies — including IFRS and financial-reporting literacy, taxation knowledge, audit-process familiarity, and information-technology proficiency — and showing that graduates who score more highly across this competency set experience shorter job-search durations. Their findings lend empirical support to the proposition that the employability advantage associated with PMS/ACCA education is not a generic credentialing effect but is substantively linked to the specific, standards-oriented content of the certification curriculum, IFRS knowledge prominent among it.

A related but conceptually distinct question concerns why students choose to pursue professional certification in the first place. Chi, Yi, Al Mamun, Hayat, Salamah, and Yang [13], applying an extended theory-of-planned-behavior model to accounting students in Malaysia, find that perceived capability and perceived career opportunity are the strongest predictors of a student's intention to pursue a certified professional accountancy qualification, while job security exerts comparatively little influence. Bhat and Khan [14], studying Omani accounting students, similarly find that financial reward, market factors, and the work environment are the dominant drivers of the decision to pursue ACCA certification, with career exposure and self-competence contributing to a lesser degree. Read together, these two studies suggest that the employability gains documented elsewhere in the literature are not incidental to student decision-making: prospective ACCA/PMS candidates appear to anticipate, and to be motivated by, precisely the labor-market advantages that the outcome-focused studies reviewed above go on to document.

2.6 The Azerbaijani Context: National Accounting Reform and IFRS Convergence

Azerbaijan's accounting system has, over the past two decades, moved progressively from a Soviet-era, tax-oriented reporting model toward a framework increasingly aligned with IFRS, particularly for public-interest entities, banks, and large enterprises engaged in international trade or seeking foreign investment. This convergence process mirrors a broader pattern observed across post-Soviet and transition economies, in which the adoption of international standards is pursued both as a technical reform and as a signal of institutional credibility to foreign investors and international financial institutions [7]. McGee and Bose [8], in an early comparative assessment of corporate-governance practice in Armenia, Azerbaijan, and Georgia, found that all three Caucasus economies lagged OECD benchmarks on several governance dimensions closely linked to financial-reporting practice, underscoring that the region's convergence toward international standards has historically had to proceed alongside, rather than after, broader institutional reform.

More directly, Valiyev, Huseynov, Gadimli, Huseynov, and Elmar [9] develop and empirically assess a practical consolidation model for reconciling Azerbaijan's national accounting standards with IFRS, using a questionnaire-based fuzzy-set analysis of the advantages and obstacles perceived by practitioners under different consolidation approaches. Their findings identify the most effective consolidation model for Azerbaijani enterprises and, notably, point to a shortage of personnel skilled in IFRS application as one of the more persistent obstacles reported by respondents a finding that lends direct, country-specific support to the argument developed in this paper.

As in other transition economies, however, the pace of standards convergence in Azerbaijan is only as effective as the availability of preparers capable of applying the new standards competently. This is precisely the structural bottleneck highlighted by Nie and Mastor [3] in their broader discussion of accounting-skills gaps in developing and transitioning markets, and echoed in the Azerbaijan-specific findings of Valiyev et al. [9]: regulatory convergence toward IFRS can outpace the domestic supply of IFRS-literate accounting professionals, creating a period during which formal adoption of the standards is not matched by uniformly high-quality implementation in practice. PMS/ACCA-oriented university education is one of the primary mechanisms through which this gap can be narrowed, which is precisely why the present paper treats professional education and standards convergence as two sides of a single policy problem rather than as separate agendas.

3. Methodology

This paper adopts a narrative literature review methodology, appropriate for synthesizing a still-emerging body of evidence on the joint effects of professional accounting education and IFRS adoption. The review draws on peer-reviewed journal articles addressing (i) the effect of IFRS/IAS adoption on financial reporting quality and (ii) the role of professional accounting bodies and certification programs in shaping graduate employability. Sources were selected on the basis of thematic relevance to the two research strands identified above, and were synthesized thematically rather than through a formal systematic-review protocol or meta-analysis, given the conceptual rather than purely empirical aim of the paper.

Consistent with a literature-review design, no primary survey or firm-level data were collected for this paper; the tables and figures presented below are accordingly analytical and conceptual syntheses of the reviewed sources rather than reports of newly generated empirical statistics. This distinction is made explicit here so that the nature of the evidence base is transparent to the reader.

The synthesis proceeds in three steps. First, the core theoretical contributions of each reviewed source are extracted and organized (Table 1). Second, the mechanisms connecting professional education to IFRS implementation capacity are organized into a conceptual framework (Figure 1) and a corresponding process pathway (Figure 2). Third, the reviewed evidence is used to derive a set of propositions (Table 4) intended to guide future empirical research, including research using Azerbaijani firm-level or graduate-cohort data.

Two inclusion criteria guided the selection of sources. First, a source needed to address, directly and substantively, either the reporting-quality effects of IFRS/IAS adoption or the employability effects of professional accounting certification, rather than treating either topic only in passing. Second, priority was given to peer-reviewed journal articles published within roughly the last decade, so as to reflect the current state of both the IFRS-convergence literature and the accounting-employability literature, both of which have evolved substantially in recent years. Sources meeting these criteria were then read in full, and their central claims, evidence base, and scope conditions were extracted into the structured summary presented in Table 1.

It should be acknowledged that a narrative synthesis of this kind, based on a small and purposively identified set of sources, cannot claim the same degree of comprehensiveness as a formal systematic review conducted according to a pre-registered protocol (for example, following PRISMA-style reporting) across multiple bibliographic databases. The methodological choice made here reflects the paper's aim — to propose and justify a conceptual framework linking two literatures, rather than to exhaustively map either literature — and this scope limitation is revisited explicitly in Section 8.

4. Conceptual Framework

Building on the literature reviewed in Section 2, Figure 1 organizes the relationship between professional education and IFRS adoption around a shared mediating factor: the supply of qualified financial specialists. PMS/ACCA-oriented education supplies the labor market with graduates equipped to interpret and apply IFRS, while the practical demands of IFRS implementation require exactly this type of competence. The interaction between these two forces produces the dual outcome examined in this paper — improved graduate employability, on one hand, and improved financial reporting transparency and comparability, on the other — which together constitute what the framework labels a synergistic improvement of the broader financial ecosystem.

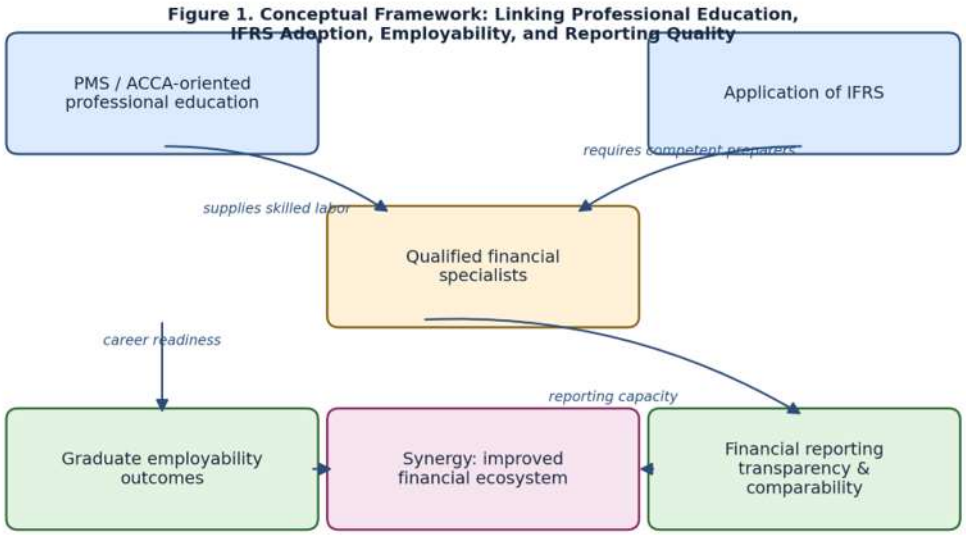


Figure 1. Conceptual Framework: Linking Professional Education, IFRS Adoption, Employability, and Reporting Quality

The framework deliberately places the supply of qualified financial specialists at its center rather than treating either professional education or IFRS adoption as the sole driver of outcomes. This positioning reflects a central argument of the paper: neither PMS/ACCA-oriented education nor IFRS adoption is, by itself, sufficient to guarantee improved reporting quality or improved employability outcomes. Rather, each strengthens the other's effectiveness IFRS convergence increases the market value of professional certification by increasing employer demand for standards-literate staff, while a larger supply of certified graduates increases the practical feasibility of high-quality IFRS implementation. This mutually reinforcing relationship is what the framework labels a synergy, and it is the structural feature that motivates the propositions developed in Section 5.5.

5. Discussion

5.1 Comparative Overview of PMS and ACCA

Although PMS and ACCA share a common orientation toward professional, standards-based accounting competence, they differ in scope and international recognition. Table 2 summarizes these differences as they emerge from the reviewed literature and from the general design of the two programs.

Table 2. Comparative Overview of PMS and ACCA Program Orientation

Dimension	**PMS (Professional Accounting System)**	**ACCA (Association of Chartered Certified Accountants)**
Primary orientation	National-level professional accounting competence	Internationally recognized, comprehensive certification
Subject coverage	Core accounting and reporting practice	Finance, audit, taxation, and management accounting
IFRS emphasis	Present, applied within the national context	Extensive, treated as a central curricular priority [4]
Typical career impact	Strengthens domestic labor-market positioning	Broadens access to international employers [5]

5.2 PMS/ACCA-Oriented Education and Graduate Employability

The reviewed literature converges on the finding that professional, certification-aligned education raises the employability of finance and accounting graduates. Nie and Mastor [3] show that skill development anchored in practical, standards-based training is central to graduates' labor-market readiness, while Mistry [4] demonstrates that curricula built around professional-body syllabi strengthen the specific employability skills that employers value. Kwarteng and Mensah [5] extend this finding by showing that certification-aligned skill sets translate into measurably better employment outcomes, including faster job placement and improved career progression.

Taken together, these findings support the proposition advanced in the introduction: PMS/ACCA-oriented education functions as a signaling and skill-formation mechanism simultaneously. It signals to employers that a graduate has met an internationally benchmarked standard of competence, and it substantively equips graduates with the applied, standards-based skills — including IFRS literacy — that employers in the finance sector increasingly require.

This dual function helps explain why the employability effects documented in the literature tend to persist across different labor-market conditions: even where aggregate hiring demand in the finance sector fluctuates, employers appear to retain a preference for candidates whose competence has been externally verified against an internationally recognized benchmark, since such verification reduces the employer's own cost of assessing candidate quality. The signaling channel and the skill-formation channel are therefore best understood as complementary rather than competing explanations for the employability advantage associated with PMS/ACCA education.

5.3 IFRS Adoption and Financial Reporting Transparency

On the reporting-quality side, Wadesango et al. [1] and Mensah [2] provide complementary evidence. The former offers a broad review linking IAS/IFRS adoption and associated regulatory reforms to improvements in the overall quality of financial reporting across jurisdictions, while the latter provides firm-level evidence from Ghanaian manufacturing companies showing that IFRS adoption is associated with measurable gains in reliability, comparability, and completeness of reported financial information.

Table 3 organizes the dimensions of financial reporting quality most frequently discussed in this literature, together with the mechanism through which IFRS adoption is argued to affect each dimension.

Table 3. Dimensions of Financial Reporting Quality Associated with IFRS Adoption

Quality Dimension	Definition	Effect Commonly Attributed to IFRS Adoption
Transparency	Clarity and accessibility of disclosed financial information	Reduces information asymmetry between preparers and users [1]
Reliability	Faithful representation of underlying economic events	More accurate recognition of revenues, expenses, assets and liabilities [1]
Comparability	Ability to compare statements across firms and countries	Common recognition and measurement principles across jurisdictions [2]
Completeness	Extent to which all material information is disclosed	Standardized, principle-based disclosure requirements [2]

It is worth noting that these four dimensions are not independent of one another in practice. Improvements in reliability, for instance, tend to reinforce comparability, since more faithfully represented figures are more meaningfully compared across firms; and improvements in completeness tend to reinforce transparency, since a more complete disclosure set leaves less scope for material omissions to obscure a firm's underlying financial position. Wadesango et al. [1] make a related point in their review, noting that the reporting-quality gains attributed to IFRS adoption in the literature are frequently reported as a composite improvement across several of these dimensions simultaneously, rather than as isolated gains in a single dimension.

5.4 The Synergy Mechanism

The two strands of literature reviewed above are rarely brought into direct conversation, yet the underlying mechanisms are closely linked. Figure 2 traces this pathway as a five-stage process, beginning with the integration of PMS/ACCA syllabi including their IFRS content into university curricula, and ending with higher-quality, more comparable financial reporting by the firms that ultimately employ the resulting graduates.



Figure 2. Pathway from Professional Education to Improved Financial Reporting Outcomes

Each stage of this pathway is supported, at least partially, by the reviewed literature: curriculum integration and competency development are documented by Mistry [4] and Nie and Mastor [3]; certification and its labor-market effects are documented by Kwarteng and Mensah [5]; and the resulting improvement in reporting quality once qualified specialists are employed in practice is documented by Wadesango et al. [1] and Mensah [2]. The contribution of the present paper is to connect these previously separate findings into a single explanatory sequence.

5.5 Propositions for Future Empirical Research

Because this paper is based on a narrative synthesis of existing literature rather than newly collected data, its central contribution regarding the synergy mechanism is best expressed as a set of testable propositions rather than as confirmed findings. Table 4 presents four such propositions, derived from the conceptual framework in Figure 1 and the pathway in Figure 2, intended to guide subsequent empirical work — for example, using survey data from Azerbaijani PMS/ACCA graduates or firm-level financial statement data from companies that have adopted IFRS.

Table 4. Propositions Derived from the Literature Review for Future Empirical Testing

#	Proposition
P1	Graduates of PMS/ACCA-oriented programs achieve shorter job-search durations and higher starting compensation than graduates of non-certification-aligned programs, controlling for academic performance.

#	Proposition
P2	Firms that employ a higher proportion of professionally certified (PMS/ACCA) finance staff exhibit financial statements that score more favorably on IFRS-based comparability and disclosure-quality metrics.
P3	The positive relationship between IFRS adoption and financial reporting quality is stronger in firms with greater availability of professionally certified accounting staff.
P4	Integrating ACCA-aligned IFRS content into national university curricula is associated, over time, with a measurable increase in the employment rate of finance graduates in IFRS-reporting firms.

6. Implications for Policy and Practice

The synthesis presented above carries several implications for universities, professional bodies, and policymakers in transition economies such as Azerbaijan. For universities, the evidence reviewed suggests that deeper integration of ACCA/PMS syllabi and, in particular, their IFRS content — into national accounting and finance curricula is likely to improve graduate labor-market outcomes without requiring a wholesale redesign of existing degree structures.

For professional bodies and regulators, the reviewed literature suggests that the pace at which national accounting standards converge with IFRS should be matched by parallel investment in professional-certification infrastructure; the benefits of standards convergence are unlikely to be fully realized where the supply of professionally qualified preparers remains limited.

For policymakers concerned with national competitiveness, the framework proposed in this paper suggests that education policy and financial-reporting policy should not be treated as separate domains. Because the two strands are mutually reinforcing, coordinated investment for example, subsidizing ACCA tuition for accounting students while simultaneously accelerating IFRS convergence for domestic firms may generate returns greater than the sum of the two interventions considered in isolation.

More specifically, three coordinated policy actions follow from the framework developed in Sections 4 and 5. First, universities and professional bodies could jointly map ACCA and PMS syllabi against existing degree requirements, so that students are able to pursue certification in parallel with their degree rather than sequentially after graduation, shortening the time required to reach full labor-market readiness. Second, regulators overseeing the pace of IFRS convergence could coordinate the timing of new reporting requirements with projected growth in the domestic supply of certified preparers, so as to avoid periods in which formal standards adoption outpaces practical implementation capacity, a risk highlighted in Section 2.6. Third, employers particularly larger domestic firms newly subject to IFRS-based reporting could be encouraged, through professional-body outreach or targeted incentives, to expand structured internship and mentorship placements for PMS/ACCA-track students, strengthening the practice-oriented skill-formation channel identified in Section 5.2.

7. Contribution and Significance of the Study

The principal contribution of this paper lies not in any single empirical finding, since none is newly reported here, but in the explicit conceptual bridge it draws between two literatures that have largely developed in parallel: the literature on IFRS adoption and reporting quality, and the literature on professional accounting certification and graduate employability. By organizing the reviewed evidence around a shared mediating construct the supply of qualified financial specialists — the paper offers a vocabulary and a set of testable propositions (Table 4) that can be used by future researchers to examine the two phenomena jointly rather than in isolation.

A second contribution is contextual: by situating the discussion explicitly within the Azerbaijani accounting-reform context (Section 2.6), the paper points toward a specific and policy-relevant application of the general framework namely, the coordination of curricular reform in national universities with the ongoing convergence of national accounting practice toward IFRS. While the framework itself is intended to be generalizable to other transition economies facing a similar convergence process, its explicit grounding in the Azerbaijani case is intended to make the paper's policy implications concrete and actionable rather than purely abstract.

Third, by presenting the reviewed evidence in structured tabular and diagrammatic form (Tables 1–4; Figures 1–2), the paper aims to make the underlying mechanisms more readily usable by non-specialist readers, including university administrators and policymakers who may not have the time to engage with the full body of primary literature but who are nonetheless positioned to act on its implications.

8. Limitations

This review is subject to several limitations. First, it draws on a focused set of five sources and does not constitute a systematic review or meta-analysis; the conclusions offered should therefore be read as a synthesis of existing conceptual and empirical work rather than as new empirical findings. Second, most of the underlying empirical evidence on IFRS and reporting quality originates from contexts outside Azerbaijan, notably Ghana [2] and other jurisdictions reviewed by Wadesango et al. [1]; the applicability of these findings to the Azerbaijani context, while plausible, has not been empirically verified here. Third, the propositions presented in Table 4 are, by design, untested; they are intended to orient future data collection rather than to report confirmed results.

9. Conclusion

This paper has examined, through a literature-based synthesis, the joint significance of IFRS adoption and PMS/ACCA-oriented professional education for the finance sector. These two developments complement one another, jointly creating the conditions both for raising the quality of financial reporting and for preparing competitive specialists for the labor market. Their combined effect accelerates economic development, improves the investment environment, and strengthens financial stability.

IFRS adoption increases the transparency, reliability, and comparability of financial statements, thereby strengthening confidence within the global financial system. PMS/ACCA-oriented education, in turn, serves to prepare the professional and skilled personnel necessary for the effective implementation of these standards. The interaction between these two directions contributes both to raising the quality of financial reporting and to increasing the labor-market competitiveness of graduates. As a result, a solid foundation is formed for economic development and financial stability — a foundation that, as argued in Sections 6 and 7, merits coordinated attention from universities, professional bodies, and policymakers alike, and further empirical testing along the lines proposed in Table 4.

For Azerbaijan specifically, the analysis suggests that the country's continuing convergence toward IFRS-based reporting and the ongoing expansion of ACCA/PMS-oriented university education should be understood, and planned, as complementary elements of a single reform trajectory rather than as separate initiatives pursued independently by different institutions. Universities, professional bodies, regulators, and employers each hold a piece of the mechanism traced in Figure 2; coordinated action across these actors is likely to yield faster and more durable gains — in both the quality of national financial reporting and the competitiveness of finance graduates — than any single actor could achieve alone.

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STUDY OF ELECTRICAL PROPERTIES OF RARE EARTH ELEMENTS-DOPPED GaSe NANOCRYSTAL

Dr. Seyfaddin JAFAROV
Nakhchivan State University, org/0009-0000-1609-0387, seyfadjafarov@gmail.com,. Faculty of Physics and Mathematics, Azerbaijan

ABSTRACT

Introduction and Purpose: In n-GaSe single crystals doped with rare earth elements (REEs) such as Gd, Ho and Dy, N 0; 10-5; 10-4; 10-3; 10-2; 10-1 The properties of some electrical instabilities of various origins at temperatures ((77-400K), wavelengths (0.30≤λ≤3.50 μk) and light intensities (up to 102 lk-) have been investigated. Mechanisms that provide a good qualitative explanation for the occurrence and characteristics of individual effects in the studied material, as well as the influence of NTE doping on these effects, have been proposed.

Materials and Methods: As a result of the studies, it was found that for the same values of temperature (T), intensity (L) and light wavelength (λ), the effect of doping with rare earth elements such as Gd, Ho and Dy on the electrical instability studied in n-GaSe crystals is mainly determined by the doping level (N_NTE), and not by the material of the dopant. In cross-contact M-GaSe<NTE>10-8 s (fast transition effect), as N_NTE increases, the value of the electrical voltage required for the transition (Up) initially increases slightly compared to the initial value,□ □□M structures, where the transition effect dominates, the time during which the structure transitions from a high-resistance state to a low-resistance state (transition time) occurs,

Results: As for the observed effect of NTE doping, it can most likely be explained by a change in the degree of spatial arrangement of n-GaSe<NTE> crystals, an increase in the concentration of shallow α-bonding levels, as well as a decrease in the energy depth of their formation and r-centers of slow recombination due to a change in the interaction of donor-acceptor pairs with increasing N_NTE. The feasibility of this hypothesis is also supported by the observed behavior of the temperature dependence of the parameters of low-frequency current oscillations and a decrease in the upper limit of the temperature range for their observation with increasing N_NTE.

Discussion and Conclusion: Within the framework of the proposed hypotheses, the disappearance of the saturation region of the current-voltage characteristic and low-frequency current oscillations in structures with longitudinal contacts under the simultaneous influence of internal and additive light can be explained by the simultaneous depletion of r-recombination centers and shallow α-adhesion levels in the case of relatively short-wavelength and long-wavelength additive light, respectively.

Keywords: rare earth, wavelengths, light intensity, low frequency, electrical instabilities

ECO-FRIENDLY SYNTHESIS OF CHITOSAN@TiO_2 NANOCOMPOSITE FOR EFFICIENT DYE ADSORPTION AND TEXTILE WASTEWATER TREATMENT: A COMBINED EXPERIMENTAL AND THEORETICAL STUDY

Soukaina El Bourachdi
Laboratory of Engineering, Electrochemistry, Modelling and Environment, Faculty of Sciences Dhar El Mehraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco.

Lekbira El mersly
Laboratory of Advanced Materials and Process Engineering (LAMPE), Faculty of Sciences, Ibn Tofaïl University, B.P. 133, 14000 Kenitra, Morocco.
Laboratoire de Chimie Analytique et Moléculaire, Faculté Polydisciplinaire de Safi, Université Cadi Ayyad, Sidi Bouzid, B.P. 4162, Safi 46000, Morocco.

Yassine Rakcho
Laboratory Materials, Processes, Environment and Quality, National School of Applied Sciences, Cadi Ayyad University (UCA), Route Sidi Bouzid BP 63, 46000 Safi, Morocco

Ali Raza Ayub
Key Laboratory of Clusters Science of Ministry of Education, School of Chemistry and Chemical Engineering, Beijing Institute of Technology, Beijing, 100081, P. R. China.

Abdelhay el Amri
International Water research Institute (IWRI), Mohammed VI Polytechnic University, Lot 660 Hay Moulay Rachid, Ben Guerir 43150, Morocco.

Mahdi Lechheb
Materials Sciences for Energy and Sustainable Development Team, Department of Chemistry, FST Errachidia, Moulay Ismail University, Errachidia, Morocco

Amal Lahkimi
Laboratory of Engineering, Electrochemistry, Modelling and Environment, Faculty of Sciences Dhar El Mehraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco

ABSTRACT

Background:The textile industry generates substantial volumes of dye-contaminated wastewater, posing severe environmental and health risks due to the persistence, toxicity, and resistance to biodegradation of synthetic dyes such as Crystal Violet (CV) and Methylene Violet (MV). This study aimed to develop a sustainable and efficient nanocomposite adsorbent by combining green-synthesized titanium dioxide (TiO_2) nanoparticles with chitosan (CS) to address the limitations of conventional dye removal methods, including high cost, energy consumption, and generation of harmful by-products.

Methods:TiO_2 nanoparticles were synthesized via a green route using crude aqueous ginger extract, with synthesis optimized by a Box–Behnken design considering extract volume (1–5 mL), titanium precursor concentration (0.1–0.5 M), and calcination temperature (400–500 °C). The optimized TiO_2 nanoparticles were immobilized in chitosan beads to fabricate the CS@TiO_2 nanocomposite. The material was characterized by FTIR, XRD, SEM-EDS, BET, and pHPZC analyses. Adsorption performance was evaluated through kinetic, isotherm, thermodynamic, reusability, and DFT studies, and validated using real textile wastewater.

Findings: The optimal synthesis conditions (5 mL CAE volume, 0.3 M precursor concentration, calcination at 400 °C) yielded mesoporous TiO_2 nanoparticles with a high BET surface area of 150.49 $m^2\ g^{-1}$ and an average particle size of 10.38 nm. Incorporation into chitosan further enhanced the surface area to 201.24 $m^2\ g^{-1}$ with a well-developed mesoporous structure (average pore diameter: 8.25 nm). The CS@TiO_2 nanocomposite demonstrated rapid adsorption equilibrium within 120 min, following pseudo-second-order kinetics (R^2 = 0.992 for CV, R^2 = 0.989 for MV). Langmuir isotherm provided the best fit, with maximum adsorption capacities of 165.84 mg g^{-1} for CV and 132.84 mg g^{-1} for MV. Thermodynamic analysis confirmed spontaneous, endothermic adsorption ($\Delta G°$ = −6.26 to −7.84 kJ/mol for CV; $\Delta G°$ = −3.86 to −4.59 kJ/mol for MV). DFT calculations revealed enhanced electronic properties upon TiO_2 incorporation (HOMO–LUMO gap reduced from 5.27 to 1.20 eV), with CV exhibiting stronger electron-donating capacity and higher global softness (1.65 eV^{-1}) compared to MV (0.26 eV^{-1}). Application to real textile wastewater achieved remarkable removal efficiencies: 87.75% for COD, 75.00% for BOD_5, and 98.35% for electrical conductivity, with near-complete decolorization. The nanocomposite maintained appreciable reusability, retaining 67.77% removal efficiency for CV after five cycles. These findings establish CS@TiO_2 as an efficient, eco-friendly, and reusable adsorbent for sustainable textile wastewater treatment.

Keywords: Adsorption, Chitosan, TiO_2 nanoparticles, Green synthesis, Wastewater treatment, Crystal Violet, Methylene Violet.

DEVELOPMENT OF CHITOSAN–ZNO–GHASSOUL CLAY BIOHYBRID BEADS FOR PHOTOCATALYTIC DYE DEGRADATION AND CU(II) PHOTOREDUCTION

Soukaina El Bourachdi
Laboratory of Engineering, Electrochemistry, Modelling and Environment, Faculty of Sciences Dhar El Mehraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco.

Abdelhay el Amri
International Water research Institute (IWRI), Mohammed VI Polytechnic University, Lot 660 Hay Moulay Rachid, Ben Guerir 43150, Morocco.

Mahdi Lechheb
Materials Sciences for Energy and Sustainable Development Team, Department of Chemistry, FST Errachidia, Moulay Ismail University, Errachidia, Morocco

Yassine Rakcho
Laboratory Materials, Processes, Environment and Quality, National School of Applied Sciences, Cadi Ayyad University (UCA), Route Sidi Bouzid BP 63, 46000 Safi, Morocco

Ilham Naghoume
Laboratory of Engineering, Electrochemistry, Modelling and Environment, Faculty of Sciences Dhar El Mehraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco

ABSTRACT

This study developed a sustainable photocatalytic system for wastewater treatment based on green-synthesized ZnO nanoparticles incorporated into chitosan-based composite beads. ZnO nanoparticles were synthesized using Argania spinosa press-cake extract and optimized through a Box–Behnken design to maximize their surface area. The optimized nanoparticles were subsequently incorporated into binary (CS@ZnO) and ternary (CS@ZnO@Ghassoul) nanocomposite beads using a simple ionotropic gelation method.

The ternary CS@ZnO@Ghassoul nanocomposite exhibited superior performance, achieving a BET surface area of 39.823 m^2/g and 97.87% photodegradation of Basic Yellow 28 within 40 min, with a reaction rate constant (k_{app}) of 0.1071 min^{-1}, significantly higher than that of pure ZnO. The beads also showed excellent reusability, retaining more than 96% degradation efficiency after three regeneration cycles. Furthermore, the regenerated composites demonstrated a dual functionality by efficiently photoreducing Cu^{2+} ions. The regenerated CS@ZnO@Ghassoul beads achieved 99.5% Cu^{2+} removal within 110 min (k_{app} = 0.02614 min^{-1}), outperforming the regenerated CS@ZnO beads (92.01%, k_{app} = 0.01505 min^{-1}), while maintaining a high BET surface area of 30.966 m^2/g. These findings highlight the potential of the developed composite as a recyclable and efficient photocatalyst for wastewater remediation.

Computational calculations using density functional theory (DFT) supported the experimental findings, revealing that Basic Yellow 28 has a narrow energy gap (2.05 eV), indicating high reactivity. The high electrophilicity index (ω = 4.59 eV) confirms that BY28 is a strong electron acceptor, readily attracting electrons from the photocatalyst surface. Additionally, the high charge transfer capacity (ΔN_{max} = 2.92) demonstrates its strong ability to exchange electrons with ZnO, which facilitates rapid oxidative degradation. These electronic properties explain why BY28 is efficiently degraded by the CS@ZnO@Ghassoul clay composite. Finally, the developed beads successfully treated real textile wastewater, reducing chemical oxygen demand (79.3%), biochemical oxygen demand (67.0%), and dye content (59.9%).

These results demonstrate that the CS@ZnO@Ghassoul ternary nanocomposite is an efficient, reusable, and eco-friendly photocatalyst with strong potential for sustainable industrial wastewater treatment and circular economy applications.

Keywords: Argania spinosa press-cake extract; Basic Yellow 28; BET surface area; Cu^{2+} photoreduction; Green synthesis; Zinc oxide particles

DESIGN OF NOVEL POTENT SELECTIVE SURVIVIN INHIBITORS USING 2D-QSAR MODELING, MOLECULAR DOCKING, MOLECULAR DYNAMICS, AND ADMET PROPERTIES OF NEW MX-106 HYDROXYQUINOLINE SCAFFOLD DERIVATIVES

Aloui Mourad
LIMAS Laboratory, Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco

Menana Elhalaoui
LIMAS Laboratory, Faculty of Sciences Dhar El Mahraz, Sidi Mohamed Ben Abdellah University, Fez, Morocco

ABSTRACT
Given the critical role of survivin (BIRC5) in tumor cell regulation, developing novel inhibitors represents a promising approach for cancer therapy. This study details the design of innovative survivin inhibitors based on the hydroxyquinoline scaffold of our previously reported lead compound, MX-106. Our study identified nine compounds whose inhibitory activity is expected to be superior to that of the most active molecule in the series. These compounds demonstrated potent suppression of MDA-MB-435 breast cancer cell proliferation in vitro and exhibited enhanced metabolic stability compared to the series' most active member. To evaluate these derivatives as potential survivin inhibitors, we employed a multi-faceted approach combining 2D-QSAR methods, molecular docking, molecular dynamics, and ADMET property assessment. Our molecular modeling studies led to the design of nine novel compounds (Pred1-Pred9) predicted to exhibit potent survivin inhibitory activity based on MLR models. To assess their suitability as drug candidates, we recommend a thorough evaluation of their ADMET properties. These compounds hold promise as innovative anticancer agents targeting survivin, similar to the established MX-106.

Keywords: Breast cancer, QSAR, ADMET properties, tumor cells, molecular dynamics, selective survivin inhibitors, molecular docking, MX-106 hydroxyquinoline scaffold.

EFFECTS OF INTEGRATED CURRICULUM TEACHING APPROACH ON LOWER BASIC TWO SOCIAL STUDIES STUDENT'S ACHIEVEMENT AND RETENTION IN PLATEAU STATE, NIGERIA

HULDA MAXWELL DAVWET
Ph.D, Department of Science and Technology Education, Faculty of Education, University of Jos, Plateau State, Nigeria

MANJI AMOS

ABSTRACT
The study investigated the Effects of Integrated Curriculum Teaching Approach on Lower Basic Two Social Studies Students' Achievement and Retention in Plateau State, Nigeria. The aim of the study was to find out how much learning gained when curriculum is organized in two related subjects in the same level of schooling to reinforce each other. Three objectives, research and hypotheses guided the study respectively. Quasi-experimental pretest–posttest control group design was used for the study. Population comprised of 1,509 Lower Basic Two students from eighteen Junior Secondary Schools in Kanke Local Government Area of Plateau State. Using a simple random sampling technique, two schools were drawn with a sample size of 173 students. The two schools were used for the experimental and control groups respectively. Social Studies Achievement Test (SSAT) was used to collect data. Instrument validity was established through experts' judgment, while a reliability coefficient of 0.84 was obtained using a test -retest method. A descriptive statistics of mean and standard deviation answered the research questions while ANCOVA was used to test the hypotheses at 0.05 alpha level with the help of SPSS 26.0. The findings indicated no significant difference existed between the experimental and control groups at the pretest stage. However, following the intervention, students in the experimental group exposed to integrated curriculum teaching approach achieved significantly higher posttest and retention mean score compared to the control group who were denied the intervention. Also, no significant gender difference existed in students' achievement. The study concluded that integrated curriculum teaching approach significantly enhances students' achievement and retention in Social Studies irrespective of gender. The study recommended that, Social Studies teachers and other teachers to adopt integrated curriculum teaching approach to promote students' active learning for long-term retention of concepts.
Keywords: Integrated Curriculum Approach, Social Studies, Achievement and Retention

INFLUENCE OF LECTURERS' CHARACTERISTICS ON EMOTIONAL INTELLIGENCE SKILLS DEVELOPMENT OF BUILDING TECHNOLOGY EDUCATION STUDENTS IN TERTIARY INSTITUTIONS IN NORTH CENTRAL, NIGERIA

Ntabayi, Solomon Musa
Department of Industrial Technology Education,
Federal University of Technology, Minna, Niger State Nigeria.

ABSTRACT

This study examined the influence of lecturer characteristics on the emotional intelligence skills development of Building Technology Education students in tertiary institutions in North-Central Nigeria. A multi-method approach involving descriptive and correlational procedures was adopted. The target population comprised 75 NCE III Building Technology Education students in Colleges of Education offering the programme in North-Central Nigeria. Census sampling was adopted; however, due to low BTE enrolment across institutions and difficulties accessing some institutions during data collection, 28 valid responses were obtained and analyzed. The instrument for data collection was validated by three experts and pilot-tested at Kaduna Polytechnic, Nigeria and Cronbach Alpha yielded an overall reliability coefficient of 0.76. Mean and standard deviation were used to answer the research questions, while scatter plot, Pearson Product Moment Correlation Coefficient, and simple linear regression were used at the 0.05 significance level. The findings revealed high levels of lecturer characteristics and students' emotional intelligence skills development, each with an overall mean of 3.15. The scatter plot indicated a weak negative linear relationship ($R^2 = 0.004$), while PPMC showed a negligible, non-significant negative relationship ($r = -0.059$, $p = 0.764$). Regression analysis showed that lecturer characteristics explained 0.4% of the variance in emotional intelligence skills development and was not statistically significant for enhancing positive lecturer characteristics were rated high, with teamwork during classroom and practical activities recording the highest mean. The study recommended deliberate use of collaborative, supportive, respectful, and emotionally responsive instructional practices to foster students' emotional intelligence development.

AI-ASSISTED LEARNING TOOLS AND STUDENTS' ACADEMIC WRITING: PERFORMANCE, RESPONSIBLE USE, AND ACADEMIC INTEGRITY

Afshan Naseem
Assistant Professor, Department of Education, University of Management and Technology, Lahore, Pakistan.
ORCID ID:0000-0002-8253-3980

Mushba Ishtiaq
MPhil Scholar, Department of Education, University of Management and Technology, Lahore, Pakistan.

ABSTRACT
Artificial intelligence (AI)-assisted learning tools are increasingly becoming part of academic writing practices in higher education, offering students new opportunities to develop, refine, and improve their writing. This study examined the relationship between students' perceptions of AI-assisted writing tools, their academic writing performance, and their ethical and responsible use of AI in academic writing. A quantitative correlational research design was employed with 204 undergraduate and postgraduate students from public and private universities in Pakistan. Data were collected through a structured five-point Likert-scale questionnaire measuring perceptions of AI-assisted writing tools, academic writing performance, and ethical and responsible AI use. The findings revealed a strong positive relationship between students' perceptions of AI-assisted writing tools and their academic writing performance. Ethical and responsible use of AI was also positively associated with students' academic writing performance. Further analysis indicated that both perceptions of AI-assisted writing tools and responsible AI use contributed significantly to academic writing performance. The findings suggest that AI-assisted tools can support students' academic writing when integrated thoughtfully and used responsibly. The study highlights the importance of developing students' AI literacy, ethical awareness, and academic integrity alongside the use of AI technologies. It further emphasizes the need for higher education institutions to provide appropriate guidance on the responsible use of AI in academic writing so that technological assistance enhances learning without compromising academic standards.
Keywords: Artificial intelligence; AI-assisted learning; academic writing; writing performance; responsible AI use; AI literacy; academic integrity; higher education

TEACHING OF EFL SPEAKING SKILLS IN SECONDARY SCHOOL IN GUINEA: CHALLENGES AND PERSPECTIVES IN *LA GUINÉE FORESTIÈRE*

Régis Orens Kobéna Afadzi Johnson,
English Department
Faculty of Art and Human Sciences
University of N'zérékoré

Baba Samoura,
English Department
Faculty of Art and Human Sciences
University of N'zérékoré

Cécé Kolie, Université de N'zérékoré
English Department
Faculty of Art and Human Sciences
University of N'zérékoré

ABSTRACT
Spending years in learning a language and being unable to speak it and hold a conversation in it is nothing but a serious waste of time. Unfortunately, learners at the English department at universities in general and at Guinean Universities show incapability in holding a conversation after spending a minimum if seven years learning the language in secondary school. this study aims at assessing the EFL teaching procedure in general with a focus on the speaking aspect. It is worth recalling that it is one of the most complex skills to be taught for it requires extract efforts and integrates all the other aspects of language learning. Through questionnaires addressed to twenty (25) teachers and one hundred (100) learners of secondary schools in *la Guinée Forestière*, classroom observations, and interviews with educational authorities, it is first of all noticed that teachers must be trained to teaching speaking skills. Out of the Twenty-five (25) teachers sampled for the study only seven (07) then 28% acknowledge that they carry speaking activities in their classrooms. The remaining 72% consider it as a waste of time since learners show to be hostile to it. As for learners, the great majority 79% think that speaking activities are very difficult and boring. Results also show that learners fear vocabulary, pronunciation and grammatical mistakes and nourish a visible lack of motivation. Upon classroom observation, the way classes are organized and conducted, the lack of preparation from teachers, the lack of basic facilities, and the teaching method used by teachers stand as causes of learners' poor performances when it comes to speaking.

Keywords: EFL, Speaking skills, secondary school in Guinea, *la Guinée Forestière*

BRIDGING TRADITION AND MODERNITY: THE ROLE OF INDIAN KNOWLEDGE SYSTEMS IN ETHICAL AND INTERDISCIPLINARY EDUCATION

Prof. Dr. Ananda Majumdar
Harvard University, alumnus, Business, MacEwan University, Edmonton, Human Resources,Research profile ,Kennedy University of Saint Lucia and at QAHE.
ORCID ID: 0000-0003-3045-0056

ABSTRACT
This paper explores how Indian Knowledge Systems (IKS) promote ethical and interdisciplinary education in India (Giri & Baskey, 2025; Kumbhakar et al., 2026). Using documentary analysis and case studies, it examines how IKS has been integrated into curricula and its impact on student learning (Karisetty et al., 2020; Singh, 2026). Evidence from schools and universities demonstrates that IKS practices—such as yoga, Vedic mathematics, environmental ethics, and value-based modules—enhance moral awareness, teamwork, problem-solving, creativity, and cultural respect (Sharma & Savita, 2025; Brahmi et al., 2025). Examples from Kendriya Vidyalaya and Banaras Hindu University show improved collaboration and ethical abstractengagement among students (Karisetty et al., 2020; Kumbhakar et al., 2026). The study also highlights challenges like curriculum standardization, teacher training, skepticism, and resource constraints (Majhi, 2025; Udupa & C., 2026). Overall, integrating IKS can help connect tradition with modern education, fostering responsible citizens for sustainable, value-driven futures (Mohil, 2025; Shroff, 2025).
Keywords: Indian Knowledge Systems; Ethical Education; Interdisciplinary Learning.

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