

Research Article / Araştırma Makalesi

## TURKIYE'S DIGITAL TRANSFORMATION: A COMPREHENSIVE LITERATURE REVIEW OF SOCIAL, CULTURAL, LEGAL, AND ECONOMIC CHALLENGES AND OPPORTUNITIES

Abdülkadir AKTURAN<sup>1</sup> 

### ABSTRACT

This study examines Türkiye's digital transformation as a multidimensional process that spans social, cultural, legal, and economic domains. The main purpose is to provide a comprehensive synthesis of the country's digitalization trajectory between 2014 and 2024, highlighting both the opportunities and challenges that arise in this context. Unlike prior research, which often focuses narrowly on technological adoption or infrastructure, this study integrates insights from peer-reviewed literature, government strategies, and international organization reports to assess digitalization in a holistic manner. This broader approach enables a more balanced understanding of how social inequalities, cultural change, regulatory frameworks, and economic dynamics interact in shaping Türkiye's digital future. The findings reveal that although internet penetration and e-commerce adoption have expanded, a persistent digital divide remains along gender, regional, and socio-economic lines. Digital platforms are reshaping family structures, values, and political engagement, while concerns about misinformation and data privacy continue to grow. Advances in data protection, AI ethics, and e-commerce regulation are noteworthy, yet unresolved issues such as algorithmic bias and cybersecurity threats constrain progress. Economically, delayed 5G deployment and limited data center capacity present barriers, but FinTech, smart cities, and digital entrepreneurship suggest strong growth potential. The study is limited by its reliance on secondary sources, which restricts empirical testing of causal relationships. Nonetheless, the review contributes to the literature by offering an integrative framework that underscores the need for inclusive digital policies and adaptive legal mechanisms.

**Keywords:** Digital Transformation, Türkiye, Digital Divide, Data Privacy, Artificial Intelligence, E-Commerce

**JEL Classification:** O33, L86, K24, I28, H83

## TÜRKİYE'NİN DİJİTAL DÖNÜŞÜMÜ: SOSYAL, KÜLTÜREL, HUKUKİ VE EKONOMİK ZORLUKLAR VE FIRSATLAR ÜZERİNE KAPSAMLI BİR LİTERATÜR İNCELEMESİ

### ÖZET

Bu çalışma, Türkiye'nin dijital dönüşümünü sosyal, kültürel, yasal ve ekonomik alanları kapsayan çok boyutlu bir süreç olarak incelemektedir. Temel amaç, ülkenin 2014-2024 yılları arasındaki dijitalleşme yolculuğunun kapsamlı bir sentezini sunmak ve bu bağlamda ortaya çıkan fırsatları ve

<sup>1</sup> Asst. Prof., İstanbul Piri Reis University, İstanbul, Türkiye, aakturan@pirireis.edu.tr

zorlukları vurgulamaktır. Genellikle dar bir şekilde teknolojik benimseme veya altyapıya odaklanan önceki araştırmaların aksine, bu çalışma, dijitalleşmeyi bütünsel bir şekilde değerlendirmek için hakemli literatürden, hükümet stratejilerinden ve uluslararası kuruluş raporlarından elde edilen bilgileri entegre etmektedir. Bu daha geniş yaklaşım, sosyal eşitsizliklerin, kültürel değişimin, düzenleyici çerçevelerin ve ekonomik dinamiklerin Türkiye'nin dijital geleceğini şekillendirmede nasıl etkileşime girdiğine dair daha dengeli bir anlayış sağlamaktadır. Bulgular, internet penetrasyonu ve e-ticaret benimsemesinin artmasına rağmen, cinsiyet, bölgesel ve sosyoekonomik çizgilerde kalıcı bir dijital uçurumun varlığını sürdürdüğünü ortaya koymaktadır. Dijital platformlar aile yapılarını, değerleri ve siyasi katılımı yeniden şekillendirirken, yanlış bilgi ve veri gizliliği konusundaki endişeler artmaya devam etmektedir. Veri koruma, yapay zekâ etiği ve e-ticaret düzenlemelerindeki gelişmeler kayda değer olsa da, algoritmik önyargı ve siber güvenlik tehditleri gibi çözülmemiş sorunlar ilerlemeyi kısıtlamaktadır. Ekonomik açıdan, gecikmiş 5G dağıtımını ve sınırlı veri merkezi kapasitesi engeller teşkil etse de, FinTech, akıllı şehirler ve dijital girişimcilik güçlü bir büyüme potansiyeline işaret etmektedir. Çalışma, nedensel ilişkilerin ampirik olarak test edilmesini kısıtlayan ikincil kaynaklara dayanmasıyla sınırlı bir çerçevededir. Bununla birlikte, inceleme, kapsayıcı dijital politikalara ve uyarlanabilir yasal mekanizmalara olan ihtiyacı vurgulayan bütünleştirici bir çerçeveye sunarak literatüre katkıda bulunmaktadır.

**Anahtar Kelimeler:** Dijital Dönüşüm, Türkiye, Dijital Uçurum, Veri Mahremiyeti, Yapay Zeka, E-Ticaret  
**JEL Sınıflandırması:** O33, L86, K24, I28, H83

## 1. Introduction

Türkiye's digitalization has been the subject of growing academic interest because its implications are multifaceted in terms of the country's socioeconomic composition. This review of literature seeks to critically evaluate the scholarly and policy-focused debates around Türkiye's digital transformation. Based on a wide variety of scholarly literature and policy reports, it investigates the central drivers, limitations, and consequences of digitalization in social, juridical, and economic spheres. Türkiye's unique demographic profile, growing population of tech-savvy youth, and geopolitically strategic location pose challenges along with opportunities for digitalization. The review stresses the need to harmonize cross-border digital governance systems, especially in the context of Türkiye's proximity to and engagement with the European Union (Meltzer, 2019: 25).

This literary study aims to provide a detailed overview of the social, legal, and economic challenges and opportunities of Türkiye's digital transformation. In analyzing this, several scholarly works will be used to assess the state of affairs with digital transformation in Türkiye at present, covering main drivers and inhibitions alongside potential implications for the social, legal, and economic conditions of the country. Türkiye's unique position as a rising economic power, with a younger and more technologically savvy population, and its geopolitical position spanning Europe and Asia, challenges and offers opportunities for its digitalization. Türkiye's digitalization is influenced by its demographic dividend, expanding middle class, and role as a regional trade and investment hub (Ersöz et al., 2018: 249). This is because Türkiye is just by the European Union and belongs to many other groups that focus on the economy and politics. It is important for them to work together on their digital plans and rules. This will not only bring good chances to work together but also make them find answers to problems about how to rule across different nations (Meltzer, 2019: 25). Drawing on diverse sources of scholarly

literature, the paper examines the current state of digital transformation in Türkiye, identifies key drivers and hurdles, and delves into potential implications in three core areas: social, legal, and economic. The extent to which this analysis is applicable arises from its capacity to clarify how Türkiye's digital revolution alters social service delivery and engagement with citizens. Digital technology can revolutionize the social context, making it possible to have effective and transparent public services, yet digital technology introduces new challenges such as data privacy, digital inclusion, and the impact on conventional societal institutions. This study, examining the implications of Türkiye's digital transformation, can provide key information to guide policymakers, enable strategic planning, and empower stakeholders to understand the complex and fast-changing digital world.

This review was developed by the systematic analysis of peer-reviewed academic literature, governmental reports, and international organization statistics between 2014 and 2024. The primary databases searched were Scopus, Web of Science, and Google Scholar. Some of the primary keywords searched were "Türkiye digital transformation," "e-government," "ICT policy Türkiye," "digital economy Türkiye," and "AI in Türkiye." The inclusion criteria were centered on empirical studies, policy analyses, and conceptual research relevant to the digitalization of Türkiye.

## **2. Social Challenges and Opportunities**

### **2.1. Digital Divide**

The digital divide is a framing concept; it accounts for disparities at levels both individual and societal concerning access to and competencies for the use of information and communication technologies (ICT) (van Dijk, 2020; Hüsnüoğlu & Öztürk, 2017: 8). Although Türkiye has been highly successful in recent years in making progress toward digitalization, inequality still plagues the process along regional, gender-based, and socio-economic lines. This paper will define the digital divide of Türkiye using data from the Turkish Statistical Institute for the year 2024 (TÜİK, 2024). As seen in Table 1, reported by TÜİK in their 2024 Household Information Technologies Usage Survey, 95.1% of households have internet access as of 2024. For comparison, this figure was only 88.3% in 2019 (TÜİK, 2024). However, there are enormous disparities in skills among people to be able to use digital services; while currently 87.1% of people between the ages of 16 and 74 use the internet, usage also varies with age, education level, and socioeconomic background. TÜİK (2024) places it that 90.2% of males use the internet compared to 84.1% of females. Women face more disadvantages in access to digital technologies compared to men. There are also regional disparities in internet availability; while it is more than 98% in cities, it is around 85% in rural communities. Digital literacy refers to an individual's capability to use the internet effectively (Selwyn, 2004: 344). The disparities of digital literacy vary within all of Türkiye. Data from 2024 indicates that 49.5% of internet users take part in e-commerce activities, which showcases the growth of the digital economy in Türkiye. Though there has been general augmentation concerning access to the internet in Türkiye, a digital divide still exists for particular groups. Policies like infrastructure investment would increase it in rural areas, and programs on digital education that would be expanded alongside women's digital skills can play important roles in this lessening the differences that exist online Türkiye has achieved high levels of internet penetration (TÜİK, 2024), disparities however

do exist gender-wise, age-wise regional-wise and socioeconomic status. Selwyn (2004) and van Dijk (2020) identify digital literacy as a deeper level of the divide that continues to be a hindrance among rural populations and the aging. Despite increased adoption of e-commerce (49.5% in 2024), internet capabilities and accessibility differ by gender. Infrastructure and digital education investments are necessary in overcoming these disparities.

**Table 1: Internet Access and Usage Statistics in Türkiye (2024)**

Category	Statistic	Source
Household Internet Access	95.1% of households have internet access	TÜİK, 2024
	(up from 88.3% in 2019)	TÜİK, 2024
Internet Usage (Ages 16–74)	87.1%	TÜİK, 2024
By Gender	Males: 90.2%	TÜİK, 2024
	Females: 84.1%	TÜİK, 2024
Urban vs Rural Access	Urban: over 98%	TÜİK, 2024
	Rural: around 85%	TÜİK, 2024
Disparities in Digital Literacy	Vary by age, education, socioeconomic status	TÜİK, 2024
E-Commerce Participation	49.5% of internet users	TÜİK, 2024

Source: <https://data.tuik.gov.tr>

## 2.2. Cultural and Societal Impacts

Türkiye's rising use of digital technology has the potential to significantly alter existing social and cultural norms (Syamsiyatun, 2020:321, 335). The rapid transition to digital platforms for communication, business, and social exchange is transforming family dynamics across communities and people's interactions with their physical and social environments (Şahin, 2023: 193). Türkiye's rich cultural heritage and strong family values are facing new challenges as modern technologies enable new forms of social engagement and blur the line between public and private spaces. The widespread use of social media and digital platforms has significant implications for Turkish public discourse, political engagement, and social cohesion (Cihangir 2020: 188). Digital technologies have also made it possible to disseminate information quickly, allowing citizens to be more involved in political and social affairs. Güz, Yeğen, and Yanık's study in Türkiye (Güz et al., 2017) revealed that new media form an important news and information source. Greater access to information has, however, facilitated the spread of misinformation, conspiracy theories, and polarizing narratives with the potential to erode society cohesion as well as democratic processes (Taskin et al., 2021: 2361). Anonymity and decentralization of digital platforms can enhance these risks by making it difficult to assess content quality and credibility (Dumbrava, 2021).

Since then, the proliferation of digital technologies has led to growing concerns about online privacy and security (Sawaneh et al., 2021: 38). More information is at stake, transmitted through these digital means, personal and sensitive data now have higher probabilities of being compromised, stolen, or monitored (Cakrani 2013: 280). In Türkiye for securing people's confidence as well as ensuring individual privacy protection requires personal data protection

in addition to strong digital regulatory principles (Kartal, 2018: 2; Özkan et al., 2022: 297-300). These aspects make social and cultural impacts very multidimensional and broad regarding Türkiye's digital transformation (Sütlü & Onursal, 2020: 376). Increased interconnections between greater productivity and civic participation with digital technology also create new challenges for mainstream value maintenance, public debate quality, and individual private as well as data integrity (Bankins et al., 2023: 160). As information technologies enable increased connectivity, productivity, and civic engagement, they also create new challenges to maintain traditional values, the legitimacy of public discourse, and to protect citizen privacy and data security. These challenges need to be solved by an extended strategy that reconciles technological progress with maintaining the social and cultural identity of Turkish society (Vurdu, 2021: 53; Imer & Kaya, 2020: 7-8).

### **2.3. Education and Skills Development**

Ersoy (2019) and Saçak et al. (2020) contend that the digital transformation of Türkiye highly contributes to education and digital competence building. The educational system needs to change with the emergence of the need for digital employees, since the system has to equip learners with the skills necessary for them to thrive in the digital economy. Integrating digital technology into educational curricula, creating online learning platforms, and educating teachers in digital pedagogies are all crucial steps toward preparing Türkiye's workforce for the digital age (Aydoğan, 2024; Bagaric & Franca, 2021: 46-51). As Türkiye progresses through its digital transformation, the development of education and skills emerges as a fundamental factor in ensuring economic competitiveness and social inclusion (Aly, 2022: 240). Digitalization in education and in vocational learning is vital in bridging skills gaps and preparing individuals for the new demands of the digital economy (Schwab, 2017). Türkiye has done an amazing job of using digital technologies in its educational program. The 2010-initiated Fatih Project aimed to foster interactive learning environments by adding smart boards to each classroom and tablets to each student (Yavuzalp et al., 2015: 118-119). Nevertheless, such digital access inequities persist, particularly in rural areas with limited access to broadband (World Bank, 2022). Universities and vocational training centers are also adapting to digitalization through online learning tools and industry-specific courses. STEM (Science, Technology, Engineering, and Mathematics) education is gaining traction in universities, while coding and data analytics courses are growing more popular in secondary schools (Srivastava, 2023: 3; OECD, 2021). This includes integrating digital skills training programs, such as coding and computational thinking, into the curriculum, as well as investing in modern educational facilities and technology, particularly in rural and underprivileged areas (Belmar, 2022: 3). Beyond formal education, the introduction of lifelong learning opportunities and ongoing upskilling activities will be critical in preparing Turkish citizens to meet the growing needs of the digital economy (Semerci et al., 2020: 70-72). However, gaps in digital literacy among educators and students indicate the need for continuous professional development programs. One of the most significant hurdles to Türkiye's digital transformation is the skills gap between the workforce and the expectations of the digital economy. Recent surveys indicate that a significant section of Türkiye's workforce lacks advanced ICT skills, hindering their ability to adapt to new technology (TÜİK, 2024). The organizations are therefore investing in upskilling employee programs. The government initiatives take the form of the National Technology Initiative, which is responsible for promoting digital literacy at all levels of education (Veres et al., 2021: 2-5; Ministry of Industry and Technology, 2023). The

increased share of remote work and online entrepreneurship maximizes the degree of soft skills such as adaptability, critical thinking, and digital communication. Closing these gaps requires the collaboration of politicians, education, and business. In turn, the digitalization of Türkiye has challenged and offered the prospects of education and skills development. To break these challenges, governments, educators, and stakeholders from industry should join hands to make digital skills a tool for success in the digital era for the challenged citizens (Matriano, 2023: 2).

To promote education and skills development in Türkiye's digital transition, many policy steps are required:

*Expanding Digital Infrastructure:* Providing equal access to high-speed internet and digital devices, especially in underserved areas.

*Enhancing Teacher Training Programs:* Implementing ongoing digital literacy and pedagogical training for instructors.

*Strengthening Industry-Academia Collaboration:* Promoting collaboration between universities and technology companies to better match courses with market demands.

*Promoting Lifelong Learning:* Creating flexible and accessible reskilling programs to help workers shift to digital careers.

Education and skill development are the critical components of Türkiye's digital revolution. Much has been achieved in this regard, though the problems of accessibility, digital literacy, and the readiness of the workforce persist. A program approach supported by technical investment, policy reform, and industry partnership will be critical to delivering education for the skills required to thrive in the digital age for all parts of the Turkish population. Thus, it is meant to empower all sections of the Turkish populace to take full advantage of the opportunities offered by the digital age (Şahin, 2023: 194).

## **2.4. Opportunities in Türkiye's Digital Transformation**

The rapid expansion of e-commerce is one of the most promising opportunities arising from the digital transformation of Türkiye. Recent data from the Turkish Ministry of Trade says that the e-commerce volume in Türkiye was 61.7% in 2024 over the previous year, reaching 3.16 trillion TL. The compound annual growth rate was 85.66% from 2019 to 2024 (Ministry of Trade, 2024). Mobile commerce and AI-driven personalized shopping experiences are examples that are provided by the OECD to explain how this rise is possible, by which consumer engagement is improved (OECD, 2022). In Türkiye in 2024, 51.7% of the population aged 16 to 74 years reported that they had purchased or ordered goods or services over the internet in the last 12 months. This percentage was 49.5% in 2023. The share of e-commerce customers was slightly higher among males (54.1%) than among females (49.3%). Some 38.8% of e-commerce customers had purchased in the first three months of 2024. Among the e-commerce customers, the most purchased items were clothing, shoes, or accessories (76.7%), then restaurant or catering services (47.5%), groceries (34.0%), and cosmetics and wellness products (32.4%) in descending order. Hygiene products made the sixth item on the list with 29.2% purchased. Gender disparities were stark. Some 83.0% of females purchased clothing, shoes, or accessories, and 46.6% bought cosmetics and wellness products. These percentages for males are 70.3% and 49.2%, respectively (As seen in Table 2).

**Table 2: Proportion of Buying or Ordering Goods or Services Over the Internet by the Latest Time, 2014-2024**

Category	Statistic	Source
Digital Transformation Impact	Enhances economic growth, social inclusion, and innovation	World Economic Forum, 2021
E-Commerce Growth (YoY)	+61.7% in 2024	Ministry of Trade, 2024
E-Commerce Volume (2024)	3.16 trillion TL	Ministry of Trade, 2024
CAGR (2019–2024)	85.66%	Ministry of Trade, 2024
Individuals Buying Online (2024)	51.7%	Ministry of Trade, 2024
Individuals Buying Online (2023)	49.5%	Ministry of Trade, 2024
Gender Breakdown (2024)	Males: 54.1% Females: 49.3%	Ministry of Trade, 2024
Online Purchases (Jan–Mar 2024)	38.8% of users	Ministry of Trade, 2024
<b>Top E-Commerce Categories</b>	<b>% of Users Purchasing:</b>	
Clothing, Shoes, Accessories	76.7%	Ministry of Trade, 2024
Restaurant & Catering Deliveries	47.5%	Ministry of Trade, 2024
Groceries	34.0%	Ministry of Trade, 2024
Cosmetics & Wellness Products	32.4%	Ministry of Trade, 2024
Hygiene Products	29.2%	Ministry of Trade, 2024
<b>Gender-Specific Purchase Trends</b>		
Clothing, Shoes, Accessories	Women: 83.0% Men: 70.3%	Ministry of Trade, 2024
Cosmetics & Wellness Products	Women: 46.6%	Ministry of Trade, 2024
Restaurant Deliveries	Men: 49.2%	Ministry of Trade, 2024
Supporting Trends	Mobile commerce and AI-driven personalization	OECD, 2022

Source: TÜİK, 2024

Recent studies show the growth of e-commerce businesses in Türkiye and hence the hopeful prospect of a strong online ecosystem that will attract both local and global customers (Bilik, 2023). The growing digital economy market offers substantial importance to economic growth and the creation of digital jobs, among other sectors (Digital Economy, 2024). The fintech industry is one of the most significant beneficiaries of the digital transformation taking place in Türkiye (Bayram et al., 2022: 1-4). Just recently, all three mobile start-ups based in Türkiye secured investments for digital banking, blockchain applications, and mobile payments. Such advancements support financial inclusion, primarily in the rural and underserved areas. Focused on the recent potential research within the region, the paper posits that, with the necessary government support, Türkiye can emerge as a fintech hub in its adjoining countries (Varsak, Öztürk & Yalçın, 2023: 38). Through sustained investments, the country leverages financial inclusion barriers and integrates the unbanked population into the digital economy. One large component of smart cities' investments is the digital transformation agenda in Türkiye, particularly in major cities such as Istanbul and Ankara, which are implementing traffic sys-

tems based on the Internet of Things, IOT-centric smart grids, and AI-driven services that can improve urban efficiency and sustainability, reducing this waste and costs in energy (Trade.gov, 2023). Though these projects are not specified in the Ministry of Transport and Infrastructure 2023 report, developments indicate strong collaboration between the public and private sectors and municipalities (Kamu Araştırmaları Vakfı, 2023). It is in this kind of development that Türkiye proves its commitment to critically applying digital innovation to make a qualitative difference in life and support ecologically sensitive town planning. These initiatives will not only provide business opportunities but will also ensure resource management efficiency in sustainable urban development (Vardarli & Cakir, 2015). The development of smart city technologies will improve public service delivery and create a more connected urban environment (Boz & Cay, 2024: 3). Türkiye's urban centers can play essential roles in the digital economy if proper infrastructure is available, and in this case, the right infrastructure would be a rise in digital entrepreneurship in Türkiye (Bayar et al., 2020: 130-135). This, in turn, indicates a major economic development opportunity through government initiatives in artificial intelligence, cybersecurity, and cloud computing startup investments, and even more through their investment in upskilling programs for example coding boot camps and digital literacy programs to reskill the workforce for the digital economy as reported by the European Commission in 2023 (Demir, 2024:348). In addition, digital entrepreneurship fosters job creation and innovation, which will eventually lead young entrepreneurs to be able to contribute to economic growth. Türkiye's digital transformation has plenty of opportunities to raise economic growth, financial inclusion, smart urbanization, and support for digital entrepreneurship (Banking Regulation and Supervision Agency, 2023). By improving the regulations regime and investing in the digital infrastructure, plus putting more emphasis on the workforce development, all these efforts will place Türkiye in a leading position regionally for technological innovation and digital economic integration.

## **2.5. Development, Opportunities, and Challenges of e-Government Applications in Türkiye**

Launched in 2008, it has since grown into a broad digital governance platform that unites thousands of services and hundreds of institutions connected to Türkiye. Operating under the Presidency's Digital Transformation Office and being implemented by Türksat A.Ş., this platform maintains its efforts in providing secure, available, and citizen-centric public services 24/7 (e devlet-istatistikleri). Continuous software and infrastructure upgrades reflect the development of technology to keep everything in line with service quality and data security. As seen in Table 3, by April 2025, the portal will deliver 8,482 services from more than 1,080 institutions central government, municipalities, universities, utilities, and many others, including private companies. It has also supported various types of authentications, e-Government passwords, mobile signatures, e-signatures, ID cards, and online banking. With more than 67.6 million registered users, 48.4% female, and 51.6% male, it serves almost the entire adult population. Mobile access added a lot of usability, a satisfaction survey among 1 million respondents showed 95.8% approval, conducted in 2024. The platform helps the desk receive more than 9.2 million calls, and nearly all were resolved. e-Devlet simply makes public access to justice, education, health, and the environment. It also gives real-time updates through web, mobiles, and social media. The centralism of the structure of information flows enables citizens, busi-

nesses, and the government sector, public administration to help digital transformation is fast and secure (Yıldırım & Bostancı, 2021: 260).

**Table 3: Key e-Government Statistics in Türkiye (2025)**

<b>Category</b>	<b>Metric</b>
<b>Total Users</b>	<b>67,611,012</b>
Female Users	32,739,976
Male Users	34,871,036
<b>Total Services</b>	<b>8,482</b>
Web-Based Services	6,716
Mobile Services	5,236
<b>Institutions</b>	
Central Government Institutions	204
Universities	206
Municipalities	524
Water and Sewerage Administrations	30
Private Institutions	126
<b>Call Center Statistics</b>	
Total Calls	9,224,201
Resolved Calls	9,224,144
Unresolved (Pending) Calls	57
<b>Satisfaction Survey</b>	
2023 Satisfaction Rate	94.8% (1 million users)
2024 Satisfaction Rate	95.8% (1 million users)

Source: e-devlet-istatistikleri, 2025.

### 3. Legal Challenges and Opportunities

#### 3.1. Regulatory Framework

A holistic and flexible adaptive rule and regulation model balancing the yin of due process with the yang of individual and societal interests has been pursued by many authors in recent years in light of the Turkish digital revolution (Ersöz et al. 2018: 248-250). Fast implementation of digital technologies brings with it new legal problems that require strong, agile control structures. For example, the protection of the Turkish people's privacy and digital sovereignty calls for extensive and effective data protection measures, which would involve initiating channels for data subjects to report breaches (Ersoy, 2019: 9-11; Özkan et al., 2022: 298). Türkiye passed Law No. 6698 on April 7, 2016 (KVKK, 2016) to fulfill the law for the protection of personal data. That law was enacted to ensure privacy and the protection of the security of individual data. Also, to ensure the protection of human basic rights and freedoms, the KVKK has been established as the control department of that legislation (As seen in Table 4). The current

legal framework has been exposed to flaws and limitations by the increasing volume and complexity of data flows, plus the proliferation of digital services and platforms. This is also true for Türkiye, growing its cybersecurity ecosystem rapidly; it needs stronger regulatory oversight, together with implementing national cybersecurity strategies (Ersoy, 2019; Gürkaynak et al., 2013: 185-188). The threats to individuals, businesses, and critical infrastructure are significant regarding cybercrime, online fraud, phishing, and data breaches. To take the necessary steps for building and bringing the right level of cybersecurity rules in the country, building a high level of digital literacy and awareness, and enhancing public-private cooperation in incident response and threat intelligence sharing is essential (Smoleń, 2019: 29-33).

**Table 4: Key Legislative and Strategic Documents on AI and Data Protection in Türkiye**

Legislation / Strategy	Year	Key Areas	Main Provisions
Artificial Intelligence Law Proposal	2024	AI governance, ethics, and accountability	Risk classification, conformity assessment, registration of high-risk systems, administrative fines (up to 35M TRY or 7% turnover), transparency and fairness principles
Law on the Protection of Personal Data (KVKK) – Amendments	2024	Data privacy, cross-border data transfer	Expanded grounds for processing sensitive data, new regime for international data transfers, administrative appeals available for sanctions
National Artificial Intelligence Strategy (2021–2025)	2021	Human capital, innovation, infrastructure, regulation, ethics	Develop AI workforce, support R&D, ensure ethical AI use, promote international cooperation, enable regulatory framework for digital economy
KVKK Guidelines on AI and Data Protection	2021	AI-specific privacy measures	Promote privacy impact assessments, data minimization, transparent consent, developer accountability

Source: <https://www.adalet.gov.tr>; <https://www.kvkk.gov.tr>

The regulation of online content and the digital economy raise unique concerns. The growth of social media platforms, digital markets, and user-generated content has raised concerns about the spread of misinformation, hate speech, and anticompetitive activity (Donkers & Ziegler, 2023: 2-3). To strike a balance between the principles of free expression and the need to maintain a safe and trustworthy digital environment, regulations must be carefully crafted to address the complexities of the digital landscape while protecting fundamental rights and encouraging fair competition (Matthews, 2022). Overall, the legal and regulatory framework that guides Türkiye’s digital transformation must keep up with the rapid pace of technological advancement. A comprehensive and flexible approach, led by global best practices and stakeholder participation, will be essential for ensuring individual rights, innovation, and the long-term development of Türkiye’s digital ecosystem.

### 3.2. E-commerce and Digital Contracts

The emergence of e-commerce and the increasing dominance of digital deals have created new legal problems in Türkiye, which require strong management (Ersöz et al., 2018:

249). Rules for e-commerce and digital agreements should settle consumer protection, dispute resolution, and matters with cross-border transactions. The Turkish Law on the Regulation of Electronic Commerce sets the rules for online deals (Öztürk, 2021: 1242). But online markets have grown too fast; digital places have grown too quickly, and newer business models have overgrown the existing statutory scheme, thereby in some areas filling the existing gaps and providing clarity for some uncertainties (Rizka, 2020:28). This involves clear refunds, returns, and warranties to a large extent that will ensure consumer protection and, thus, also build confidence and trust for the customer in the digital economy. A comprehensive legal model has been initiated by Türkiye for conducting e-commerce, protecting consumers, and building confidence in the digital market. As seen in Table 5, 6563 on the Regulation of Electronic Commerce (2014) it shall be responsible for ensuring the obligations of service providers as related to transparency, information to the consumer, and electronic contracts. Another modification, the 2022 amendment (Law No. 7416), introduced more rules regarding anti-competitive practices to apply to the large e-commerce platforms. The electronic contracts and digital signatures have legal recognition under Electronic Signature Law No. 5070. It was online transactions that triggered consumer protection by the Consumer Protection Law No. 6502, guaranteeing rights such as refunds, warranties, and the right of withdrawal. Additional regulations support secure online communication and complaint channels. The efficiency and enforceability of online agreements are ensured through the use of standardized digital contract templates and legal recognition of electronic signatures (Howells, 2019: 146). Digital challenges can be thrown into the matrix by cross-border e-commerce, especially by the conflicts of jurisdiction (Burdon, 2021). This requires proper online dispute resolution mechanisms to be set up with strong transparency and legal standardization in all relevant jurisdictions, and, as an addition, the capacity of a fair trade regulator (Development, 2023). Further, regulation in cross-border e-commerce must take into account the broad issues involved in international trade, taxation, and customs regulation. Setting up teamwork legal plans with outside friends can boost world market entry for Turkish firms while giving buyers more product availability. Beating these rule barriers is key for Türkiye to build a strong and innovation-focused digital economy that protects consumer rights and backs long-term e-commerce development.

**Table 5: Legislative and Strategic Frameworks Governing Artificial Intelligence and Data Protection in Türkiye**

Law / Regulation	Key Provisions	Year
Law No. 6563 on the Regulation of Electronic Commerce	Defines service provider responsibilities, transparency, consumer information, electronic contracts	2014
Amendment Law No. 7416	Adds rules against anti-competitive practices, introduces new obligations for large e-commerce platforms	2022
Electronic Signature Law No. 5070	Grants legal recognition to electronic contracts and digital signatures	2004
Consumer Protection Law No. 6502	Ensures consumer rights in online transactions (refunds, warranties, right of withdrawal, etc.)	2013

Source: <https://www.resmigazete.gov.tr>

### 3.3. AI and Data Governance

A significant wave of change arising out of the use of artificial intelligence, in parallel with the accumulation and utilization of data at an exponential rate, will reach the transformations at the heart of Türkiye (Moss, 2024). Organizations that make investments in AI systems and undertake research on the same systems in fields like healthcare, banking, and public services, among many others, are able to improve their decision-making processes, increase efficiency, and personalize service delivery to individual clients (Turan et al., 2020: 248). Legal and ethical issues have gained prominence and must be addressed due to the increased use of flows and data-driven technology. This could harm privacy, lead to the wrong usage of personal information, and create algorithmic bias. Algorithmic bias is a top concern because artificial intelligence systems can institutionalize and enhance present societal biases by making unjust and discriminatory decisions in fields like healthcare, banking, and public services, among many others (Stahl, 2021). A rigorous test and evaluation of AI algorithms with transparency and accountability measures would be important in lowering bias risks to ensure fair and equitable implementation of these technologies. The other issue is data privacy since the large capture and exploitation of personal data by AI-powered applications and platforms raises individual rights and the possibility of access by unauthorized persons (Alaran et al., 2025: 1-2). For securing the privacy and digital sovereignty of Turkish citizens, comprehensive data governance frameworks are to be built, having stringent data protection regulations, powerful encryption technologies, and clear consent mechanisms (Inside Privacy, 2016).

Strategic deployment of AI technology and big data analytics, as described above, would improve the quality and efficiency of public services, decision-making in governance, and hence long-term development of the digital economy in Türkiye (Moss, 2024). With due consideration of the benefits and risks of disruptive technology, it is under the power of Türkiye to use AI for enhanced citizen involvement, quicker decision-making processes, and personalized and relevant service for the public (İçen, 2022: 2; Şahin, 2023: 200). For this initiative to be successful, members of parliament, business leaders, and academia, together with non-governmental organizations, must work hand in hand to create an appropriate legal and ethical framework for the governance of AI and big data in Türkiye (Güner, 2020: 230-232). A framework of this nature should set down explicit standards for algorithm audits, data management, and accountability of AI, while encouraging a culture of responsible innovation that will safeguard fundamental rights in the digital age. In so doing, legal and regulatory barriers to innovation is identified, and at the same time, consumer rights are protected while assuring the long-term growth of the digital economy of the country (Ersoy, 2019: 9-11).

### 3.4. Opportunities

One of the key opportunities for the growth of business and access to the internal and global markets in the era of the digital revolution of Türkiye is the development of e-commerce. This development will trickle down to empower the small enterprises through the availability of low-cost e-commerce software aimed at wider client bases on a local and international level. The integration of emerging technologies such as blockchain and artificial intelligence will increase efficiency and security in financial services, ensuring transparency for businesses and customers (Qader & Çek, 2024:1-3). With the COVID-19 crisis, the investment in digital public services, including eHealth and eEducation, will enable access to important services,

mostly for underprivileged or geographically remote (Ozan, 2020: 3736). Furthermore, the integration of IoT and smart city technologies can enhance urban planning, resource management, and public service delivery, resulting in more sustainable and habitable communities across Türkiye. Capitalizing on these opportunities would allow Türkiye to promote inclusive economic growth, improve the efficiency and responsiveness of public institutions, and foster better social cohesion and digital literacy among its inhabitants.

### **3.5. Challenges**

However, Türkiye's digital transformation presents significant challenges that have to be addressed for the process to be efficient and fair. The most critical issue is the digital divide, which comprises the people who have access to digital resources and can effectively use them, and the others who do not. This may intensify existing socioeconomic inequalities as the direct beneficiaries of high-resource access are better positioned in terms of income, education, and location, among others. Widespread, affordable high-speed internet access and a digitally literate population can address the issue and drive digital inclusion to represent the whole demographic heterogeneity of Türkiye (Reisdorf & Rhinesmith, 2020: 133). A second major challenge would be the development of an appropriate and effective legal and regulatory framework for the digital economy while protecting the rights of workers and consumers. The rapid pace of technological change has, in addition, introduced new digital business models that do not address data privacy, cybersecurity, and equitable treatment for gig economy workers under existing laws and regulations (Boyd et al., 2019: 2). While the benefits of integrating artificial intelligence and big data analytics into different sectors are immense, the risks are also high, and such potential benefits can maintain and exacerbate existing societal inequities, leading to unjust and discriminatory decisions in sectors such as health, finance, and public administration. Therefore, proper scrutiny, through testing, and the application of transparency and responsivity mechanisms are key in not only dealing with bias but also ensuring the just and fair deployment of these technologies. The most crucial elements required to eliminate process bias that leads to unfair and unjust decisions in sectors such as health, banking, or public management include thorough testing and validation of AI algorithms as well as the enforcement of transparency and traceability measures (Abujaber & Nashwan, 2024: 2).

## **4. Economic Challenges and Opportunities**

### **4.1. Digital Infrastructure**

The Internet infrastructure has a significant role in Türkiye's digital transformation. There have been great improvements in the last years; however, there are still major shortcomings and insufficiencies that do not ensure the proper development of the digital economy's potential. As seen in Table 6, as of 2020, the fixed-broadband penetration rate was about 15%, under the OECD average. Therefore, the Turkish government has set a very ambitious target for the whole country to be covered by fiber optics until 2023, also including a 5G implementation, which should mean that there would be high-speed internet access everywhere. One such scheme is the 'Fiber-to-the-Home' program designed to serve residential and business users with fiber infrastructure as of March 2024; there were about 94.2 million internet subscribers in the country, including 74.4 million mobile internet users and 7 million using fiber internet. The share of fiber internet subscribers of fixed broadband users stood at 35.3%, as such below OECD's 42%

average, which further speaks to the possible necessity of more investments in the infrastructure meant for fiber to enhance the speed and quality of services (Aktaş, 2024). The country's incumbent operator, Turk Telekom, extended its fiber-optic infrastructure to 437,000 kilometers by the end of 2023, reaching over 32 million households. More than half of its LTE 4G base stations had fiber backhaul, showing steady steps toward a more advanced digital infrastructure (Turk Telekom). Besides the other necessities, the country needs to develop data center and cloud computing service capabilities as well, if ever the digital economy is to be sustained in Türkiye. Although Istanbul and Ankara, among other cities where 5G trials were held by major telecom operators such as Turkcell, Vodafone Türkiye, and TT Mobil, none had launched a nationwide commercial 5G by early 2024 (Lifewire, 2023). In a sign of what the technology could provide, Turk Telekom in 2021 conducted a 5G network remote surgery via smart glasses. There has been increasing demand for solid data infrastructure as reliance on cloud-based services rises. While several local and global cloud firms have set foot in the Turkish market, more investments are needed to facilitate the rising demand for storage, processing, and digital services, etc. (Ozan, 2020: 3734). The Turkish data center market is forecast to attract \$688.0 million investments by 2029 at a CAGR of 6.52% (Arizton Advisory & Intelligence, 2024). To back this up, the growth, the rise of cloud adoption in the public and private sectors, has been put into the National Cloud Strategy by the government to increase efficiency and cut down on operational charges (TechSci Research, 2023). The balance of the infrastructural bottlenecks shall be a shared task between the public sector and the private sector. Initiatives for sharing digital infrastructure development, between sharing regulatory removal barriers and public-private partnership promotion from the government, must be taken into consideration (Development, 2022).

**Table 6: Key Performance Indicators of Türkiye's e-Government Gateway (as of April 30, 2025)**

Indicator	Value	Date
Fixed broadband penetration rate	~15%	2020
OECD average fixed broadband penetration	Higher than 15%	2020
Fiber internet subscribers	7 million	March 2024
Total internet subscribers	94.2 million	March 2024
Mobile internet users	74.4 million	March 2024
Fiber share in fixed broadband	35.3%	Early 2024
OECD average fiber share	42%	Early 2024
Fiber infrastructure length (Turk Telekom)	437,000 km	End of 2023
Households covered by fiber	32 million+	End of 2023
LTE 4G base stations connected with fiber	52%	End of 2023
Projected data center investment	USD 688.0 million	By 2029
Data center investment CAGR	6.52%	2024–2029
Nationwide 5G commercial rollout	Not yet achieved	As of 2024
Cities with 5G trials	Istanbul, Izmir, Ankara	Ongoing
National Cloud Strategy	Launched	Ongoing

**Source:** Republic of Türkiye Digital Transformation Office, e-Devlet Kapısı Statistics, accessed April 30, 2025.

## **4.2. Innovation Ecosystem**

The strength and dynamism of Türkiye's innovation ecosystem have become integral to its digital transformation, with a broad spectrum of participants, including research institutions, startups, and venture capital firms. The country has, in fact, increasingly opened up endeavors over the last couple of years to foster digital innovation and entrepreneurship. For example, the National Artificial Intelligence Strategy 2021–2025, a report published by the Presidential Digital Transformation Office and the Ministry of Industry and Technology, underlines the need for stronger collaboration among AI-focused startups and technology development zones and incubation centers. It also supports the idea of establishing excellence centers while encouraging the development of interdisciplinary research projects in hot areas such as artificial intelligence, blockchain, and the Internet of Things (The Türkiye National Artificial Intelligence Strategy, 2021-2025, 2021). TÜBİTAK is the other actor that undertakes the responsibility of encouraging research and development. Aiding the drive of Türkiye's digital agenda forward are the newly emerging technologies investment by Türkiye through institutions such as TÜBİTAK BİLGEM and its Blockchain Research Lab. In such a setting, these institutions will share new ideas with the business community, while at the same time, talent outside the community will be nurtured. Simultaneously, since the Turkish startup ecosystem has grown aggressively, a healthy circle of creative digital companies that exploit new technologies to address a broad set of societal and economic problems has formed (Kamel, 2022: 256-258). These startups have received very large investments from local and overseas venture capital companies, monies that come with the needed direction as well as the most important aspect of all.

One major type of those very challenges that result in inefficiencies within the innovation ecosystem of Türkiye involves upgrading intellectual property rights, reducing the ease of access to skilled workers, and public and private partnership laws and incentives that would better align to promote innovation and entrepreneurship (Hardelin et al., 2016; Turkish Ecosystem Overview and Trends 2024). Given this, governmental policies and actions are to play decisive roles. Among the many, the Turkish government introduced several programs and incentives that aimed at fostering a very vibrant innovation ecosystem that is, including reduced taxes related to R&D, and in addition to startup incubator and accelerator programs, technology development zones (Szczygielski et al., 2016: 220). Further, to require active policymaking investment in the areas to strengthen its position as a core center for digital innovation and entrepreneurship, more investments and effective policymaking would be required.

## **4.3. Industry Transformation**

Türkiye is in a digital revolution that is leading changes in essential industries, among the great challenges and opportunities. Automation, artificial intelligence, and the Internet of Things are technologies that can change the manufacturing environment and ensure quality and efficiency. Digital technology can help improve competitiveness in the small and medium-sized enterprise sector in Türkiye. High implementation costs and costs due to the high level of skill that needs to be attained by employees are a major drawback (Putong, 2023: 850). Big data, analytics, cloud, mobility, the Internet of Things (IoT), and security are hot tech trends that are currently reshaping Türkiye. They will also enable and support further process digitalization in the Turkish tourism industry in the near future (Chikurova & Çınar, 2020: 1137). Technologies

can streamline processes, enable superior customer experiences, and new revenue-generating opportunities, compelling an organization to make a shift through them. However, the fact that these technologies can streamline processes also raises data security and data privacy issues as well as new barriers to cyber protection (Bueno et al., 2024: 2). The financial sector is also undergoing great change and becoming a digital environment with the rise of mobile banking, fintech solutions, and services based on the blockchain. This raises financial inclusion and reduces the cost of transactions and sector efficiency, though to maintain consumer protection and stability in the financial system, there must be adequate regulations as well (Eroğlu et al., 2024).

#### 4.4. Opportunities

It is argued by Naz et al. (2022) and Yıldırım (2020) that the rapid digitalization of Türkiye can not only boost economic growth but also employment. One major driving factor that underpins the rapid growth of the country's digital innovation ecosystem is, in fact, a strong startup community, and quality research institutions coupled with venture capital investments (Isher, 2024: 832). This, in turn, will lead to new technology-based business models and applications through which skilled employment in such areas as artificial intelligence, data analytics, and software engineering will be created (Isher, 2024: 832-834). Some others add that high productivity and efficiency gains will be realized once the latest digital technology is adopted within the key sectors of the economy, such as manufacturing, tourism, and finance, among others (Abu-ALSondos et al., 2024: 362). Turkish companies can increase their competitiveness in the domestic and international markets through the implementation of automation, the Internet of Things, and advanced analytics (Vurdu, 2021: 59; Ersöz et al., 2018: 250). This involves the enhancement of product quality and customer experience. Türkiye's digital transformation can draw substantial foreign direct investment in new-age infrastructure and technologies. This will seal the country's space as one of the most preferred destinations for global firms willing to capitalize on the digital revolution (Çınar, 2020: 2418). To take advantage of this, most thoroughly and collaboratively, governments, business leaders, and educational institutions must work together. Coordinated steps for the strengthening of intellectual property rights, upskilling the workforce, and related regulations to bridge the gap in digital expansion will be important to have lasting effects from which the gains of the digital transformation of Türkiye will be sustained and evenly shared (Ersoy, 2019: 9-11).

#### 5. Conclusion

This research has shaped the Turkish digital story with a mix of disciplines, drawing key results from the social, legal, and economic debate. It is from a literature view of an integral world, where on one hand infrastructures, entrepreneurial ecosystems, and top strategic moves by the government have been fairly good, in a due course, and even then the greater challenges, such as unequal regional access to digital services, the fragmentation of regulations, and the low maturity of data management, continue to take central stage. It is under a highly reputable scholarship that the bulk of the writing has been done on the impact of such policy frameworks as the National AI Strategy and e-Government initiatives. Just a little, if any, real research has been done on the social impacts of these frameworks, especially in marginalized communities. The convergence between algorithmic regulation and legal ethics is relatively less researched

and, within the Turkish context, underdeveloped. As an alternative to sectoral technological innovation, the literature prays for a cross-sectoral approach towards inclusive governance and rights-based regulatory design. Future research should give priority to longitudinal analysis, comparative regional study, and the implementation outcomes, further treatment of the bridging gap between digital policy and lived experience. This will not only strengthen the scholarly understanding more distinctly but will also make a very strong, robust base for making evidence-based policy for Türkiye in its ongoing transition in the digital world.

#### **Researchers' Contribution Rate Statement**

All stages of the study were prepared by the corresponding author.

#### **Conflict of Interest Statement**

There is no potential conflict of interest in this study.

#### **References**

- Abu-ALSondos, I. A., Shehadeh, M., Ajouz, M., Alkhwaldi, A. F., Abdeldayem, M., & Aldulaimi, S. H. (2024, January). The role of digital transformation in business: opportunities challenges and future directions. In *2024 ASU International Conference in Emerging Technologies for Sustainability and Intelligent Systems (ICETISIS)*, (pp. 361-365). IEEE. <https://doi.org/10.1109/icetisis61505.2024.10459639>
- Abujaber, A. A., & Nashwan, A. J. (2024). Ethical framework for artificial intelligence in healthcare research: A path to integrity. *World journal of methodology*, *14*(3), 94071. <https://doi.org/10.5662/wjm.v14.i3.94071>
- Aktaş, Adil Batuhan (2024), Retrieved from [https://en.teyit.org/in-depth/is-Türkiyes-internet-speed-holding-it-back-a-closer-look-at-the-data?utm\\_source=chatgpt.com](https://en.teyit.org/in-depth/is-Türkiyes-internet-speed-holding-it-back-a-closer-look-at-the-data?utm_source=chatgpt.com) Accessed: 15.05.2025
- Alaran, M. A., Lawal, S. K., Jiya, M. H., Egya, S. A., Ahmed, M. M., Abdulsalam, A., ... & Lucero-Priso III, D. E. (2025). Challenges and opportunities of artificial intelligence in African health space. *Digital Health*, *11*, 20552076241305915. <https://doi.org/10.1177/20552076241305915>
- Aly, H. (2022). Digital transformation, development and productivity in developing countries: is artificial intelligence a curse or a blessing?. *Review of Economics and Political Science*, *7*(4), 238-256. <https://doi.org/10.1108/REPS-11-2019-0145>
- Arizton. (2024). Türkiye Data Center Market Investments Opportunities. Retrieved from <https://www.arizton.com/market-reports/Türkiye-data-center-market-investment-analysis> Arizton Advisory & Intelligence+1GlobeNewswire+1. Accessed: 03.05.2025
- Aydoğan, E. (2024). *Digital Work in the Age of Precarity* (Master's thesis, Middle East Technical University). <https://tez.yok.gov.tr>. Accessed: 03.05.2025
- Bagaric, D., & Franca, V. (2021). What will the future bring? Work, digitalization, and social protection under Society 5.0. *İnsan ve İnsan*, *8*(30), 45-55. <https://doi.org/10.29224/insanveinsan.977145>
- Banking Regulation and Supervision Agency. (2023). *Fintech and Digital Banking Report*. Retrieved from [www.bddk.org.tr](http://www.bddk.org.tr). Accessed: 03.05.2025
- Bankins, S., Ocampo, A. C., Marrone, M., Restubog, S. L. D., & Woo, S. E. (2024). A multilevel review of artificial intelligence in organizations: Implications for organizational behavior research and practice. *Journal of organizational behavior*, *45*(2), 159-182. <https://doi.org/10.1002/job.2735>

- Bayar, D. Y., Guven, H., Badem, H., & Soylu Sengor, E. (2020). National smart cities strategy and action plan: The Turkey's smart cities approach. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 44, 129-135. <https://doi.org/10.5194/isprs-archives-xliv-4-w3-2020-129-2020>
- Bayram, O., Talay, I., & Feridun, M. (2022). Can FinTech promote sustainable finance? Policy lessons from the case of Turkey. *Sustainability*, 14(19), 12414. <https://doi.org/10.3390/su141912414>
- Belmar, H. (2022). Review on the teaching of programming and computational thinking in the world. *Frontiers in Computer Science*, 4, 997222. <https://doi.org/10.3389/fcomp.2022.997222>
- Bilik, M. (2023). Analyzing challenges and opportunities in the e-commerce industry of Turkey. *İzmir İktisat Dergisi*, 38(4), 1138-1151. <https://doi.org/10.24988/ije.1262286>
- Boyd, A., Gatewood, J., Thorson, S., & Dye, T. D. (2019). Data diplomacy. *Science & diplomacy*, 8(1), <http://sciediplomacy>. <https://pubmed.ncbi.nlm.nih.gov/31598426>
- Boz, Y., & Cay, T. (2024). How smart and sustainable are the cities in Türkiye?-National policies and the enthusiasm level of the local governments. *Heliyon*, 10(4). <https://doi.org/10.1016/j.heliyon.2024.e26002>
- Bueno, L. A., Sigahi, T. F., Rampasso, I. S., Leal Filho, W., & Anholon, R. (2024). Impacts of digitization on operational efficiency in the banking sector: Thematic analysis and research agenda proposal. *International Journal of Information Management Data Insights*, 4(1), 100230, 1-12. <https://doi.org/10.1016/j.ijime.2024.100230>
- Burdon, T. (2021). OECD Going Digital Toolkit Notes: The role of online marketplaces in enhancing consumer protection. <https://doi.org/10.1787/ddca0e2e-en>
- Cakrani, E. (2013). Technology and Privacy, Internet Effects on Privacy. *Mediterranean Journal of Social Sciences*, 4(9), 279-283. <https://doi.org/10.5901/mjss.2013.v4n9p279>
- Chikurova, T. Y. (2020, May). Influence of Digital Economy on Personnel Training for Hotel and Tourism Business. In *2nd International Scientific and Practical Conference "Modern Management Trends and the Digital Economy: from Regional Development to Global Economic Growth" (MTDE 2020)* (pp. 1137-1140). Atlantis Press. <https://doi.org/10.2991/aebmr.k.200502.188>
- Cihangir, M. (2020). Sosyal Medya Devriminin Neo-Politik Boyutlari: Panoramik Bir Inceleme. *Akademik Araştırmalar ve Çalışmalar Dergisi (AKAD)*, 12(22), 186-196. <https://doi.org/10.20990/kilisiibfakademik.621353>
- Çınar, K. (2020). The digital revolution: Impact on tourism education. *Journal of Tourism & Gastronomy Studies*, 8(4), 2417-2443. <https://doi.org/10.21325/jotags.2020.719>
- Demir, L. (2024). Digital transformation in Turkish higher education. *International Online Journal of Education and Teaching (IOJET)*, 11(2), 345-356.
- Development, U. N. C. on T. and. (2022). Digital Trade: Opportunities and Actions for Developing Countries. In UNCTAD policy brief. United Nations Publications. Retrieved from <https://doi.org/10.18356/27082822-92> Accessed: 10.05.2025
- Development, U. N. C. on T. and. (2023). African Continental Free Trade Area: Design of Dispute Settlement Mechanism Should Reflect Preferences and Realities of All Its Member States. In UNCTAD policy brief. United Nations Publications. <https://doi.org/10.18356/27082822-105>
- Türkiye - Digital Economy, (2024). Retrieved from <https://www.trade.gov/country-commercial-guides/turkiye-digital-economy>. Accessed: 10.05.2025
- Donkers, T., & Ziegler, J. (2023). De-sounding echo chambers: Simulation-based analysis of polarization dynamics in social networks. *Online Social Networks and Media*, 37, 100275, 1-64. <https://doi.org/10.2139/ssrn.4437898>

- Dumbrava, C. (2021). Key risks posed by social media to democracy. [https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/698845/EPRS\\_IDA\(2021\)698845\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2021/698845/EPRS_IDA(2021)698845_EN.pdf)
- Eroğlu, M., Finger, M., & Köksal, E. (Eds.). (2024). *The Economics and Regulation of Digitalisation: The Case of Türkiye*. Taylor & Francis. <https://doi.org/10.4324/9781032692937>
- Ersoy, E. C. (2019). Examining Turkish law on data protection. *Computer Fraud & Security*, 2019(9), 9-11. [https://doi.org/10.1016/S1361-3723\(19\)30095-8](https://doi.org/10.1016/S1361-3723(19)30095-8)
- Ersöz, F., Merdin, D., & Ersoz, T. (2018). Research of Industry 4.0 awareness: a case study of Türkiye. *Economics and Business*, 32, 247-263. <https://doi.org/10.2478/eb-2018-0019>
- European Commission. (2023). *Türkiye Digital Skills Strategy*. Retrieved from [www.ec.europa.eu](http://www.ec.europa.eu) Accessed: 11.05.2025
- Güner, C. (2020). Yapay Zekânın Verdiği Zarardan Doğan Sözleşme Dışı Sorumluluğa Uygulanacak Hukuk. *Uyuşmazlık Mahkemesi Dergisi*, (15), 229-272. <https://doi.org/10.18771/mdergi.757376>
- Gürkaynak, G., Yılmaz, I., & Taşkıran, N. P. (2013). Governmental efforts and strategies to reinforce security in cyberspace. *International Law Research*, 2(1), 185-194. <https://doi.org/10.5539/İL.v2n1p185>
- Güz, N., Yegen, C., & Yanık, H. (2017). New media as news and information source: Sample of Muş province. *International Journal of Social Sciences and Education Research*, 3(4), 1404-1417. <https://doi.org/10.24289/ijsser.312902>
- Hardelin, J., Melyukhina, O., Wei, L., & Bayramoglu, B. (2016). Innovation, Agricultural Productivity and Sustainability in Türkiye. In OECD food and agricultural reviews. Organization for Economic Cooperation and Development. <https://doi.org/10.1787/9789264261198-en>
- Howells, G. (2020). Protecting consumer protection values in the fourth industrial revolution. *Journal of Consumer Policy*, 43(1), 145-175. <https://doi.org/10.1007/s10603-019-09430-3>
- The Turkey National Artificial Intelligence Strategy (2021-2025), Retrieved from <https://dig.watch/resource/the-national-artificial-intelligence-strategy-2021-2025> Accessed: 10.05.2025
- Republic of Türkiye Ministry of Trade. Economic Outlook December (2024). Retrieved from [https://www.trade.gov.tr/data/5b9229ab13b876136466584b/Economic%20Outlook%202024%20December.pdf?utm\\_source=chatgpt.com](https://www.trade.gov.tr/data/5b9229ab13b876136466584b/Economic%20Outlook%202024%20December.pdf?utm_source=chatgpt.com) Accessed: 10.05.2025
- e-Devlet Kapısı İstatistikleri. Retrived from <https://www.turkiye.gov.tr/edevlet-istatistikleri> Accessed: 10.05.2025
- Hüsnüoğlu, N., & Öztürk, L. (2017). Dijital bölünme: Nedenleri ve türleri. *Giresun Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 3(5), 6-21.
- İçen, M. (2022). The future of education utilizing artificial intelligence in Turkey. *Humanities and Social Sciences Communications*, 9(1), 1-10. <https://doi.org/10.1057/s41599-022-01284-4>
- Imer, G., & Kaya, M. (2020). Literature review on digital citizenship in Turkey. *International Education Studies*, 13(8), 6-15. <https://doi.org/10.5539/ies.v13n8p6>
- Inside Privacy. (2016). Türkiye's First Comprehensive Data Protection Law Comes Into Force. Retrieved from <https://www.insideprivacy.com/data-security/Türkiyes-first-comprehensive-data-protection-law-comes-into-force/> Accessed: 12.05.2025
- Isher, A. K., & Gangwar, V. P. (2024). Driving innovation and economic development: The role of business incubators in agri-tech start-up ecosystems. *Economic Affairs*, 69(2), 831-841. <https://doi.org/10.46852/0424-2513.3.2024.7>

- Kamel, S. (2022). The Influence of Entrepreneurship on the Arab Cultures and Economies: Reflections from Egypt's Entrepreneurial Journey. In *Entrepreneurship and Social Entrepreneurship in the MENA Region: Advances in Research* (pp. 255-279). Cham: Springer International Publishing. [https://doi.org/10.1007/978-3-030-88447-5\\_10](https://doi.org/10.1007/978-3-030-88447-5_10)
- Kartal, M. T. (2018). Kişisel verilerin korunması: Türk bankacılık sektörü üzerine kavramsal bir değerlendirme. *Uluslararası Ekonomi ve Yenilik Dergisi*, 4(1), 1-18. <https://doi.org/10.20979/ueyd.347548>
- Kişisel Verileri Koruma Kurumu. (2016). *Personal Data Protection Law No. 6698*. Retrieved from <https://www.kvkk.gov.tr/Icerik/6649/Personal-Data-Protection-Law> Accessed: 16.05.2025
- Lifewire. (2017). 5G Availability Around the World. Retrieved from <https://www.lifewire.com/5g-availability-world-4156244>Lifewire Accessed: 16.05.2025
- Matriano, M. T. (2023). Balancing of skills in the digital transformation of education and employability. In *SHS Web of Conferences* (Vol. 156, p. 08004). EDP Sciences. <https://doi.org/10.1051/shsconf/202315608004>
- Matthews, D. (2022). UK rejects EU approach to artificial intelligence in favour of 'pro-innovation' policy. *Science Business*, 19.
- Meltzer, J. P. (2019). Governing digital trade. *World Trade Review*, 18(S1), S23-S48. <https://doi.org/10.1017/s1474745618000502>
- Ministry of Industry and Technology. (2023). *The National Technology Initiative: 2023 Report*. Retrieved from [www.sanayi.gov.tr](http://www.sanayi.gov.tr)
- Ministry of Trade. (n.d.). E-commerce Regulations. Retrieved May 26, 2025. Retrieved from <https://ticaret.gov.tr/ic-ticaret/elektronik-ticaret/mevzuat> Accessed: 20.05.2025
- Ministry of Transport and Infrastructure. (2023). *Smart Cities and Digital Infrastructure Report*. Retrieved from [www.uab.gov.tr](http://www.uab.gov.tr) Accessed: 15.05.2025
- Moss, S. (2024). Türkiye publishes its National Artificial Intelligence Strategy. Retrieved from <https://aibusiness.com/verticals/turkey-publishes-its-national-artificial-intelligence-strategy> Accessed: 12.05.2025
- Naz, F., Karim, S., Houcine, A., & Naeem, M. A. (2024). Fintech growth during COVID-19 in MENA region: current challenges and future prospects. *Electronic Commerce Research*, 24(1), 371-392. <https://doi.org/10.1007/s10660-022-09583-3>
- OECD. (2021). Broadband policy and technology developments. In OECD digital economy papers. Retrieved from <https://doi.org/10.1787/e273ff77-en> Accessed: 16.05.2025
- OECD. (2021). *OECD Skills Strategy for Türkiye*. Retrieved from [www.oecd.org](http://www.oecd.org) Accessed: 16.05.2025
- OECD. (2022). *Digital Economy Outlook for Türkiye*. Retrieved from [www.oecd.org](http://www.oecd.org) Accessed: 16.05.2025
- OECD. (2024). Future-proof broadband access technologies gain ground for both fixed and mobile networks across the OECD in 2023. Retrieved from <https://www.oecd.org/en/data/insights/statistical-releases/2024/07/future-proof-broadband-access-technologies-are-gaining-ground-for-both-fixed-and-mobile-networks-across-the-oecd-in-2023.html>OECD Accessed: 20.05.2025
- Ozan, M. S. (2020). E-Government in Turkey: An assessment for public administration. *International Journal of Social and Humanities Sciences Research (JSHSR)*, 7(63), 3733-3739. <https://doi.org/10.26450/jshsr.2201>
- Özkan, Ö., Şahinol, M., Aydınoglu, A. U., & Son, Y. A. (2022). Reflections on Turkish Personal Data Protection Law and Genetic Data in Focus Group Discussions. In *NanoEthics* (Vol. 16, Issue 3, p. 297-318). Springer Science+Business Media. <https://doi.org/10.1007/s11569-022-00431-0>

- Öztürk, S. P. (2021). The era of digital transformation: Visualizing the geography of e-commerce usage in Turkey. *Environment and Planning A: Economy and Space*, 53(6), 1241-1243. <https://doi.org/10.1177/0308518x211007798>
- Putong, I. H. (2023). Digitalization Strategy of Small and Medium Enterprises (SMEs) of Agribusiness Sector at North Sulawesi. *International Journal of Academic Research in Business and Social Sciences*, 13(5), 849-857. <https://doi.org/10.6007/ijarbss/v13-i5/16917>
- Qader, K. S., & Cek, K. (2024). Influence of blockchain and artificial intelligence on audit quality: Evidence from Turkey. *Heliyon*, 10(9). <https://doi.org/10.1016/j.heliyon.2024.e30166>
- Reisdorf, B., & Rhinesmith, C. (2020). Digital inclusion as a core component of social inclusion. *Social Inclusion*, 8(2), 132-137. <https://doi.org/10.17645/si.v8i2.3184>
- Republic of Türkiye. (2004). Law No. 5070 on Electronic Signatures. Official Gazette No. 25355. Retrieved from <https://www.resmigazete.gov.tr/eskiler/2004/01/20040123.htm> Accessed:10.05.2025
- Republic of Türkiye. (2013). Law No. 6502 on the Protection of Consumers. Official Gazette No. 28835. Retrieved from <https://ticaret.gov.tr/data/5d42a9b313b87632542a2dae/LAW%20ON%20CONSUMER%20PROTECTION.pdf> Accessed:10.05.2025
- Republic of Türkiye. (2014). Law No. 6563 on the Regulation of Electronic Commerce. Official Gazette No. 29166. Retrieved from <https://www.lexpera.com.tr> Accessed:10.05.2025
- Republic of Türkiye. (2022). Law No. 7416 Amending the Electronic Commerce Law. Official Gazette No. 31880. Retrieved from <https://www.erdem-erdem.av.tr> Accessed:10.05.2025
- Rizka, R. (2020, March). Road Map E-Commerce as an Alternative Law Protection for Consumers in Era Trade Online. In *2nd Social and Humaniora Research Symposium (SoRes 2019)* (pp. 26-29). Atlantis Press. <https://doi.org/10.2991/assehr.k.200225.007>
- Saçak, R., Gür, Ş., & Eren, T. (2020). Türkiye'nin Dijital Dönüşüm Yol Haritasında Yer Alan Stratejilerin Topsis Yöntemi İle Sıralanması. *Dokuz Eylül Üniversitesi İşletme Fakültesi Dergisi*, 21(2), 335-346. <https://doi.org/10.24889/ife.839791>
- Şahin, S. B. (2023). Digital transformation of public services as state transformation: An overview of the experience in Turkey during the pandemic. *Alternatives*, 48(3), 191-205. <https://doi.org/10.1177/03043754231174757>
- Sawaneh, I. A., Kamara, F. K., & Kamara, A. (2021). Cybersecurity: A key challenge to the information age in Sierra Leone. *Asian Journal of Interdisciplinary Research*, 4(1), 35-46. <https://doi.org/10.34256/ajir2114>
- Schwab, K. (2017). The Fourth Industrial Revolution, Crown Business, New York. *The smart-up ecosystem: Turning Open Innovation into smart business*.
- Selwyn, N. (2004). Reconsidering political and popular understandings of the digital divide. *New media & society*, 6(3), 341-362. <https://doi.org/10.1177/1461444804042519>
- Semerçi Çetin, H. C., Sevimbay, A., Akçaalan, M., & Cengiz, D. Y. The Future of Education in Turkey's 2023 Educational Vision Document: Views of Academicians in the Faculty of Education. <https://doi.org/10.14689/ejer.2020.87.4>
- Smoleń, K. M. (2018). The Problem of Cyber Attacks on the Critical Infrastructure of the State in the Energy Sector. The Case of Turkey. *TEKA of Political Science and International Relations*, 13(2), 27-47. <https://doi.org/10.17951/teka.2018.13.2.27-47>
- Srivastava, S. (2023). The evolution of education: Navigating 21st-century challenges. *International Journal for Multidisciplinary Research*, 5(5), 1-9. <https://doi.org/10.36948/ijfmr.2023.v05i05.6314>

- Stahl, B. C. (2021). *Artificial intelligence for a better future: an ecosystem perspective on the ethics of AI and emerging digital technologies* (p. 124). Springer Nature. [https://doi.org/10.1007/978-3-030-69978-9\\_4](https://doi.org/10.1007/978-3-030-69978-9_4)
- Sütlü, U., & Onursal, F. S. (2020). Social Transformation - Industry 4.0. In *Lecture notes in mechanical engineering* 373-382. Springer Nature. [https://doi.org/10.1007/978-3-030-62784-3\\_31](https://doi.org/10.1007/978-3-030-62784-3_31)
- Syamsiyatun, S. (2020). Communal Challenges for Child Education in the Digital Era: A Perspective from Gender and Family Power Relations. *Jurnal Pemberdayaan Masyarakat: Media Pemikiran Dan Dakwah Pembangunan*, 4(2), 319-344. <https://doi.org/10.14421/jpm.2020.042-02>
- Szczygielski, K., Grabowski, W., Pamukcu, M. T., & Tandogan, V. S. (2017). Does government support for private innovation matter? Firm-level evidence from two catching-up countries. *Research Policy*, 46(1), 219-237. <https://doi.org/10.1016/j.respol.2016.10.009>
- Taskin, S. G., Kucuksille, E. U., & Topal, K. (2022). Detection of Turkish fake news in Twitter with machine learning algorithms. *Arabian Journal for Science and Engineering*, 47(2), 2359-2379. <https://doi.org/10.1007/s13369-021-06223-0>
- TechSci Research. (2024). Türkiye Cloud Computing Market 2028 By Size, Share, Trends, Growth, Forecast. Retrieved from <https://www.techsciresearch.com/report/Türkiye-cloud-computing-market/7843.html> TechSci Research Accessed:16.05.2025
- TelecomTalk. (2024). Turk Telekom Expands Fiber Network Coverage to Over 32 Million Households. Retrieved from <https://telecomtalk.info/turk-telekom-expands-fiber-network-coverage-32million/976270/> TelecomTalk Accessed:16.05.2025
- Teyit. (2024). Is Türkiye's internet speed holding it back? A closer look at the data. Retrieved from <https://en.teyit.org/in-depth/is-Türkiyes-internet-speed-holding-it-back-a-closer-look-at-the-data> Teyit Accessed:16.05.2025
- Trade.gov. (2023). *Türkiye - Smart City Technology & Equipment*. International Trade Administration, U.S. Department of Commerce. Retrieved from <https://www.trade.gov/country-commercial-guides/Türkiye-smart-city-technology-equipment> Accessed:20.05.2025
- TÜİK Kurumsal. (2024). [https://data.tuik.gov.tr/Bulten/Index?p=Hanehalki-Bilisim-Teknolojileri-\(BT\)-Kullanım-Arastirmasi-2024-53492](https://data.tuik.gov.tr/Bulten/Index?p=Hanehalki-Bilisim-Teknolojileri-(BT)-Kullanım-Arastirmasi-2024-53492) Accessed:16.05.2025
- TÜİK. (2024). *Labor Force Statistics: Digital Skills in Türkiye*. Retrieved from [www.tuik.gov.tr](http://www.tuik.gov.tr) Accessed:16.05.2025
- Turan, T., Kemalöglü, N., & Küçüksille, E. (2020). Hukuk'ta Yapay Zeka: Çalışmalar ve Gelecek Öngörülleri. *Mehmet Akif Ersoy Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 11(2), 246-255. <https://doi.org/10.29048/makufebd.748843>
- Turkish Ecosystem Overview and Trends. (2024). <https://www.scalexventures.com/content/turkish-start-up-and-vc-ecosystem-at-a-glance> Accessed:20.05.2025
- Turkish Statistical Institute (TÜİK). (2024). *E-commerce Growth Statistics*. Retrieved from [www.tuik.gov.tr](http://www.tuik.gov.tr) Accessed:16.05.2025
- turkiye.gov.tr. (2024). E-Devlet Kapısı Hizmet Sayısı ve Kullanıcı İstatistikleri. Retrieved from <https://www.turkiye.gov.tr/edevlet-istatistikleri> Accessed:16.05.2025
- turkiye.gov.tr. (2025). E-Devlet Kapısı Kullanıcı Sayısı. Retrieved from <https://www.turkiye.gov.tr/edevlet-istatistikleri?kullanici=Istatistikleri> Accessed:16.05.2025
- Van Dijk, J. (2020). *The digital divide*. John Wiley & Sons.
- Vardarlıer, P., & Cakır, A. R. (2015). A Study on Sustainable Innovation Profile of Turkey. <https://doi.org/10.20525/ijrbs.v4i4.16>

- Varsak, S., Öztürk, H., & Yalçın, H. (2023). Fintech Applications in the Financial System: Risks and Opportunities. *İktisadi Araştırmalar Dergisi, 1*(2), 37-46.
- Veres, M. M., Veres, C., Rauca, A. M., Marian, L. O., & Sigmirean, A. (2021, January). Research on qualified vocational training development in the context of digitalization. In *Proceedings* (Vol. 63, No. 1, p. 68). MDPI. <https://doi.org/10.3390/proceedings2020063068>
- Vurdu, S. A. (2021). The impact of Covid-19 pandemic on supply chain trade. *Industrial Policy, 1*(1), 51-60.
- World Bank. (2022). *Bridging the Digital Divide: Türkiye's Connectivity Challenges*. Retrieved from [www.worldbank.org](http://www.worldbank.org) Accessed:10.05.2025
- World Bank. (2022). *Financial Inclusion in Türkiye: Digital Payment Adoption*. Retrieved from [www.worldbank.org](http://www.worldbank.org) Accessed:10.05.2025
- World Economic Forum. (2021). The Future of Digital Transformation. Retrieved from [www.weforum.org](http://www.weforum.org) Accessed:10.05.2025
- Yavuzalp, N., Derya Gürer, M., Curaoğlu, O., Durmuş, S., Akayoğlu, S., Bahar, M., ... & Tekinarslan, E. (2015). FATİH Project in Turkey: A case analysis. *International Journal of Research in E-learning IJREL, 1*(1), 117-127.
- Yıldırım, A. C. (2020). Turkish banks and digitalization: Policy recommendations from a qualitative study. *BDDK Bankacılık ve Finansal Piyasalar Dergisi, 14*(2), 145-174. <https://doi.org/10.46520/bddkdergisi.841167>
- Yıldırım, S., & Bostancı, S. H. (2021). The efficiency of e-government portal management from a citizen perspective: evidences from Turkey. *World Journal of Science, Technology and Sustainable Development, 18*(3), 259-273. <https://doi.org/10.1108/WJSTSD-04-2021-0049>