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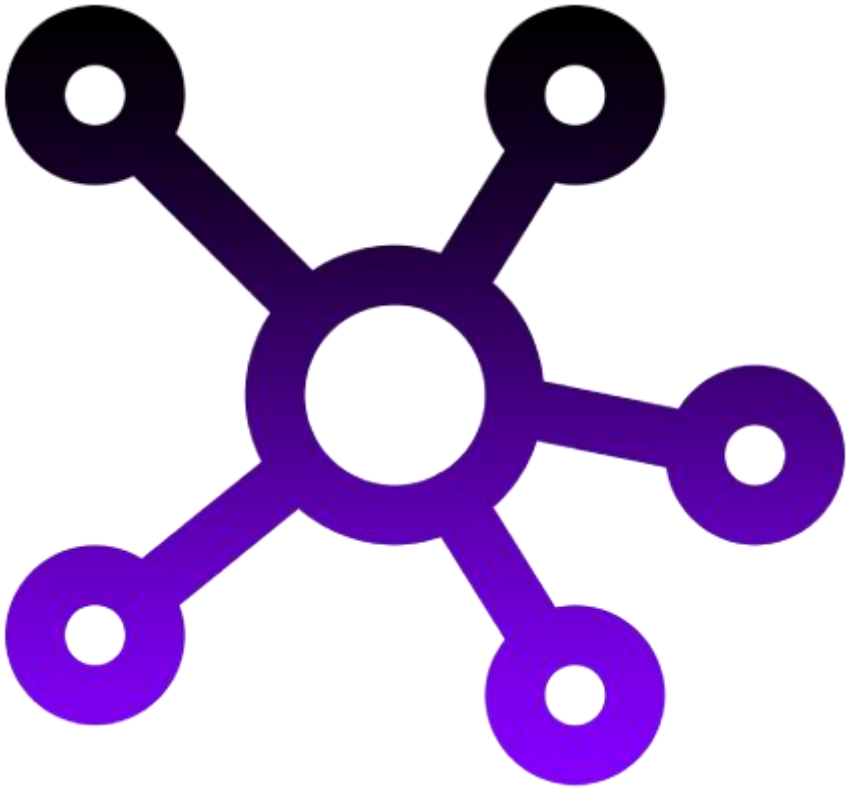

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THE DIGITAL PATH TO FINANCIAL INCLUSION: UNLOCKING NEW OPPORTUNITIES FOR ALL

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Sava DIMOV
Burgas Free University
8001, Burgas,
62 San Stefano Str.
Bulgaria
dimov@bfu.bg
ORCID ID: 0009-0000-3862-2583

Valerii SMIRNOV
Financial University under the Government of the Russian Federation LLC; Leningradsky Ave, 49, Moscow, Russia, 125167
valera_smirnov@inbox.ru
ORCID ID: 0000-0002-5280-5244

Veronika KOTOVA
Financial University under the Government of the Russian Federation LLC; Leningradsky Ave, 49, Moscow, Russia, 125167
nicakotova@gmail.com
ORCID ID: 0009-0009-9934-1959

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ABSTRACT

This article examines the transformative role of digital finance in advancing financial inclusion, particularly in low-income and remote regions. Digital finance, encompassing tools like mobile wallets, digital lending platforms, and online payment systems, has redefined access to financial services by making them more accessible, affordable, and inclusive. The study highlights how these innovations empower underserved populations, enabling them to participate in the formal financial ecosystem and fostering economic growth. The research also explores key barriers that hinder the expansion of digital finance, including inadequate infrastructure, low digital literacy, cybersecurity challenges, and regulatory gaps. The study is based on a comprehensive review of literature, case studies, and financial inclusion data, offering insights into the opportunities and challenges of digital finance. The findings underscore the urgency of addressing these barriers to fully realize the potential of digital finance in bridging financial disparities. In this current aspect, scientific research includes: ***The objectives of the development focus on****: To analyze how various digital finance tools contribute to financial inclusion; To examine the impact of digital finance on low-income and remote populations based on the corresponding statistics; To identify barriers to the growth of digital finance.* ***The methods and approaches used include****: Method for processing data by collecting and converting data into usable information; Instrumental analysis for data processing using Google BigQuery and Talend; Correlation studies through analysis of relationships between several variables; Combining qualitative and quantitative data processing methods; Experimental and statistical analysis for classifying income groups; Risk analysis and main barriers to the expansion of digital financial infrastructure.* ***The results of the study present****: Financial Inclusion Dynamics for High-income Economies; Financial Inclusion Dynamics for Upper Middle-income Economies; Financial Inclusion Dynamics for Lower Middle-income Economies; Financial Inclusion Dynamics for Low-income Economies.* ***The main conclusions prove that****: First, Digital finance is not a passing trend. It is changing the way people think about money, investments, and financial services; Second, However, to fully unlock the potential of digital finance, it is essential to address the barriers that hinder its growth; Third, In the digital age, financial inclusion has the potential to be vastly expanded through innovative technologies.*

Keywords: digital finance, financial inclusion, FinTech, underserved population, economic empowerment, inclusive financial ecosystem

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INTRODUCTION

In an increasingly interconnected world, access to financial services is a cornerstone of economic empowerment and social progress. Yet, for millions of people, especially in low-income and remote regions, traditional financial systems remain out of reach due to geographical, economic, and institutional barriers. Digital finance has emerged as a game-changer, revolutionizing the way individuals and businesses engage with financial services. From mobile banking to digital payments, these technologies are transforming the financial landscape by making services more accessible, affordable, and inclusive.

The Research by Douglas Arner, Janos Barberis, and Ross Buckley highlights the stages in the development of FinTech. The rationale behind FinTech 3.5 in developing countries is compelling and multifaceted, characterized by several key factors: (Arner, Barberis & Buckley, 2015):

– youthful populations with digital savviness and mobile device access;

– a rapidly expanding middle class, with Asia projected to house 60% of the global middle class by 2030;

– inefficient financial and capital markets that open doors for informal alternatives;

– a lack of extensive physical banking infrastructure;

– behavioral tendencies favoring convenience over trust;

– significant untapped markets, including 1.2 billion people without bank accounts;

– relatively relaxed data protection and competitive environments.

According to Alia Shkurdoda and Andrzej Puczyk, “Digital payments have emerged as a transformative force in the global financial landscape. The digital payments market is currently at $17.72 trillion. It is expected to show an annual growth rate of 15.71%, resulting in a total transaction value of $36.75 trillion by 2029” (Shkurdoda, & Puczyk, 2025).

The relevance of this topic lies in its critical role in addressing global inequality. With financial inclusion recognized as a key driver of poverty reduction and sustainable development, understanding the impact of digital finance on accessibility to financial services is both timely and essential.

The purpose of this scientific research is to explore the role of digital finance in advancing financial inclusion, particularly in underserved regions, and to identify the barriers that limit its full potential.

To accomplish this, the following objectives were set:

1. To analyze how various digital finance tools contribute to financial inclusion;

2. To examine the impact of digital finance on low-income and remote populations based on the corresponding statistics;

3. To identify barriers to the growth of digital finance.

The object of this research is the global financial inclusion landscape, while the subject is the role and impact of digital finance in expanding access to financial services. The study employs a combination of qualitative and quantitative research methods, including literature review, case study analysis, and data analysis

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of financial inclusion metrics. Primary and secondary sources such as academic articles, industry reports, and policy briefs, form the foundation of the research.

The scientific significance of this study lies in its contribution to the academic discourse on financial inclusion and its potential to guide future research on the subject. Practically, the findings offer actionable insights for policymakers, financial institutions, and technology providers to design and implement strategies that leverage digital finance for inclusive growth. By addressing these critical aspects, this article aims to provide a comprehensive understanding of how digital finance can pave the way toward greater financial inclusion, unlocking opportunities for all.

THEORETICAL PART

Understanding Digital Finance

Digital finance refers to the integration of technology into financial services, transforming how individuals and businesses manage their money. This encompasses a broad range of financial activities facilitated through digital channels, including payments, lending, investing, insurance, and wealth management. At its core, digital finance leverages cutting-edge technologies – such as mobile apps, blockchain, artificial intelligence, and big data – to offer efficient, convenient, and user-friendly financial services. It aims to improve access to financial resources, enhance customer experiences, and increase transaction speed and security.

The evolution of digital finance represents a significant transformation in the financial landscape, commencing in the late 20th *century* amid rapid technological advancements and shifting consumer expectations. In the mid-1990s, a substantial change began as banks introduced online platforms, enabling customers to access their accounts for balance inquiries and fund transfers from the comfort of their homes (Beck & Demirgüç-Kunt, 2008, p.383-396). This innovation marked the advent of online banking, reflecting not just a shift towards convenience but the initiation of a new era in financial management characterized by increased accessibility.

As the late 1990s transitioned into the early 2000s, the proliferation of e-commerce further catalyzed the evolution of digital finance (Ansar, et al., 2022; Blaney, 2024; Chuen, & Deng, 2017; Goldfinch, 2025; Lauer & Lyman, 2015; Lee-Ying Tay, et al., 2022; Monye, 2023; Peterson, 2018; Sharma et al., 2025). Online shopping gained remarkable popularity, fundamentally altering consumer purchasing behavior. During this period, payment processing companies such as PayPal emerged, providing secure transaction methods that enhanced consumer confidence and encouraged broader participation in the digital economy.

The subsequent decade, characterized by the ubiquity of smartphones, witnessed the rise of mobile payment solutions. In the 2010s, applications such as Venmo and Square Cash revolutionized monetary transactions by enabling instant transfers via mobile devices. Furthermore, technology leaders like Apple and Google

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developed mobile wallets, further streamlining the payment process and integrating digital finance into everyday consumer behavior.

The landscape of digital finance underwent another pivotal transformation in 2009 with the introduction of Bitcoin, which signaled the emergence of decentralized finance. This novel application of blockchain technology fundamentally altered the manner in which transactions are recorded and secured, facilitating the proliferation of various digital currencies and decentralized applications that would redefine financial interactions.

By 2015 and beyond, the concept of "Fintech" gained widespread recognition as startups began to disrupt traditional financial services. These innovations encompassed a range of offerings, including peer-to-peer (abbr. P2P) lending platforms, robo-advisory services, and cryptocurrency exchanges. Such developments democratized access to financial resources, empowering individuals and small enterprises with enhanced options for effective money management.

COVID-19 boosted the adoption of digital financial services. According to the World Bank data, "about 40 percent of adults in developing economies excluding China who made a digital merchant payment using a card, phone, or the internet, and more than one-third of adults in developing economies who paid a utility bill directly from an account, did so for the first time after the start of the pandemic" (Ansar, et al., 2022; Blaney, 2024; Chuen, & Deng, 2017; Global Financial Inclusion; Metreau et al., 2024; Peterson, 2018; Schou-Zibell et al., 2016; Sharma et al., 2025; World Bank Country and Lending Groups). The demand for digital finance grew substantially, incentivizing FinTech companies to develop new customized solutions for their consumers. As a result, modern landscape of digital finance encompasses a multitude of prominent products, namely:

a. Mobile banking refers to the use of mobile devices to carry out banking activities (Lee-Ying Tay, et al., 2022; Monye, 2023). Most banks now offer dedicated mobile applications that enable customers to perform essential tasks, such as checking balances, transferring funds, paying bills, and applying for loans, all from their smartphones in real time.

b. Digital payment systems have significantly evolved, allowing consumers to conduct transactions seamlessly and securely. This category includes electronic wallets (e-wallets) such as PayPal, Apple Pay, Google Pay, and Samsung Pay, which facilitate quick payments via mobile devices. Digital payment solutions also encompass contactless payments and QR code scanning capabilities, making transactions fast and efficient in various settings, from online shopping to in-person purchases.

c. Online lending platforms have emerged as an alternative to traditional banking loans, making it easier for individuals and small businesses to obtain financing. These platforms, such as Lending Club and Prosper, connect borrowers with investors willing to fund loans, often with streamlined application processes and competitive interest rates. Furthermore, digital lending encompasses peer-to-peer lending, which allows individuals to lend money directly to borrowers without financial intermediaries.

d. Robo-advisors are automated platforms that provide investment management services, using algorithms

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to analyze individual risk tolerances and investment goals. These services, offered by companies like Betterment and Wealthfront, democratize investment access by providing personalized investment strategies at lower fees than traditional financial advisors.

e. Cryptocurrencies, such as Bitcoin, Ethereum, and others, have fundamentally altered the financial landscape. These digital currencies operate on blockchain technology, enabling secure, decentralized transactions without the need for intermediaries like banks (Han, 2024, p.57-89). Cryptocurrency exchanges, such as Coinbase and Binance, allow users to trade, buy, and sell these digital assets. The growing interest in cryptocurrencies has also given rise to decentralized finance (DeFi) platforms, which provide financial services without traditional banking infrastructure.

f. Crowdfunding has become a popular method for raising capital, enabling individuals and businesses to secure funding from a large number of contributors through online platforms such as Kickstarter, Indiegogo, and GoFundMe. These platforms allow entrepreneurs to present their ideas and projects, attracting investments from those interested in supporting innovative ventures.

g. Insurtech has emerged when the insurance sector faced digital transformation. Insurtech companies leverage technology to innovate the way insurance products are developed, marketed, and managed. Digital platforms facilitate seamless customer interactions, quick policy issuance, and streamlined claims processes. Moreover, the use of big data and analytics allows for more personalized insurance offerings based on individual risk profiles.

h. Personal finance management (PFM) applications are designed to help individuals track their spending, budget, and save money more effectively. Apps like Mint, YNAB (You Need a Budget), and Personal Capital provide users with insights into their financial habits and support goal-oriented savings strategies. By aggregating financial accounts into a single platform, these applications empower users to make informed decisions regarding their finances.

Digital Financial Inclusion Phenomenon

The diverse landscape of digital finance has made significant strides in promoting financial inclusion worldwide. A new phenomenon titled “Digital Financial Inclusion” has emerged. “Digital financial inclusion refers to the process of ensuring those in underserved or financially marginalized communities (unbanked populations) have access to affordable financial services and products through digital means” (Blaney, 2024). The key idea behind this is that all individuals should be able to access financial services, regardless of their location, social status, disposable income, or other barriers that may have previously limited their financial opportunities. In general, digital financial inclusion aims not only to bridge the gap between traditional banking and the unbanked but also to empower individuals and communities economically.

Digital finance contributes to financial inclusion through several interconnected mechanisms that leverage technology and innovation to widen access to financial services. (See figure 1).

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Authors' Team Construction, based on the Key Debate Review on "Key Developments for Increasing Financial Inclusion" (Schou-Zibell, et al., 2016, p.6-8).

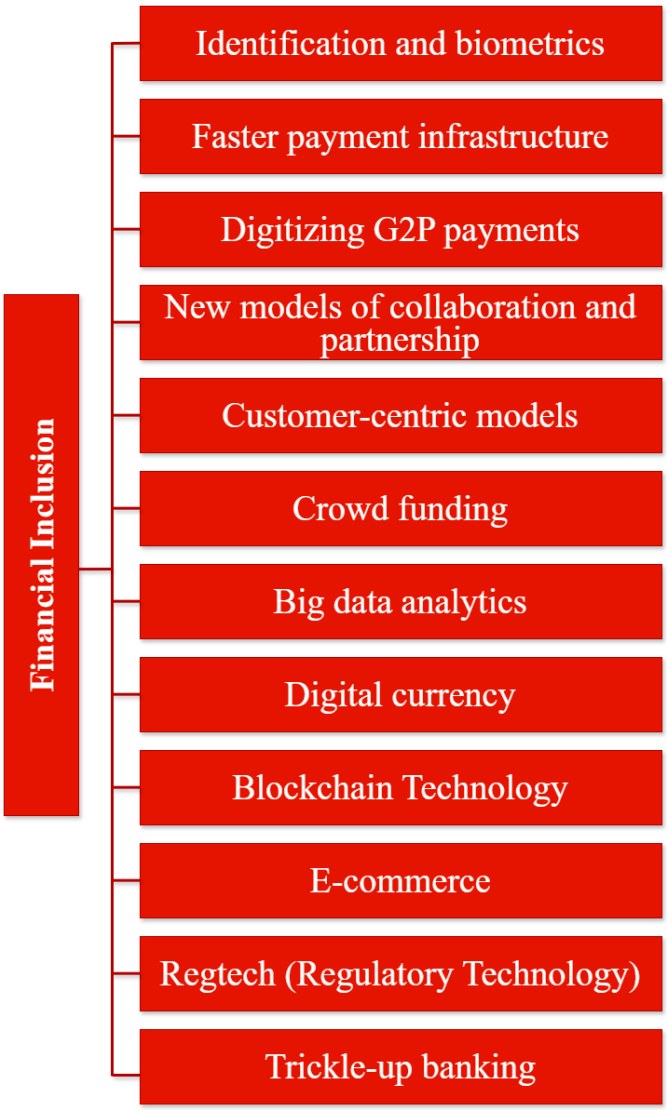

Figure 1. Pillars of Financial Inclusion in the Digital Finance Context

The processes related to access, dissemination and new financial inclusion products require the following three things to be noted, namely:

Firstly, recent enhancement of internet access, particularly in rural and previously underserved areas, has enabled individuals to connect with financial service providers (Han, 2024). This includes online banking, e-wallets, and peer-to-peer lending platforms. Additionally, internet connectivity allows for instant transactions, facilitating services such as real-time payments and immediate access to credit, which is crucial for meeting urgent financial needs.

Secondly, the proliferation of mobile technology has made it possible for individuals in remote or

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underserved areas to access financial services without needing a physical bank branch (Gomber, Koch & Siering, 2017, p.537-580). Modern mobile banking apps allow users to perform transactions, check balances, and manage accounts at their convenience. Moreover, by providing access to mobile networks, institutions can lower the costs associated with physical banking infrastructure, passing these savings on to consumers through reduced fees.

Thirdly, modern financial technology companies (FinTechs) have introduced innovative products tailored to the needs of populations, such as microloans, credit assessment based on alternative data, and even savings programs that use gamification to encourage savings habits. Meanwhile, fintech solutions often feature simplified application processes that require less paperwork and can be completed digitally, reducing barriers to access for individuals who may have struggled with traditional banking processes, especially, the elderly.

Apart from that, many digital finance platforms incorporate education modules that teach users about budgeting, saving, investing, and responsible borrowing. Consequently, financial literacy increases, empowering users to make informed financial decisions. At the same time, engaging campaigns focused on underserved communities can raise awareness of available digital financial options, fostering a culture where individuals seek out and utilize financial services (Ansar et al., 2022; Blaney, 2024; Khera et al., 2021; Peterson, 2018; Sharma et al., 2025; World Bank Country and Lending Groups).

Furthermore, supportive regulatory frameworks all over the world create a conducive environment for digital finance to thrive and ensure consumer protection. State policies (i.e., initiated by national central banks) promote innovation and safeguard users, encouraging more stakeholders to enter the market (Monye, 2023, p.3-48). Partnerships among governments, fintech companies, and non-governmental organizations help build sufficient infrastructure that further enhances access to digital finance for marginalized communities (Lauer & Lyman, 2015).

Undoubtedly, digital finance is not the only factor promoting financial inclusion (Peterson, 2018, pp.329-340). However, in comparison to other factors like regulatory frameworks, physical proximity to banks, and educational attainment, digital finance has proven to be a more effective and rapid tool for expanding access to financial services due to its innovative and progressive nature.

In essence, the diverse digital finance landscape largely contributes to financial inclusion by lowering barriers, enhancing accessibility, and providing tailored financial products and services that meet the unique needs of underserved populations. In other words, digital finance paves the way for more equitable access to financial resources, empowering individuals and communities to participate fully in the economy.

Empirical part

Analysis of Financial Inclusion by Income Groups in the Digital Context

The positive effect of digital finance on financial inclusion is clearly proved by the relevant statistics – Global

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Financial Inclusion (Global Findex) Database produced by World Bank. This database "measures people's use of financial services across economies and over time, based on over 150,000 interviews across more than 140 economies" (Ansar et al., 2022; Lauer & Lyman, 2015; Lee-Ying Tay, et al., 2022; Metreau, et al., 2024; Monye, 2023; Peterson, 2018; Schou-Zibell, et al., 2016; Sharma et al., 2025).

Shkurdoda, A. & A. Puczyk (2025) Digital Payment Technologis: The Future of Money and for simplicity, it was decided to 184 countries available for analysis into 4 groups according to Gross national income (GNI) per capita (Table 1). GNI benchmarks were derived from the official World Bank recommendations for the 2025 Fiscal Year (World Bank Country and Lending Groups).

Table 1. Income Groups Classification

Economy Type by Income	Gross National Income per capita
Low-income	< $1145
Lower middle-income	$1,146 - $4,515
Upper middle-income	$4,516 and $14,005
High-income	> $14,005

***Source*:** Extracted and compiled by the authors from a World Bank Database (Metreau et al., 2024; World Bank Country and Lending Groups)

The table below contains the indicators used to assess the dynamics of financial inclusion in the context of growing digitalization of finance over the period 2011-2021 (the latest data available).

Table 2. Financial Inclusion Dynamics for High-income Economies

Indicator, % age 15+	2011	2014	2017	2021	Change, %
Account[1]	88,2	92,8	93,7	96,4	9,3
Account female	86,2	92,4	92,9	96,7	12,2
Account male	90,4	93,2	94,5	96,0	6,2
Account, in labor force	92,1	95,1	95,6	97,1	5,4
Account, out of labor force	79,3	88,2	89,8	95,2	20,1
Account, primary education or less	71,3	78,0	83,9	89,8	25,9
Account, secondary education or more	91,8	95,0	95,4	97,2	5,9

[1] Respondents who have an account at a bank or any other type of financial institution or report personally using a mobile money service in the past year.

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Account, income, poorest 40%	84,8	89,6	90,0	94,4	11,3
Account, income, richest 60%	90,9	94,9	96,1	97,7	7,5

Source: Author's calculations according to Database: World Bank, IBRD-IDA and World Bank Blogs (Metreau et al., 2024; World Bank Country and Lending Groups)

Predominantly, more people from high-income states have access to financial services, which can be largely explained by a substantial increase in digital finance solutions over the past years. As can be seen from Table 2, the account ownership gender gap has narrowed markedly, while it is evident that financial inclusion now expands beyond just the working population. A significant increase of those with primary education or less, having financial accounts, suggests that digital finance has been instrumental in bringing unbanked populations into the formal financial system. The gap between the poorest and richest groups has narrowed as well.

Table 3. Financial Inclusion Dynamics for Upper Middle-income Economies

Indicator, % age 15+	**2011**	**2014**	**2017**	**2021**	**Change, %**
Account	56,6	70,9	72,4	84,3	48,9
Account female	52,3	68,2	68,7	82,3	57,4
Account male	60,9	73,7	76,2	86,3	41,7
Account, in labor force	62,5	76,9	77,6	81,6	30,6
Account, out of labor force	41,9	56,2	60,3	68,2	62,8
Account, primary education or less	51,2	66,4	65,9	79,2	54,7
Account, secondary education or more	64,0	76,1	79,2	89,3	39,5
Account, income, poorest 40%	41,1	63,8	62,3	78,8	91,7
Account, income, richest 60%	66,8	75,6	79,6	88,0	31,7

***Source*:** Author's calculations according to Database: World Bank, IBRD-IDA and World Bank Blogs (Metreau et al., 2024; World Bank Country and Lending Groups)

Overall, upper middle-income states followed the same patterns in financial inclusion expansion as their wealthier counterparts yet were much more sensitive to digitalization of finance. Upper middle-income economies are seeing larger proportionate increase in financial inclusion across all demographic groups, especially women, poor populations, and those out of the labor force. Table 3 depicts that financial inclusion in high-income countries may be closer to saturation, whereas there is more room for growth in upper middle-income states. Undoubtedly, such a difference is due to higher GNI per capita levels in wealthier governments, which means individuals in high-income regions possess more disposable income to be spent on tools to access

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Table 4. Financial Inclusion Dynamics for Lower Middle-income Economies

Indicator, % age 15+	2011	2014	2017	2021	Change, %
Account	30,5	43,7	58,3	62,4	104,6
Account female	24,8	37,5	53,4	59,2	138,7
Account male	36,2	49,9	63,2	65,5	80,9
Account, in labor force	36,1	51,4	63,6	67,7	87,5
Account, out of labor force	22,6	33,5	51,4	55,0	143,4
Account, primary education or less	24	32,8	49,4	57,3	138,8
Account, secondary education or more	42,6	55,3	67,5	69,2	62,4
Account, income, poorest 40%	21,3	34,1	51,4	58,4	174,2
Account, income, richest 60%	36,5	50,1	62,9	65,0	78,1

Source: Author's calculations according to Database: World Bank, IBRD-IDA and World Bank Blogs (Metreau et al., 2024)

Table 5. Financial Inclusion Dynamics for Low-income Economies

Indicator, % age 15+	2011	2014	2017	2021	Change, %
Account	10,1	18,7	31,5	39,0	286,1
Account female	7,6	15,3	26,3	34,5	353,9
Account male	12,5	22,2	36,9	43,9	251,2
Account, in labor force	13,3	22,9	36,4	46,7	251,1
Account, out of labor force	4,6	11,2	19,7	22,9	397,8
Account, primary education or less	7,0	14,3	25,5	29,2	317,1
Account, secondary education or more	17,3	30,4	46,8	62,4	260,7
Account, income, poorest 40%	6,0	11,5	22,2	29,5	391,7
Account, income, richest 60%	12,4	23,6	37,7	45,3	265,3

Source: Author's calculations according to Database: World Bank, IBRD-IDA and World Bank Blogs (Metreau et al., 2024)

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Based on the data outlined in Tables 4 and 5, it can be concluded that among all the studied income groups, the low-income and lower middle-income economies are seeing the most dramatic improvements in financial inclusion, primarily driven by digital finance. These economies, where financial exclusion was once a major issue, are experiencing large-scale growth, especially in female inclusion, low-income groups, and non-labour force populations. Digital finance is helping to close the gap by providing affordable and scalable financial solutions.

Upper Middle-income economies and High-income economies are closer to saturation in terms of financial inclusion, but they still show significant improvements, particularly in gender equality and the inclusion of marginalized groups. These economies are increasingly focused on enhancing services and addressing remaining gaps in financial access.

Overall, with the help of digital finance, financial systems are becoming more inclusive, consistently fostering greater economic participation and empowerment for traditionally excluded groups across all income categories.

The Main Barriers to Digital Financial Infrastructure Expansion

Even though digital finance offers significant benefits in advancing financial inclusion, it comes with several risks and barriers that can hinder its effectiveness.

Firstly, many regions, especially rural and remote areas, still lack reliable internet and mobile network coverage, and even face frequent power outages, limiting the ability of users to access digital platforms reliably. Meanwhile, digital infrastructure costs (i.e., the cost of a mobile phone and subscription charges) may seem unaffordable for some vulnerable population segments.

Secondly, the digital literacy gap remains persistent in some parts of the globe. Many people, especially in developing countries, lack the skills to navigate digital financial platforms. This includes understanding how to use apps, online banking, or mobile payment systems effectively. Elderly populations and those with limited education may find digital platforms particularly challenging to use.

Thirdly, cybersecurity and fraud risks remain quite high. Digital finance platforms are vulnerable to hacking and unauthorized access, risking personal and Financial Data (Sharma et al., 2025). Users, particularly those with low financial literacy levels, can fall victim to phishing schemes, identity theft, or fake financial services, leading to financial losses and mistrust in digital systems.

Moreover, a lack of harmonized legal frameworks across borders can hinder the growth of digital finance, especially for cross-border payments. At the same time, insufficient regulation in low-income regions may result in inadequate grievance mechanisms for users who face issues with digital finance services. Addressing these interconnected barriers is urgent to ensure the further advancement of financial inclusion. Without reliable infrastructure, affordable access, enhanced digital literacy, and robust regulatory frameworks, the transformative potential of digital finance will remain unrealized for millions of underserved individuals.

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CONCLUSION

First conclusion. Digital finance is not just a passing trend; it is reshaping the way people think about money, investments, and financial services. The diversity of digital finance has transformed the financial landscape, offering innovative tools and services that cater to a wide range of needs. From mobile wallets to digital lending platforms, these solutions are breaking down traditional barriers and driving financial inclusion, particularly in low-income and remote regions where access to conventional banking remains limited.

Second conclusion. However, to fully unlock the potential of digital finance, it is essential to address the barriers that hinder its growth, including inadequate infrastructure, low digital literacy, and cybersecurity challenges. By investing in solutions to these issues and fostering an inclusive digital ecosystem, governments can ensure that digital finance not only drives economic empowerment but also creates equitable opportunities for all, leaving no one behind.

Third conclusion. In the digital age, financial inclusion has the potential to be vastly expanded through innovative technologies that reach underserved populations globally. Nevertheless, achieving true inclusivity requires addressing challenges like digital literacy, infrastructure gaps, and regulatory barriers. When effectively managed, digital financial services can promote economic empowerment, social equity, and sustainable development, making financial access more widespread, efficient, and resilient for all.

Conflict of interests:

The authors declare no conflict of interest.

Author Contributions:

Conceptualization, S.D., V.S. and V.K.; software, V.S. and V.K.; methodology, S.D.; validation, S.D., V.S. and V.K.; formal analysis, V.S.; investigation, S.D.; resources, S.D. and V.S.; data curation, S.D.; writing – original draft preparation, V.S., S.D. and V.K.; writing – review and editing, V.S.; visualization, S.D.; supervision, V.S.; project administration, S.D. and V.S.; funding acquisition, S.D. and V.S.

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The data presented in this study are available on request from the corresponding author.

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CUSTOMER EXPERIENCE IMPACT ON BRAND LOYALTY: AN EMPIRICAL STUDY'S METHODOLOGY

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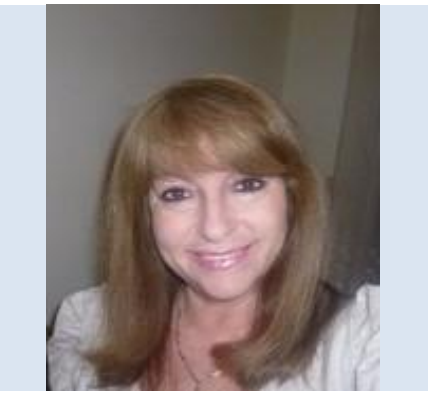

Lina ANASTASSOVA
Burgas Free University
8001, Burgas, 62 San Stefano Str.
Bulgaria
anastassova@bfu.bg
ORCID ID: 0000-0002-0614-8220

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ABSTRACT

In fiercely competitive markets, providing an outstanding customer experience can serve as a crucial differentiator. Brands that emphasise customer experience can distinguish themselves from competitors while attracting and retaining loyal customers (Havir,2019; Patov,2024). Engaging with clients and soliciting their feedback can further enhance this experience. Brands that actively consider customer input and implement improvements demonstrate a commitment to satisfaction that fosters loyalty. In this paper the methodology of research about the influence of customer experience on brand loyalty is presented. The main research goal is to investigate how various aspects of customer experience (including product quality, emotional engagement, staff behavior, satisfaction etc,) correlate with levels of brand loyalty among various consumer segments. The study will examine the importance for customers of multiple factors influencing brand loyalty, such as customer satisfaction, perceived value, trust in the brand, and emotional connections. Research focus in the paper is on the issue of how sustained positive interactions shape long-term loyalties through metrics like repeat purchases or retention rates over extended periods. Another important research aspect is to measure negative customer experiences' impact on brand loyalty, namely, to assess how adverse experiences (such as complaints or service failures) affect consumer allegiance toward the brands, leading them towards competitor options. The target population of the study are the current customers of multiple consumer brands. The sampling method is planned to be a convenience sample with a size of more than 1000 respondents in order to guarantee data representativeness. The paper discusses in its second part the data collection methods and the statistical methods for data analysis, which will include descriptive statistics (frequencies, mean, median or mode) and Inferential statistics (t-tests, ANOVA, correlation and regression analysis) used for identifying relationships among variables.

Keywords: customer experience, brand loyalty, customer satisfaction, empirical study

JEL classification: M3, M0
Paper type: Research article

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INTRODUCTION

Customer experience encompasses every interaction a consumer has with a brand, spanning the stages of pre-purchase, purchase, and post-purchase. This includes elements such as customer service, product quality, user interface, and overall satisfaction (Becker & Jaakkola, 2020). The customer experience is essential in shaping brand loyalty. Customer experience serves as a fundamental driver of brand loyalty. Companies prioritising the understanding and enhancement of this experience are more likely to nurture loyal customers who contribute to sustainable business growth (Rane & Choudhary, 2023). By focusing on fostering positive interactions, personalising experiences, and ensuring consistency across touchpoints, brands strengthen their base of loyal clients while thriving in competitive environments.

Research Goal and Objectives

When defining research objectives regarding the influence of customer experience on brand loyalty, it is crucial to adhere to specific criteria: specific, measurable, achievable, relevant, and time-bound (SMART). The main goal of the current research is to investigate and analyze the relationship between the customer experience and brand loyalty, depending on the various social-demographic factors. The research objectives are as follows:

-To investigate how various aspects of customer experience (including product quality, emotional engagement, staff behaviour, satisfaction etc,) correlate with levels of brand loyalty among different consumer segments.

-To evaluate customer satisfaction's role in mediating between customer experience and brand loyalty: explore how customer satisfaction mediates the relationship between overall experiences with a company's offerings and levels of brand loyalty impacting repeat purchasing behavior.

-To compare customer experience across various demographic segments, and namely to examine variations in perceptions regarding customer experience among different demographic and social groups (age categories, income and education levels) concerning its effects on brand loyalty for targeted marketing strategies of the companies.

-To measure negative customer experiences' impact on brand loyalty, and namely, to assess how adverse experiences (such as complaints or service failures) affect consumer allegiance toward a brand, leading them towards competitor options.

-To explore emotional and psychological aspects related to customer experience: to investigate emotional responses linked with consumer experiences, including factors like trust or attachment, which correspondingly relate back toward promoting advocacy for a particular brand.

-To examine the importance for customers of various factors influencing brand loyalty, such as customer satisfaction, perceived value, trust in the brand, and emotional connections.

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-To examine how sustained positive interactions shape long-term loyalties through metrics like repeat purchases or retention rates over extended periods.

-To assess technology's role in shaping both customer experience and brand Loyalty, Objective: Evaluate how advancements within technology realms—including but not limited to online platforms/mobile applications/social media influence perceptions around both areas mentioned above, including the effectiveness of digital touchpoint engagements encountered by users alike.

- To examine the customers' attitude towards AI and robots' implementation in businesses and their impact on customer experience.

- To develop recommendations for enhancing customer experience that fosters brand loyalty: Based on findings derived from research insights, provide actionable suggestions aimed at improving strategic approaches towards cultivating enhanced consumer relations, leading towards stronger fidelity amongst clientele.

LITERATURE REVIEW

As well known, customer experience is a key marketing concept, yet the growing number of studies focused on this topic has led to considerable fragmentation. The purpose of some papers is to review the literature on customer experience to develop a better understanding of the concept and propose a research agenda (Jain at al.,2017).

Other authors examine existing definitions and conceptualizations of customer experience as a construct and provide a historical perspective of the roots of customer experience within marketing. They attempt to bring together what is currently known about customer experience, customer journeys, and customer experience management (Lemon & Verhoef, 2016; Palmer A (2010). Some authors put stress on the impact and implications of the new technologies on each broad stage of the shopping journey (pre-transaction, transaction, and post-transaction) and advance a new conceptualization for managing these new AI technologies along customer experience dimensions to create experiential value (Hoyer et al., 2022).

Another research topic related to customer experience is a measurement of the experience. Klaus and Maklan (2013) introduce a new measure appropriate for the modern conceptualisation of customer experience: the Customer experience quality (EXQ) scale. In their article the authors extend that work and compare (EXQ's) predictive power with that of customer satisfaction. They establish that EXQ better explains and predicts both, loyalty and recommendations, then customer satisfaction (Klaus and Maklan, 2013).

By integrating contributions from different fields some researchers are conceptually developing Customer Experience Model (CEM) to represent the different aspects of customer experience in a holistic diagrammatic representation (Verma et al. 2012). There are authors which purpose of their research is to explore innovations in customer experience at the intersection of the digital, physical and social realms. It explicitly considers

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experiences involving new technology-enabled services, such as digital twins and automated social presence (i.e. virtual assistants and service robots) (Bolton et al.2018; Ivanov et al. 2023; Ivanov & Webster, 2019),

Many research papers are exploring how customer experience in the service and in the retail sectors has been measured and the goal of these studies is to develop a reliable and valid measure of retail customer experience (Bueno et al. 2019; Bagdare and Jain R, 2013; Anastassova and Luizov,2018), The purpose of this paper is to provide directions for future research on: broadening the role of customers in customer experience; taking a practice-based approach to customer experience; and recognizing the holistic, dynamic nature of customer experience across all touch points and over time. There are authors who try to provide directions for future research on: broadening the role of customers in customer experience; taking a practice-based approach to customer experience; and recognising the holistic, dynamic nature of customer experience (McColl-Kennedy et al.2015).

A favourable customer experience can result in repeat purchases, advocacy for the brand, and enduring relationships with customers. Positive experiences foster emotional connections between customers and brands; when customers feel appreciated and understood, their likelihood of developing loyalty increases. Brands that elicit positive emotions tend to build deeper relationships with their clientele. High levels of customer satisfaction are closely linked to brand loyalty; satisfied customers are more inclined to make repeat purchases, thereby lowering churn rates and enhancing customer lifetime value (CLV). Moreover, those who have positive experiences are more likely to recommend the brand to others (Mostafa & Kasamani, 2020), facilitating organic word-of- mouth marketing. Brand advocates can significantly sway potential customers and improve the brand's reputation. Maintaining consistency across all customer touchpoints—such as online platforms, physical stores, and customer service—is vital for establishing trust and loyalty. Inconsistencies may lead to confusion and dissatisfaction, which could harm loyalty efforts.

Personalizing the customer experience based on individual preferences significantly boosts loyalty; consumers appreciate brands that acknowledge their unique needs and tailor their offerings accordingly. Conversely, negative experiences can prompt customers to switch brands and diminish their loyalty (Yakin, 2023). Brands that neglect complaints or provide subpar service risk damaging their reputation and losing clientele. In recent years, there has been a growing interest in the role and application of artificial intelligence and robotisation in many sectors incl. in tourism and hospitality (Cain et al., 2019; Ivanov & Webster, 2019; Samala et al., 2020). The implementation of AI can improve the customer experience by analyzing customer behavior and personalising the offers and services which can lead to higher brand loyalty. Those who invest in crafting positive experiences cultivate long-term relationships built on trust and satisfaction that ultimately lead to increased loyalty over time.

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RESEARCH METHODOLOGY

The outlined research objectives create an extensive framework for examining how customer experience impacts brand loyalty, effectively allowing scholars insight into substantiating business strategies, improving relationships formed between businesses and their clients and consumers.

Research Design and Sampling

As far as the type of research is concerned, it will be a descriptive study and the approach will be mixed-qualitative and quantitative- based on the research questions. The target population are the current customers of various consumer brands. The sampling method will be a convenience sample with a size of more than 1000 respondents in order to guarantee data representativeness.

Research Hypotheses

When developing hypotheses regarding brand loyalty influenced by age, social status, and income, it is crucial to evaluate how these elements may affect consumer behaviour and brand perceptions. Below are several hypotheses to direct my research:

Age and Brand Loyalty:

H1: Younger consumers (ages 18-24) tend to demonstrate lower brand loyalty compared to older consumers (ages 45 and above), as they are more inclined to seek out new brands and products.

H2: Middle-aged consumers (ages 35-44) exhibit higher brand loyalty than both younger (ages 18-24) and older consumers (ages 55 and above), owing to established preferences and familiarity with brands.

Social Status and Brand Loyalty:

H3: Consumers from higher social status backgrounds show stronger brand loyalty than those from lower social status backgrounds due to better access to premium brands and a heightened perception of brand prestige.

H4: Individuals with lower social status are more prone to switch brands in response to price promotions and discounts, leading to reduced overall brand loyalty compared with their higher-status cou

Income and Brand Loyalty:

H5: Higher-income consumers display greater brand loyalty because they can afford premium brands that offer quality perceived as valuable.

H6: Lower-income consumers tend toward decreased brand loyalty as they exhibit greater price sensitivity and a propensity for switching brands in search of cheaper options.

Combined Effects:

H7: Consumers who are older, belong to higher social strata, and possess higher incomes will likely exhibit the greatest levels of brand loyalty. Conversely, younger individuals from lower social statuses with lower incomes will likely show the least amount of brand fidelity.

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Positive experience and brand loyalty

H8: The factors influencing brand loyalty are positive experience with the brand, product quality, and emotional engagement, and they correlate moderately with levels of brand loyalty.

Negative experience and brand loyalty

H9: The negative experience with the brand has a strong influence on brand loyalty. There is a negative correlation between both phenomena, and this reveals the possibility of a brand switch.

These hypotheses provide a foundational framework for investigating brand loyalty while enabling an examination of complex relationships among demographic variables impacting consumer behaviour. When testing these propositions, consider employing surveys, interviews, or focus groups for data collection that could support or challenge these ideas. Statistical analysis will also play a crucial role in determining the significance of the relationships examined.

Type of products -material products or services, and brand loyalty

H10: The brand loyalty does not depend on the product types and there will be no significant differences between the brand loyalty level of both product types.

Data Collection Methods

Every research relies on a set of data collection methods, depending on the goals and objectives set. In this case, the methods will be a combination of descriptive and qualitative techniques: online surveys/questionnaires aimed at collecting quantitative data on consumer attitudes toward brand loyalty and customer experience assessment. The questions will include Likert scale items, multiple-choice queries, and open-ended questions. The other method will be Focus groups, which will facilitate group discussions focused on exploring consumer perceptions about the brand in a collaborative environment. Existing secondary data sources will be investigated and analyzed as well, such as sales figures, customer feedback reviews, and market research reports as supplemental information alongside primary data collection efforts. The statistical methods for data analysis will include standard methods for quantitative analysis like descriptive statistics (frequencies, mean, median or mode) and Inferential statistics (t-tests, ANOVA, correlation and regression analysis) used for identifying relationships among variables. A qualitative analysis will be conducted based on content analysis approaches aimed at highlighting recurring themes relevant to brand loyalty.

The Research Report

The final part of the research will include a conclusion and provide recommendations for marketers and branding professionals derived from research conclusions about the customer experience impact on brand loyalty The research report will state any limitations present in the study, such as sample size constraints or geographical biases, and will propose potential avenues for future studies that further explore the dynamics surrounding brand loyalty.

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CONCLUSION

This kind of research is important for the company marketers as consistent positive experiences build brand trust, which is a direct precursor to loyalty. Conversely, bad experiences can drive customers away, with a significant percentage leaving after just one or a few negative interactions. The presented methodology of a future research can be useful for many marketers as in today's competitive market, a strong customer experience is a powerful differentiator. Research helps brands understand what customers value most, enabling them to prioritize improvements that truly matter for the customers in various product categories. The research data analysis will support the efforts of the companies producing and delivering multiple groups of products to improve their experiential marketing which will lead to higher customer satisfaction and sales.

Conflict of interests:

The authors declare no conflict of interest.

Author Contributions:

Conceptualization, methodology, validation, formal analysis, investigation, resources, data curation, writing - original draft preparation, writing - review and editing, visualization – L.A.

Author have read and agreed to the published version of the manuscript.

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Data Availability Statement:

The data presented in this study are available on request from the corresponding author.

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THE TRANSFORMATION OF THE MEDIA SPHERE IN GEORGIA: TRANSIT FROM TRADITIONAL MEDIA TO DIGITAL PLATFORMS

Oksana VOINTSEVA
University of Insurance and Finance,
Sofia, 1 Gusla str.,Bulgaria
e-mail: o.vointseva@gmail.com,
ORCID ID: 0009-0005-8225-7495

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ABSTRACT

This article examines the transformation of the media sphere in Georgia as a transit from traditional media to digital platforms, with a primary focus on economic and structural dimensions rather than political alignments. The study considers how television, print, online outlets and global platforms have become interdependent within a small, resource-constrained market, and how this hybrid configuration affects access to information and the sustainability of media actors. The analysis shows that television remains an important source of news and a major advertising channel, while online media and social networks have gained prominence, especially among younger and urban audiences. At the same time, global platforms have become key intermediaries for distribution and digital advertising, shaping opportunities and constraints for domestic media organisations.

In this context, the research objectives are: (1) to reconstruct the main stages of the Georgian media system's evolution from a broadcast-centred to a platform-influenced environment; (2) to analyse how changes in technology, regulation and the advertising market affect the roles and revenue models of traditional and digital media; and (3) to assess how platformisation influences the sustainability and diversity of the media sphere in a small market. The study is based on a desk-based mixed-methods approach, combining qualitative analysis of media landscape and information ecosystem reports, advertising market studies and regulatory documents with secondary quantitative data from longitudinal media consumption surveys.

The results identify three stages of transformation (broadcast dominance, early digital convergence and platformisation), document the emergence of a hybrid media system, and highlight persistent economic vulnerability and growing dependence on global platforms. The main conclusions are that: (1) the Georgian media sphere should be understood as a single hybrid ecosystem rather than separate "traditional" and "digital" sectors; (2) small-market conditions and platform intermediation critically shape the outcomes of digital transition; and (3) improving data on digital advertising and developing integrated policy approaches are essential for supporting a sustainable and diverse media environment.

Keywords: Georgia, media transformation, hybrid media system, digital platforms, media economics, advertising market, media consumption

JEL classification: L86, M37

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INTRODUCTION

Over the past two decades, the media sphere in Georgia has undergone a gradual but consistent transformation driven by technological change, market dynamics and regulatory adaptation. In the early 2000s, the information space was dominated by national television channels and a limited number of print outlets, which concentrated both audience attention and advertising revenues (Mikashavidze, 2010, 2018). Television was the key source of news for the majority of the population and served as the main platform for public communication, while radio and print played a supplementary role in specific niches such as regional coverage or specialised content (Mendel, 2022).

The spread of broadband internet, mobile communication and, later, affordable smartphones has substantially changed this configuration. A growing share of the population now accesses news and entertainment online, through digital editions of traditional media, online-only outlets and global social media platforms. Audience research shows that television remains an important source of information, but digital platforms steadily increase their share in total media consumption, especially among younger and urban users (Atchaidze, 2024; CRRC-Georgia, 2025; IREX & CRRC-Georgia, 2025). Digital platforms such as Facebook, YouTube, Instagram and messaging applications have become important distribution channels for Georgian media, allowing content to circulate beyond the boundaries of linear broadcasting schedules and national territories (Internews, 2021).

In parallel, the economic foundations of the media sector have been evolving. Traditional media companies have launched websites, streaming services and social media pages, while new digital-born outlets have entered the market with lower entry costs and more flexible formats (Mikashavidze, 2018; Internews, 2021). Advertising spending is slowly redistributing between broadcast, online and platform-based channels, and media organizations are experimenting with mixed revenue models that include commercial advertising, sponsorship, grants, branded content and, in some cases, direct audience support (Transparency International Georgia, 2011, 2018; Mendel, 2022). Sectoral reports and expert analyses underline that the Georgian media environment is now best described as a hybrid media market, where legacy and digital actors operate simultaneously and increasingly rely on the same digital infrastructures and platforms (Mikashavidze, 2018; Internews, 2021; Atchaidze, 2024).

This configuration is consistent with broader theoretical discussions of **hybrid media systems** and multi-platform media markets in Western contexts, where legacy broadcasters, print brands and digital-native outlets compete and collaborate across shared digital infrastructures rather than replacing one another (Chadwick, 2013; Napoli, 2003). Comparative studies of European and North American markets show that digitalisation tends to produce layered systems in which content, audiences and advertising revenues flow across television, print, online and social media, while platforms act as central intermediaries (Couldry & Hepp, 2017; Newman

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et al., 2024). In this sense, the Georgian media sphere follows the same structural logic as larger Western markets, but under the specific constraints of a small economy and a limited advertising base.

Finally, the transformation of the media sphere is taking place in a broader context of economic and regulatory alignment with European standards. European Commission progress reports and domestic assessments note steps towards approximation with EU rules on audiovisual services, competition and data protection, as well as participation in assistance programmes that target ownership transparency, market regulation and digital innovation (European Commission, 2023, 2024; Mendel, 2022). These processes have indirectly influenced the structure and strategies of Georgian media organizations, including their digital development, without predetermining their editorial profiles.

Despite the availability of monitoring reports, audience surveys and market overviews, several important aspects of this transformation remain under-described at the analytical level. Existing studies often address either the legal status of media, freedom-of-expression guarantees or individual segments of the market, but rarely treat the Georgian media sphere as an integrated economic and technological system that is moving from a broadcast-centred to a platform-centred logic (Internews, 2021; Mendel, 2022). Much of the international literature on hybrid media systems and deep mediatization focuses on Western or large markets (Chadwick, 2013; Couldry & Hepp, 2017), leaving small, post-socialist environments comparatively underexplored.

First, there is still limited systematic analysis of how traditional media companies in Georgia adapt their business models, cost structures and production routines when they expand to digital and platform environments. While sectoral assessments document that many outlets now operate websites and social media pages, less is known about the economic consequences of this shift: how advertising revenues are redistributed between broadcast and online products, how platform algorithms affect visibility and monetisation, and how different types of outlets (national, regional, niche) cope with these changes (Mikashavidze, 2018; Transparency International Georgia, 2011, 2018).

Second, audience surveys provide useful data on preferred news sources and devices but are less informative about the interaction between consumption patterns and the economic sustainability of media actors. They show, for example, that by 2024–2025 social media and online platforms are widely used as information sources, yet they do not fully explain how this translates into traffic, engagement and income for Georgian media companies (CRRC-Georgia, 2025; IREX & CRRC-Georgia, 2025; Atchaidze, 2024). Nor is there a systematic assessment of how global platforms shape market entry conditions, competition and innovation in a small media market such as Georgia's (Internews, 2021).

Third, although several reports discuss challenges related to media sustainability, market concentration and the small size of the advertising market, they typically examine these issues at one point in time rather than following them across the full trajectory of digital transition (Transparency International Georgia, 2011, 2018; European Commission, 2023). As a result, the economic and structural dimensions of the transit from

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traditional media to digital platforms—pricing, advertising flows, investment in digital infrastructure, human capital, and the role of global platforms as intermediaries—are still insufficiently mapped and conceptualised.

This study aims to address these gaps by examining the transformation of the media sphere in Georgia as a primarily economic and structural process of transit from traditional media to digital platforms. Building on existing landscape descriptions, information ecosystem assessments and media consumption surveys (Mikashavidze, 2018; Internews, 2021; CRRC-Georgia, 2025), the main objective is to understand how technological innovation, market incentives and regulatory changes jointly reshape the configuration of the media sector, the strategies of media organizations and the habits of audiences.

More specifically, the study pursues three goals:

1. To reconstruct the main stages and drivers of media transformation in Georgia from a television-centred system to a hybrid environment where digital platforms play a central role in distribution and discovery of content, complementing and extending earlier descriptive work on the media landscape (Mikashavidze, 2010, 2018; Mendel, 2022).
2. To analyse the adaptation strategies of traditional and digital-born media actors, focusing on revenue models, cost structures, investment in digital technologies and the use of platform tools for audience development, building on but going beyond existing advertising-market and sustainability studies (Transparency International Georgia, 2011, 2018; European Commission, 2023).
3. To explore the implications of platformisation for the sustainability and diversity of the media market, including the balance between local and global actors, opportunities for niche and regional outlets, and the capacity of the sector to innovate under conditions of limited resources (Internews, 2021; Atchaidze, 2024).

By focusing on these economic and structural aspects, the article seeks to contribute to a more nuanced understanding of media change in Georgia, beyond normative or partisan evaluations. The Georgian case is considered as an example of a small, open media market that navigates digital transformation in the context of broader economic development and regulatory approximation to European standards (European Commission, 2023, 2024). The findings may be relevant not only for scholars of media systems, but also for policymakers, regulators and media practitioners who design and implement strategies for sustainable digital development in similar environments.

RESEARCH METHODOLOGY

This study is designed as a desk-based mixed-methods analysis combining qualitative document analysis and secondary quantitative data. The objective is to reconstruct the main stages of the transit from traditional media to digital platforms in Georgia and to link these stages to changes in market structure, regulation and audience behaviour.

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The period under review is 2003–2025, which covers the phase of broadcast dominance, the spread of broadband internet and early online outlets, and the subsequent expansion of social networks and platform-based distribution. This time frame is consistent with the longitudinal perspective adopted in existing media landscape and ecosystem assessments (Mikashavidze, 2010, 2018; Internews, 2021; Mendel, 2022).

The first group of materials consists of analytical reports and assessments that describe the structure, regulation and economic development of the Georgian media sector. Core references include the Media Landscape: Georgia overviews prepared for the European Journalism Centre, which summarise the configuration of traditional and digital media, ownership patterns and regulatory context (Mikashavidze, 2010, 2018).

The analysis also draws on Georgia Media Landscape Assessment 2021 published by the Europe Foundation, which provides a comprehensive review of legal and institutional conditions and incorporates previous studies on the information ecosystem (Mendel, 2022), as well as on Georgia: An Information Ecosystem Assessment by Internews, which focuses on information flows and digital channels (Internews, 2021).

Economic and market-related aspects are examined through advertising market studies produced by Transparency International Georgia, in particular The Georgian Advertising Market (Transparency International Georgia, 2011) and the later analysis of the 2017–2018 advertising market (Tsetskhladze & Andguladze, 2019). These reports are used to trace changes in the size and composition of advertising spending and the relative position of television and digital channels.

These documents are complemented by relevant regulatory and policy texts, such as laws on broadcasting and electronic communications, annual reports of the Georgian National Communications Commission, and European Commission country reports on alignment with the Audiovisual Media Services Directive. They serve primarily to identify regulatory milestones that may have influenced market incentives and digital development.

The second group of sources consists of secondary quantitative data on media consumption and internet use produced by CRRC-Georgia and partner organisations. The study relies on:

- the Georgia Media Consumption Survey 2024, implemented by CRRC-Georgia, which provides detailed indicators on sources of news, platforms and devices (Atchaidze & Fabos, 2024);
- the Georgia Media Consumption Survey 2024 report prepared for IREX, which contains additional breakdowns by socio-demographic groups (IREX & CRRC-Georgia, 2025);
- time-series data from Caucasus Barometer and related CRRC surveys, which allow the reconstruction of trends in media use and internet access from the late 2000s onwards (CRRC-Georgia, 2011–2024);
- the article Tracking Georgia's Media, Internet Usage and Perceptions Over a Decade, which synthesises CRRC data on media consumption and trust (Atchaidze, 2024).

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These datasets and publications provide longitudinal indicators of main news sources (television, online media, social networks, messaging apps), device usage and differences between age and settlement groups. Advertising figures and revenue distributions are taken from Transparency International Georgia's reports and, where relevant, from data cited in media sustainability and ecosystem studies (Transparency International Georgia, 2011; Tsetskhladze & Andguladze, 2019; Internews, 2021).

The documentary and regulatory materials (Mikashavidze, 2010, 2018; Mendel, 2022; Internews, 2021; Transparency International Georgia, 2011; Tsetskhladze & Andguladze, 2019) were subjected to qualitative content analysis. Texts were coded for references to:

1. the structure of the media market (types of outlets, distribution channels, ownership);
2. technological and economic changes (digitalisation, development of online platforms, advertising trends);
3. regulatory measures and policy initiatives relevant to media and digital communication.

Codes were then grouped into time periods corresponding to major technological and market shifts, allowing the reconstruction of a phased narrative of media transformation.

Survey and market data from CRRC-Georgia, IREX/CRRC-Georgia and related publications (Atchaidze, 2024; Atchaidze & Fabos, 2024; IREX & CRRC-Georgia, 2025) were analysed using descriptive statistics. For each available year, key indicators were extracted and organised into tables and graphs, including:

- primary sources of news;
- frequency of use of television, online media and social networks;
- device ownership and use for media consumption;
- selected indicators of trust in different media types.

Where overlapping data were available, results from different surveys were compared to check for consistency and to minimise artefacts of differing methodologies.

The study has several important limitations. First, it relies exclusively on secondary data and publicly available documents; no original surveys or interviews were conducted within the framework of this research. Second, survey methodologies and sampling strategies vary across years and projects, which may affect direct comparability of some indicators. Third, detailed financial data at outlet level are not publicly available, so conclusions about revenue models and cost structures are based on aggregated advertising data and sectoral assessments rather than on full financial statements.

Despite these constraints, the combined use of media landscape assessments, information ecosystem studies, advertising market reports and longitudinal survey data provides a transparent and replicable empirical basis for analysing the economic and structural transit from traditional media to digital platforms in Georgia.

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RESULTS

Based on media landscape assessments, ecosystem reports and advertising market studies (Mikashavidze, 2010, 2018; Internews, 2021; Mendel, 2022; Transparency International Georgia, 2011; Tsetskhladze & Andguladze, 2019), three broad stages of transformation of the Georgian media sphere can be distinguished for the period 2003–2025.

Stage 1: Broadcast-centred system (approximately 2003–2010)

In the first stage, the Georgian media sphere was dominated by national television channels and, to a lesser extent, print outlets and radio. Television accounted for the largest share of audience attention and advertising revenues, while the internet remained a marginal distribution channel due to limited access, relatively high costs and low penetration of broadband and smartphones.

Media landscape overviews from this period describe a structure in which national broadcasters function as primary information providers, with regional outlets and newspapers occupying niche and local roles (Mikashavidze, 2010). Advertising market reports confirm that television captured the overwhelming majority of advertising expenditure, with print and outdoor advertising sharing the remainder and online advertising barely visible in the statistics (Transparency International Georgia, 2011).

Stage 2: Early digital expansion and convergence (approximately 2010–2015) The second stage is characterised by the gradual expansion of internet access, the spread of affordable mobile devices and the emergence of both digital extensions of traditional media and online-born outlets. National television channels and newspapers launched websites and began to upload content online, while a first generation of news portals and online platforms entered the market with lower entry costs than broadcast media.

Media assessments from the early and mid-2010s note that most major broadcasters had developed a web presence and were experimenting with online video and news updates, although their core business remained centred on linear broadcasting (Mikashavidze, 2018). At the same time, several online news portals emerged as important players in the urban information environment, particularly in Tbilisi.

Advertising market studies for this period show that television continued to dominate in terms of revenue, but the share of online advertising started to grow from a very low base (Transparency International Georgia, 2011; Tsetskhladze & Andguladze, 2019). However, detailed data on digital advertising remained limited, and a significant part of online commercial communication began to flow through global platforms rather than through local media organisations.

Stage 3: Platformisation and hybrid media market (approximately 2015–2025) In the third stage, the Georgian media sphere can be described as a **hybrid market** in which traditional broadcasters, online outlets and platform-native actors coexist and increasingly depend on the same digital infrastructures. Smartphone penetration, mobile internet coverage and the widespread use of social networks and messaging applications have made platforms central nodes for the distribution and discovery of content.

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Information ecosystem assessments underscore the growing role of Facebook, YouTube and, later, Instagram and messaging services as primary channels through which users encounter news and media content (Internews, 2021). Media outlets routinely adapt their production routines to platform formats, producing shorter videos, social media posts and cross-platform packages.

At the structural level, the legacy distinction between "broadcast" and "online" becomes less clear-cut: television channels operate multiple digital products, online-born outlets explore video and live content, and some content producers function almost exclusively as platform-native brands. At the same time, market analyses continue to describe a small and concentrated advertising environment in which television remains influential, while digital advertising is fragmented and in part captured by global platforms (Mendel, 2022; Transparency International Georgia, 2011; Tsetskhladze & Andguladze, 2019).

Evolution of audience behaviour and device use

Secondary survey data from CRRC-Georgia and partner organisations show a steady but differentiated shift in media consumption patterns over the past decade (Atchaidze, 2024; Atchaidze & Fabos, 2024; IREX & CRRC-Georgia, 2025; CRRC-Georgia, 2011–2024).

Across the full observation period, **television remains an important source of news**, particularly for older age groups and residents of smaller towns and rural areas. In earlier survey waves, TV is consistently cited as the main or most frequent source of political and public affairs information. Even in more recent data, substantial segments of the population continue to rely on national television for daily news, especially outside Tbilisi.

At the same time, **online media and social networks have gained importance**, especially among younger and urban respondents. Time-series indicators from Caucasus Barometer and dedicated media consumption surveys show that:

- the share of respondents naming the internet and social media among their main sources of news has increased markedly since the early 2010s;
- younger cohorts are more likely to report using social networks, online portals and YouTube for news and entertainment;
- smartphone use as a primary device for accessing media has expanded in parallel with mobile internet penetration (Atchaidze, 2024; Atchaidze & Fabos, 2024).

The **device profile** of media consumption has also changed. While earlier surveys indicated a more prominent role for television sets and, to some extent, desktop computers, recent data point to the centrality of smartphones and, in some segments, tablets and laptops. This trend reinforces the importance of platforms and applications that are optimised for mobile use.

Survey evidence further suggests that audiences increasingly combine multiple channels: many respondents report using television alongside online media and social networks, rather than switching from one to another.

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This pattern supports the description of the Georgian media sphere as hybrid not only on the supply side, but also in terms of audience behaviour.

Market structure and advertising flows

Advertising market studies and media landscape assessments provide a picture of a **small, resource-constrained** media market in which traditional television maintains a strong position, while digital advertising gradually increases its share (Transparency International Georgia, 2011; Tsetskhladze & Andguladze, 2019; Mikashavidze, 2018; Mendel, 2022).

Analyses of the advertising sector identify several stable features:

- Overall advertising spending in Georgia is modest in absolute terms, reflecting the size of the economy and the limited number of large advertisers.
- Television accounts for a significant portion of total advertising expenditure throughout the period, especially in the 2000s and early 2010s.
- Print advertising declines steadily, mirroring global trends and the shrinking circulation of newspapers.

Beginning in the mid-2010s, available data and sectoral assessments note **the growth of online advertising**, although measurement remains incomplete. Transparency International Georgia's later reports point to an increasing proportion of advertising budgets being allocated to digital channels, including both local online media and global platforms (Tsetskhladze & Andguladze, 2019). Media landscape assessments confirm that many outlets have diversified revenue sources by offering banner advertising, sponsored content and, in some cases, social media campaigns for clients (Mikashavidze, 2018; Mendel, 2022).

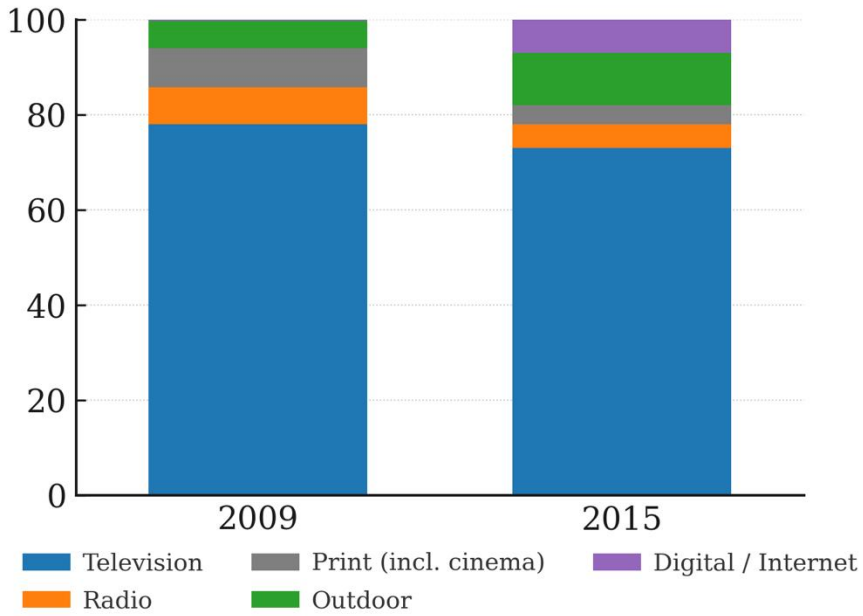

Figure 1. Distribution of gross advertising expenditure by medium in Georgia, 2009 and 2015. Sources: Transparency International Georgia (2011); Tsetskhladze & Andguladze (2019)

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However, the structure of the market creates several constraints:

- A significant part of digital advertising appears to flow directly to global platforms (e.g., search and social media advertising), which reduces the share available to domestic media actors.
- Smaller regional and niche outlets have limited access to large advertisers and often depend on public or donor funding to sustain operations.
- The lack of detailed, publicly accessible data on online advertising makes it difficult to precisely quantify the balance between local media and global platforms.

Overall, the market evidence supports the conclusion that the Georgian media sphere has moved towards a **more diversified but still vulnerable revenue structure**, in which traditional broadcasters remain important economic actors, but the digital environment increasingly shapes opportunities and constraints for all participants.

The role of global platforms as intermediaries

Although the available data do not allow for a full quantification of platform influence, the combination of information ecosystem assessments and media landscape studies highlights several aspects of the growing role of global digital platforms in the Georgian media sphere (Internews, 2021; Mikashavidze, 2018; Mendel, 2022).

First, platforms function as **key distribution channels** for Georgian media content. Many outlets maintain active profiles on major social networks and use them to promote news, video segments and live streams. This practice is driven by audience behaviour: surveys show that a substantial and growing share of users encounter media content through social feeds and messaging apps rather than by directly visiting media websites.

Second, platforms increasingly act as **gateways to advertising and monetisation**. While precise figures are not publicly available, sectoral assessments note that global platforms capture a portion of digital advertising expenditure through self-service tools and targeted campaigns, particularly for small and medium-sized businesses. This creates both opportunities – more accessible tools for advertisers and media to reach audiences – and challenges, as local media outlets compete with platforms for advertising budgets.

Third, platform design and algorithms influence **visibility and reach**. Internews' information ecosystem assessment emphasises that changes in platform algorithms can affect how easily users encounter particular types of content, which has implications for traffic to media websites and for the distribution of attention across outlets (Internews, 2021). While the present study does not include original platform data or interviews with platform representatives, the existing reports suggest that Georgian media increasingly adapt their content formats, publication schedules and promotion strategies to platform requirements.

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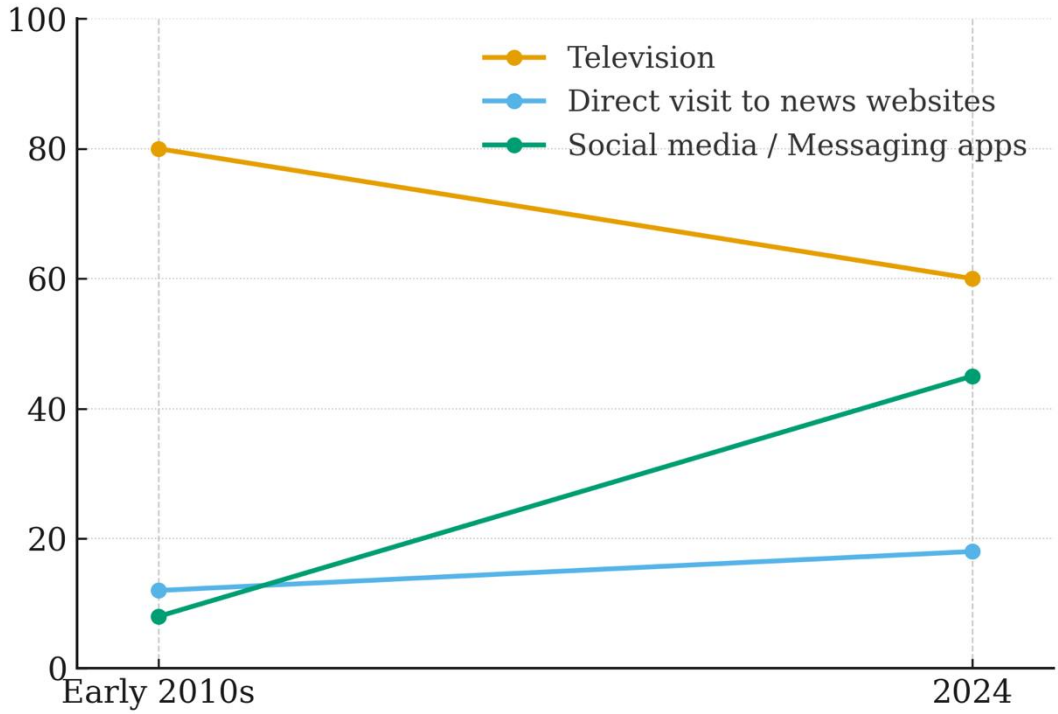

Figure 2. Change in main channels through which respondents access news in Georgia, early 2010s vs 2024 (%, multiple answers). Sources: CRRC-Georgia (Caucasus Barometer); IREX & CRRC-Georgia, Georgia Media Consumption Survey 2024

Taken together, these findings indicate that the transit from traditional media to digital platforms in Georgia is not limited to the emergence of online outlets. It also involves a deeper **reconfiguration of intermediation**, in which global platforms play a central role in connecting audiences, advertisers and content producers within a small, open media market.

DISCUSSION

The findings of this desk study indicate that the transformation of the media sphere in Georgia is better described as the emergence of a **hybrid, platform-influenced media system** than as a simple move from "television" to "the internet". Local analyses show that Georgia was historically a "television-centric" system, with TV as the dominant source of news and advertising, while more recent data demonstrate a gradual but clear increase in online and social media use (Mikashavidze, 2018; Atchaidze, 2024). This pattern aligns with international literature on hybrid media systems, where older and newer media logics coexist and interact rather than replacing each other (Chadwick, 2013).

Across the three stages reconstructed in the Results, traditional broadcasters remain structurally important in Georgia. Long-term survey data show that television continues to be cited as a main source of news by large parts of the population, especially older and non-urban respondents, even as younger and urban groups

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increasingly rely on online media and social networks (Atchaidze, 2024; CRRC-Georgia, 2011–2024; IREX & CRRC-Georgia, 2025). In parallel, Internews' information ecosystem assessment documents the central role of Facebook, YouTube and messaging apps in everyday information flows across regions and language communities in Georgia (Internews, 2021).

Taken together, these findings support the interpretation of the Georgian media sphere as a **hybrid system** in Chadwick's sense: traditional broadcasters, digital-born outlets and platform-native producers operate within a single environment where content circulates across TV, websites and social media, and where "old" and "new" media logics are tightly coupled (Chadwick, 2013; Mikashavidze, 2018). Rather than a replacement of one medium by another, the transformation involves an accumulation and recombination of channels and formats, underpinned by the rapid diffusion of smartphones and mobile internet documented in both Georgian and global surveys (Atchaidze, 2024; Reuters Institute, 2024).

The Georgian case also illustrates how **economic constraints** shape the trajectory of digital transformation. Transparency International Georgia's advertising market studies repeatedly emphasise the small size of the national advertising market and the long-lasting dominance of television in advertising revenues, with online advertising only gradually becoming visible in sector statistics (Transparency International Georgia, 2011; Tsetskhladze & Andguladze, 2019). Media landscape assessments similarly describe Georgian broadcasters as key economic actors in a market where the number of large advertisers is limited and many outlets face chronic financial pressure (Mikashavidze, 2018; Mendel, 2022).

At the same time, both Internews' ecosystem assessment and recent global evidence show that a growing share of advertising budgets is channelled through global platforms, particularly social networks and search engines (Internews, 2021; Reuters Institute, 2024, 2025).

For domestic media organisations, this means that digital transformation implies a **dual dependence**: continued reliance on television for relatively stable revenue and increasing dependence on platforms for distribution, visibility and, indirectly, monetisation. The Georgian case thus fits a broader pattern described in international literature on platformisation and media economics, where small and medium markets face intensified competition from global intermediaries for both audience attention and advertising income (Napoli, 2011; Internews, 2021).

From a sustainability perspective, available Georgian data show diversification rather than stabilisation: outlets add websites, social media products and new advertising formats, but the underlying resource base remains modest and unevenly distributed (Tsetskhladze & Andguladze, 2019; Mendel, 2022). This is consistent with comparative observations that digital revenues often do not compensate for declines in traditional income streams, especially in smaller markets (Reuters Institute, 2024).

The analysis also highlights the importance of **small-market conditions**. Georgia's limited population and economic size constrain the volume of advertising and the number of sustainable, full-scale media operations. This structural feature magnifies the impact of fixed production costs (especially for television) and intensifies

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the competitive pressure from global platforms, which benefit from economies of scale and standardised advertising tools across countries (Mendel, 2022; Internews, 2021).

At the same time, the Results suggest that **Europeanisation and regulatory approximation** act as indirect incentives for modernisation. European Commission country reports and national assessments note progress in aligning Georgian law with the EU Audiovisual Media Services Directive and in improving ownership transparency and regulatory frameworks (European Commission, 2023; Mendel, 2022). International media policy literature has long argued that such regulatory shifts can reorient media systems from a "cultural-industrial" logic towards a "competition and diversity" logic (van Cuilenburg & McQuail, 2003), and the Georgian trajectory appears to follow this pattern at least in formal terms.

However, the Georgian evidence also confirms that regulatory approximation alone does not solve issues of **economic sustainability or platform dependence**. Without parallel measures addressing the small size of the market, the transparency of digital advertising and the bargaining position of local actors vis-à-vis global platforms, convergence on European standards remains a necessary but not sufficient condition for a resilient media environment.

The findings have several implications for media policy and future research. First, they support policy approaches that treat the Georgian media sphere as a **single hybrid ecosystem**, rather than as separate "traditional" and "digital" sectors. This is in line with both local evidence of cross-platform consumption (Atchaidze, 2024; IREX & CRRC-Georgia, 2025) and international work on hybrid media systems (Chadwick, 2013). Regulatory instruments, support schemes and monitoring tools may therefore be more effective if they explicitly account for cross-media flows of content, audiences and revenue.

Second, the Georgian case underlines the need for **better data on digital advertising and platform-related revenues**. Current public statistics capture only part of online spending, and much of the value generated by Georgian audiences on platforms is not visible in national accounts. Developing more systematic measurement—through cooperation among regulators, research organisations and industry—would align Georgia with international good practice and provide an empirical basis for targeted interventions (Napoli, 2011; Mendel, 2022).

Third, the reliance of this study on secondary data points to clear directions for **future empirical work in Georgia**. Field research with media organisations could clarify how strategic decisions about formats, investment and platform use are made under conditions of financial constraint and algorithmic uncertainty, building on initial qualitative evidence gathered in ecosystem assessments (Internews, 2021). Comparative studies across South Caucasus or other small markets could help distinguish which aspects of the Georgian trajectory are context-specific and which reflect broader global trends documented in cross-country research such as the Reuters Institute Digital News Reports (Reuters Institute, 2024, 2025; Atchaidze, 2024).

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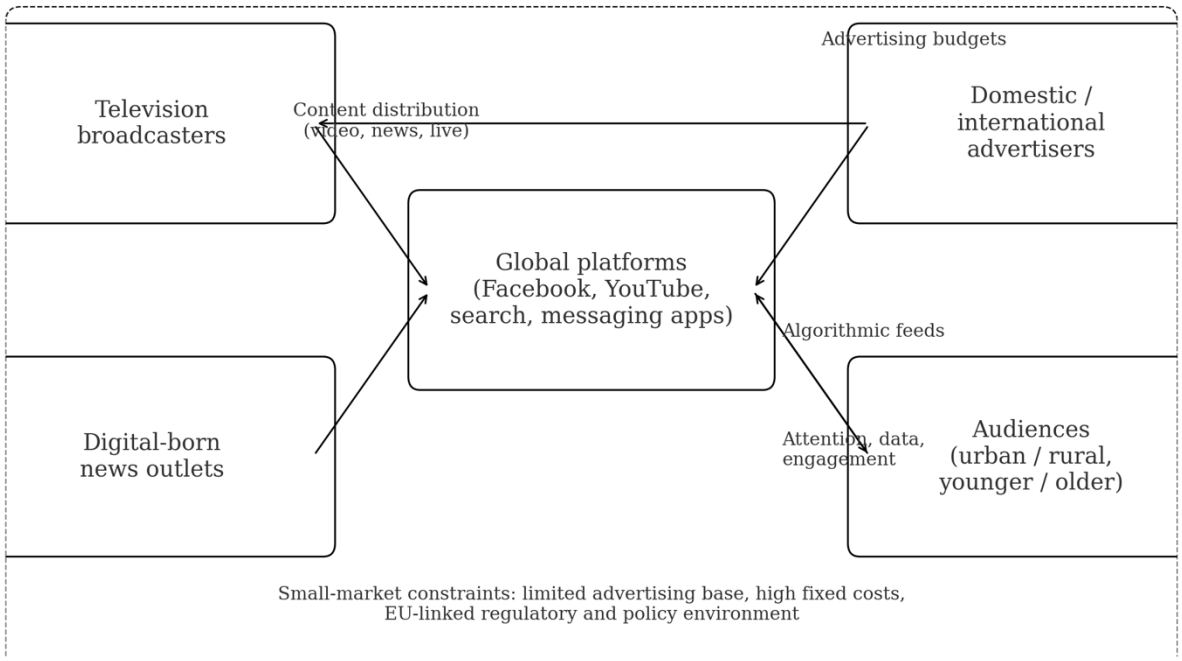

Figure 3. Hybrid media system in Georgia: actors and flows in a small, platform-influenced market

Finally, the analysis suggests a conceptual shift in how the transformation of the Georgian media sphere is framed. Instead of asking whether digital platforms will "replace" traditional media, it may be more productive to examine **how interactions between legacy actors, digital outlets and global platforms can be structured** so that domestic media remain economically viable and audiences have access to diverse, trustworthy information. This perspective connects Georgian empirical data with a broader international conversation about deep mediatization and platformisation, in which media systems are seen as evolving assemblages of technologies, organisations and practices rather than as discrete, sequential stages (Couldry & Hepp, 2017; Chadwick, 2013).

CONCLUSION

This article examined the transformation of the media sphere in Georgia as a **transit from traditional media to digital platforms**, treating it primarily as an economic and structural process rather than a technological or political episode. Using a combination of media landscape assessments, information ecosystem studies, advertising market reports and longitudinal survey data, the study reconstructed three broad stages: a broadcast-centred phase, a period of early digital expansion and convergence, and the current stage of platformisation and hybridisation.

First, the analysis showed that Georgia has not moved from a "TV era" to a purely "digital era", but has instead developed a **hybrid media system**. Television remains an important source of news and a major

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recipient of advertising revenues, especially for older and non-urban audiences, while online media and social networks have become central for younger and urban users. Media organisations increasingly operate across multiple channels simultaneously, adapting their content and formats to both broadcast and platform logics.

Second, the results highlighted the decisive role of **economic constraints** and the small size of the advertising market. The Georgian media sector is characterised by limited resources, a relatively narrow base of large advertisers and a continued structural advantage for television in attracting advertising. Digital advertising has grown, but a significant share appears to flow through global platforms, which reduces the portion available to domestic media and contributes to a dual dependence on both legacy broadcast income and platform infrastructures.

Third, the study underscored the importance of **platform intermediation** in the contemporary media sphere. Global platforms have become key gateways for the distribution and discovery of content and for the allocation of digital advertising. Georgian media organisations are therefore required to adapt their production routines, promotion strategies and, to some extent, revenue models to platform requirements, while having limited influence over platform rules and data transparency.

Fourth, the findings suggested that **regulatory approximation to European standards** has functioned as an indirect driver of institutional change, especially in areas such as audiovisual regulation and ownership transparency. However, these legal and policy reforms do not by themselves resolve structural issues of economic sustainability or the asymmetry between local actors and global platforms. Addressing these challenges will require more detailed measurement of digital advertising, closer monitoring of market developments and targeted support for innovation and diversity in the domestic media sector.

Finally, the study's reliance on secondary data and public reports points to clear directions for **future research**. Empirical work with media organisations, advertising intermediaries and platform representatives would help clarify how strategic decisions are made under conditions of financial and algorithmic uncertainty. Comparative studies of other small media markets would further situate the Georgian case within wider debates on hybrid media systems and platformisation.

Overall, the Georgian experience shows that the transit from traditional media to digital platforms is not a simple replacement of one technology by another, but a long-term process in which legacy media, digital outlets and global platforms become interdependent within a constrained economic and regulatory environment.

Conflict of interests:

The author declares no conflict of interest.

Author Contributions:

Conceptualization, methodology, validation, formal analysis, investigation, resources, data curation, writing - original draft preparation, writing - review and editing, visualization – O.V.

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MODERN INTELLIGENT SYSTEMS FOR DIGITAL TRANSFORMATION IN CORPORATE BUILDING CONSTRUCTION WITHIN THE CONTEXT OF INDUSTRY 5.0

Radoslav SIMIONOV
Burgas Free University
8001, Burgas, 62 San Stefano Str.
Bulgaria
r.simionov@bfu.bg
ORCID ID: 0000-0002-9021-9318

Radostin DOLCHINKOV
Burgas Free University
8001, Burgas, 62 San Stefano Str.
Bulgaria
rado@bfu.bg
ORCID ID: 0000-0002-4671-9702

Kamen SEYMENLIYSKI
Burgas Free University
8001, Burgas, 62 San Stefano Str.
Bulgaria
kdimitrov@bfu.bg
ORCID ID: 0000-0001-9910-2362

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ABSTRACT

The accelerating integration of digital technologies, automation, and artificial intelligence (AI) is reshaping the construction sector and enabling the transition toward intelligent, data-driven, and human-centric workflows consistent with the principles of Industry 5.0. Against this background, the present study investigates how advanced construction technologies—such as robotics, additive manufacturing, Building Information Modeling (BIM), Digital Twin environments, and Structural Health Monitoring (SHM)—can support the digital transformation of building construction. The objective is to assess the potential of these technologies to improve precision, efficiency, sustainability, and lifecycle performance, while identifying the regulatory, ethical, and engineering challenges relevant to their implementation in the Bulgarian context. The research employs a systematic synthesis of engineering and managerial solutions, combining analytical review, comparative evaluation of international standards, and conceptual modeling of integrated intelligent construction frameworks. Through this approach, the study examines machine learning methods for material optimization, predictive modeling, and real-time monitoring, as well as the role of digital twins in establishing continuous feedback loops between design, execution, and lifecycle management. The results indicate that robotic automation can increase dimensional accuracy to within 3 mm, additive manufacturing can reduce construction waste by 50–60% and shorten execution time by up to 40%, while AI-based monitoring significantly improves damage detection and predictive maintenance reliability. These findings demonstrate that intelligent systems enhance, rather than replace, engineering decision-making and contribute to more transparent, adaptive, and sustainable construction processes.
Overall, the study concludes that the successful adoption of Industry 5.0 principles in construction requires not only technological readiness but also supportive regulatory frameworks, ethical guidelines, and coordinated national strategies. Bulgaria possesses substantial potential for such transformation, provided that pilot initiatives, digital standards, and interdisciplinary collaboration are actively developed.

Keywords: *Artificial Intelligence (AI); Sustainable Construction; Energy Efficiency; Digital Twin; Building Information Modeling (BIM); Material Optimization; Machine Learning.*
JEL classification: *L10, L11, L23, L60, L61, L74, O14, O33, Q01*

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INTRODUCTION

One of the critical global trends in the construction industry is the increasing adoption of robotic and automated systems for structural development, along with the implementation of 3D printing technologies for buildings. These innovations have already found real-world applications in countries such as the Netherlands, Denmark, and the United Arab Emirates (Gračanin et al., 2019; Sofic, 2022).

In Bulgaria, however, such technologies remain at an experimental stage, as the absence of a regulatory framework and standardized procedures hinders their broader adoption.

At the same time, economic and social factors, including rising labor costs, a declining number of skilled construction professionals, and the growing need for sustainable structures are creating strong prerequisites for transformation within the sector.

Figure 1. Transition from Industry 4.0 to Industry 5.0 in the construction sector (automation → data → AI → human–machine collaboration)

The use of advanced digital technologies has the potential to significantly reduce construction costs, improve energy and resource efficiency, and shorten project implementation timelines (Rinchen et al., 2024).

In this context, the present paper aims to highlight modern trends and technological solutions in structural construction, focusing on:

- the implementation of automated and robotic systems;
- the application of 3D printing and digital twins in building processes;
- the use of intelligent monitoring and maintenance systems based on sensor networks and artificial intelligence;
- the economic and engineering advantages of these technologies in the Bulgarian context.

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This paper combines conceptual, analytical, and practical perspectives to outline the development trajectory of the national construction industry within the broader global transition toward Industry 5.0 (Carayannis & Morawska-Jancelewicz, 2022).

METHODOLOGY

The methodological framework of this study is based on a systematic synthesis of engineering and managerial solutions that support the digital transformation of the construction industry within the context of Industry 5.0. The approach integrates analytical review, comparative evaluation, and conceptual modeling of advanced technologies, including robotics, additive manufacturing, Building Information Modeling (BIM), Digital Twin systems, and Structural Health Monitoring (SHM) (Camarinha-Matos, Rocha, & Graça, 2024; Xun et al, 2021; Salunkhe & Fasth Berglund, 2022).

The research process follows three interrelated stages. The first stage involves an analytical review of international standards, European regulations, and scientific publications to identify key technological, regulatory, and ethical trends related to automation and intelligent construction. The second stage focuses on a comparative assessment of the applicability of these technologies in the Bulgarian construction sector, taking into account economic, regulatory, and workforce constraints. The final stage emphasizes the synthesis of engineering and managerial solutions into an integrated conceptual model for intelligent lifecycle management, highlighting human–machine collaboration, data-driven decision-making, and ethical responsibility as guiding principles of Industry 5.0 (Braga, Serrano & Fernández-Medina, 2025).

This methodological approach allows the paper to bridge the gap between technological innovation and practical implementation, establishing a foundation for strategic decision-making and sustainable transformation in the construction sector.

Robotics and Automation in Construction Processes

The foundation of automation lies in the transition from manual and semi-automated labor to machine-based execution, where key operations are performed by mechanized or autonomous systems integrated with built-in control algorithms. The principal goal of this transformation is to achieve greater precision, repeatability, and productivity, while simultaneously minimizing human involvement and enhancing occupational safety in the construction environment.

Modern construction automation technologies have evolved to encompass a broad range of applications, generally structured around robotic execution systems, information and control systems, and additive manufacturing technologies (Leng et al., 2022). Robotic execution systems include mechanized devices capable of performing construction tasks under partial or full autonomous control. Typical examples comprise bricklaying and assembly robots, automated reinforcement systems, and mobile robotic platforms for welding

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or concrete spraying. These systems are evaluated in terms of productivity, positioning accuracy, energy efficiency, and their ability to adapt to varying geometries and construction conditions.

Parallel to these, information and control systems employ artificial intelligence (AI) and computer vision to enable real-time monitoring, defect detection, and coordination of construction activities. Through the use of drones and sensor networks, such systems can automatically track project progress and synchronize data with Building Information Modeling (BIM) environments, allowing seamless digital management of site operations (Islam et al., 2025).

A further dimension of automation involves additive manufacturing – the 3D printing of structural components through robotic extrusion. In these processes, materials are deposited layer by layer, guided by digital instructions that define the movement of the extruder and the geometry of the printed layers. The most common systems are concrete printers with flexible manipulators or robotic arms, designed for composite fabrication and large-scale structural assembly (Paolini & Rank, 2019).

The engineering benefits of robotization in construction are substantial. Implementation of such systems results in notable improvements in dimensional accuracy, where deviations from the design geometry can be reduced to less than 3 millimeters. Studies indicate that technological errors and construction waste may be reduced by 20–30% compared to conventional manual methods, while material consistency and quality, particularly in polymer concretes and fiber-reinforced mixtures show measurable enhancement. Additionally, the construction cycle time for repetitive structures can be shortened by approximately one-third. Research conducted by the Fraunhofer Institute (Germany) and ETH Zürich confirms that full automation of selected building processes can lower labor costs by around 20%, while simultaneously improving structural precision and durability (Masri et al., 2024).

In the context of Bulgaria, the integration of robotic technologies in construction remains in an early experimental phase. As of 2025, industrial-scale 3D printing systems for building construction have not yet been deployed, and no regulatory framework for certifying automated structures exists. Nevertheless, several academic and private initiatives are exploring additive manufacturing of specific elements, such as form-shaped façade panels, decorative components, and formwork systems, though practical applications remain limited. Major barriers are: high initial investment requirements, lack of governmental incentives for technological modernization, and a shortage of engineers specialized in mechatronics and automation of construction processes. An additional challenge is the absence of national standards equivalent to ISO 22514 and EN 17412, which define levels of digital model detail and quality-control procedures (Xu et al., 2025).

Despite these limitations, European trends clearly indicate that automation is an inevitable aspect of modernization within the construction sector. Bulgaria possesses the potential to move beyond conceptual developments toward pilot implementation of robotic technologies through collaboration between academia, industry, and the public sector. The establishment of testing sites and laboratories for automated construction

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could provide the experimental foundation for evaluating new technologies and for preparing engineers to participate actively in the next stage of digital transformation.

3DPrinting of Structural Elements in Construction

The technology of 3D printing in construction, also known as additive manufacturing, represents a process of layer-by-layer deposition of a construction material – typically a cementitious, gypsum-based, or polymer composite mixture, by means of a robotic extrusion system controlled by a digital model generated in a CAD or BIM environment. The digital model is converted into a sequence of machine instructions (G-code) that define the motion of the extruder and the geometry of the printed layers. The process relies on three fundamental technological components: the digital model, the material system, and the robotic extrusion platform. The digital model defines the spatial geometry of the element, which is divided into individual layers with heights ranging from 5 to 25 mm. The material system consists of a specialized concrete or composite mixture with optimized rheological properties – viscosity, setting rate, and deformability, ensuring layer stability and strong interlayer adhesion. The robotic extrusion platform may operate on a Cartesian coordinate system or employ a multi-joint robotic arm driven along the X–Y–Z axes, providing high positioning accuracy and automated material dosing (Flor-Unda et al., 2025).

The physical processes occurring during printing are controlled in real time, with key parameters including feed rate, ambient temperature and humidity, and the initial setting time of the mixture. When proper synchronization is achieved between the mixing module and the kinematic system, precision levels of up to ±2 mm can be attained, with printing speeds reaching 1–2 m² per minute for walls up to 3.5 meters in height. Such precision places construction-scale 3D printing at the intersection between automation and high-precision industrial robotics (Ichimori et al., 2024).

The materials used in additive construction possess specific physico-mechanical characteristics. The most common are cement-based composites enhanced with micro-reinforcement, plasticizers, and setting accelerators, providing the required plasticity and rapid strength gain. Another material class comprises polymer-concrete mixtures, characterized by high plasticity and controlled shrinkage, suitable for decorative or non-structural components. Growing attention is also directed toward geopolymer mixtures, which allow for a reduction of carbon emissions by up to 70% compared to traditional Portland cement while ensuring high thermal resistance and long-term durability.

From a structural standpoint, 3D-printed components exhibit anisotropic strength, as the interlayer bonds are weaker along the Z-axis. This limitation necessitates hybrid construction solutions, where additively manufactured walls are combined with embedded reinforcement or pre-stressed elements to enhance structural stability. Experimental research conducted at ETH Zürich (2023) demonstrates that by controlling temperature and optimizing extrusion parameters, interlayer bonding strength can be increased by up to 35%, improving both homogeneity and the overall load-bearing capacity of the structure (Salami, et al., 2024).

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In Bulgaria, as of 2025, there has been no practical implementation of 3D printing for building construction. However, the existing academic and technological potential provides favorable conditions for the gradual introduction of pilot projects. The most suitable applications for initial experimentation include small-scale architectural structures such as pavilions, shelters, and low-rise residential units, as well as individual components—façade panels, partition walls, decorative modules, and infrastructural elements such as curbs or retaining blocks. Successful realization of such initiatives requires the adaptation of existing production facilities equipped with robotic arms and mixing stations, as well as the establishment of inter-institutional research centers involving universities, industry partners, and municipalities. It is also necessary to develop national guidelines for testing and certifying additive construction materials, following the models of EN 206 and ISO/ASTM 52900, alongside the implementation of digital quality control systems fully integrated with BIM workflows.

A practically feasible pilot project could involve the fabrication of a single-story demonstration pavilion with an internal volume of approximately 30 – 40 m², constructed using geopolymer materials. Such an endeavor would enable assessment of real mixture parameters, interlayer durability, and validation of the technological performance metrics of the process. Moreover, it could serve as a foundation for developing national technical specifications and for training engineers and technologists in the field of additive construction.

When fully implemented, 3D printing in construction has the potential to deliver significant economic and environmental benefits. It is projected to reduce construction waste by 50–60% compared to traditional formwork methods, shorten construction time by up to 40%, and decrease labor costs by approximately 25%. The use of geopolymer mixtures further contributes to a substantial reduction in the carbon footprint of the building sector. These advantages clearly demonstrate that additive manufacturing represents a cost-effective and sustainable solution for small and medium-sized projects, particularly under conditions of skilled labor shortages and rising construction costs (Arunachelam et al., 2022).

Intelligent Systems for Structural Monitoring and Control

Structural Health Monitoring (SHM) represents a systematic and continuous process of data acquisition, analysis, and interpretation related to the condition and behavior of civil structures in real time. The main objective of such systems is the early detection of damage, deformations, or material degradation, enabling timely intervention and prevention of potential failures. SHM is based on three fundamental engineering principles: continuous measurement of structural parameters, analysis of dynamic characteristics, and comparison of current structural conditions with baseline models using machine learning or statistical algorithms. These approaches allow not only the diagnosis of structural performance but also the prediction of future behavior and degradation patterns.

A typical SHM system consists of several interrelated layers. At its foundation lies the sensor layer, composed of embedded or external sensors that record stresses, strains, vibrations, accelerations, and

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temperature gradients. Both traditional sensors, such as strain gauges and accelerometers, and advanced fiber Bragg grating (FBG) sensors are used, the latter providing high accuracy and long-term stability. Above this, the communication layer (wired or wireless) ensures reliable data transmission to the computational infrastructure, where data processing is performed either locally through edge devices or centrally on server-based analytical platforms. At the top of the hierarchy stands the diagnostic layer, where algorithms for condition analysis and visualization are implemented, often integrated within BIM environments or digital twin systems for comprehensive structural representation.

Depending on the structural type and operational environment, sensors can be mounted on the surface of steel or concrete elements, embedded during casting or module fabrication, or applied through non-contact techniques such as laser interferometry, photogrammetry, or drone-based monitoring. Advances in microsensor technology have led to the development of energy-autonomous sensors equipped with piezoelectric microgenerators, enabling long-term operation in remote or hard-to-access areas without external power supply.

Data processing within SHM systems combines classical engineering methods with modern artificial intelligence approaches. Modal analysis is used to track variations in natural frequencies and vibration amplitudes, while time–frequency methods such as Fast Fourier Transform (FFT) and wavelet transforms enable the detection of local damage and structural instabilities. Recently, machine learning algorithms have been increasingly adopted for structural classification, damage assessment, and prediction of residual service life. The integration of these techniques with correlation analysis between multiple physical parameters, such as temperature, strain or vibration, humidity relationships, provides a much more accurate and holistic evaluation of the structural condition (Nahavandi, 2019; Crnobrnja et al., 2023).

In practical engineering applications, SHM is most commonly implemented in bridge structures, where dozens of sensors continuously record dynamic loads caused by passing vehicles. The acquired data are processed in real time by edge-computing devices, and any deviations from predefined thresholds trigger automatic alerts to control centers. Similar solutions are increasingly used in reinforced concrete buildings, tall structures, and infrastructure systems exposed to vibrational or seismic impacts.

In the Bulgarian context, the application of SHM systems remains limited, primarily to research or demonstration projects. The main constraints are the high cost of equipment, lack of specialized personnel, and the absence of a national regulatory framework governing the integration of SHM within design documentation. Nevertheless, the potential for development is significant, especially in bridge structures, high-rise buildings, heritage sites, and industrial and energy facilities, where continuous condition assessment is critical for safety and operational efficiency.

From an engineering perspective, the implementation of SHM in Bulgaria should begin with its integration into the design phase through BIM-based platforms and the development of a national protocol for structural monitoring aligned with international standards such as ISO 13374 (Condition Monitoring) and ISO 30146

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(IoT Framework). The establishment of calibration and training laboratories is also essential to prepare specialists in structural diagnostics and provide an experimental environment for testing and validating new technologies. In this way, SHM can evolve from a passive monitoring instrument into an active component of intelligent lifecycle management, supporting the digital transformation and resilience of the built environment.

Intelligent Construction and Lifecycle Management of Structural Systems

Intelligent construction represents the next stage in the evolution of the building process, in which digital technologies, automation, and data analytics are integrated into a unified framework for quality and performance management. The core concept is the transition from a traditional linear workflow to a circular, data-driven process, where information generated during design and construction is used to optimize operation and maintenance, while feedback from operational data informs and improves future project development.

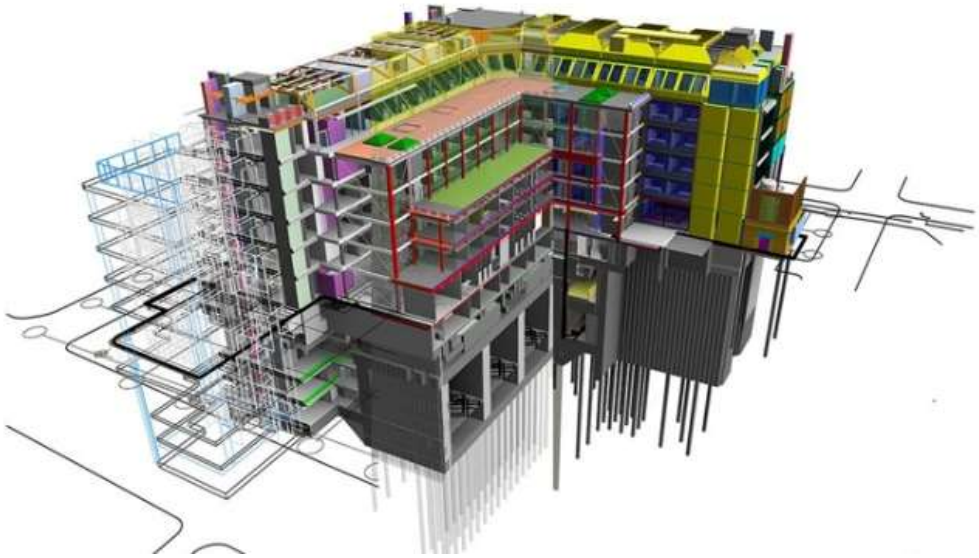

Figure 2. Functional scheme of construction robotics: execution systems, control systems, and additive manufacturing platforms

Contemporary intelligent construction systems integrate Building Information Modeling (BIM), automated machinery, sensor networks, and artificial intelligence. Through this integration, project geometry and structural parameters are transmitted directly to machines and robots operating on construction sites, enabling execution with millimeter-level precision. Machines equipped with GPS/RTK, LiDAR, and computer vision systems perform operations such as excavation, leveling, assembly, and concrete deposition under constant geometric supervision. The collected data are then transmitted back to the BIM model, forming a dynamic feedback loop between design and realization (Zhang et al., 2021).

During the construction phase, intelligent systems provide three key advantages:

- Enhanced accuracy and repeatability of construction operations;
- Reduction of human errors and overall construction cycle time;
- Real-time quality control through continuous verification of geometric and technological parameters.

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Once the structure enters the operational phase, the same infrastructure supports Lifecycle Management (LCM), enabling continuous monitoring of temperature, deformation, vibration, and humidity, which describe the structure's current condition. These data are processed by predictive analytics algorithms and applied for:

- Assessment of residual load-bearing capacity and structural integrity;
- Optimization of maintenance and repair schedules;
- Evaluation of energy and resource efficiency throughout the lifecycle.

When connected to a Digital Twin, the system transitions from passive monitoring to active predictive control. The virtual model is continuously updated with live sensor data, allowing designers and engineers to simulate various scenarios such as load changes, seismic events, or material aging. This creates a continuous feedback cycle between design, construction, and maintenance, resulting in improved safety, resilience, and sustainability of the built environment.

Figure 3. Concept of a digital twin: physical asset equipped with sensors and a virtual model with real-time data integration

In the Bulgarian context, the application of such integrated systems remains at an early stage. The absence of a regulatory framework, the limited implementation of BIM methodologies, and the low level of digitalization in construction processes hinder full-scale realization. Nonetheless, there is considerable potential for deployment in:

- Infrastructure assets with long service life, such as bridges, tunnels, and dams;
- Public and industrial buildings where lifecycle management is linked to energy efficiency and critical systems maintenance;
- New residential developments that can serve as pilot digital twin models for managing energy flows and structural behavior.

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To facilitate this transformation, a national digital asset management framework should be developed in alignment with international standards such as ISO 19650 and ISO 55000, regulating data exchange, levels of detail, and structural reliability assessment algorithms. Such an initiative would enable the creation of a unified database of infrastructure condition, supporting maintenance planning, reconstruction strategies, and investment prioritization at the national level.

Ethical, Regulatory, and Future Challenges

The introduction of artificial intelligence (AI), automation, and robotics in construction raises a number of questions related to ethical responsibility, legal regulation, and engineering oversight of automated processes. Unlike traditional systems, where accountability for design and execution is clearly defined – automated technologies establish a new form of human–machine interaction. As a result, there is a growing need to clearly delineate the roles and responsibilities of designers, operators, investors, and system manufacturers within intelligent construction ecosystems.

According to the Industry 5.0 philosophy, the human remains the central decision-making element. AI and automation are designed to support, not replace, the engineer's expertise – they analyze, recommend, and optimize, but the final engineering decision must always be validated by a qualified specialist. This principle, known as the human-in-the-loop concept, ensures a balanced relationship between algorithmic efficiency and structural safety.

At the regulatory level, the European Artificial Intelligence Act (2024) introduces the principle of risk-based assessment for the deployment of automated systems. In the construction sector, this implies that algorithms used for design, simulation, and quality control will require certification and verification similar to that applied to construction materials and products. Such regulation is particularly important because an error in computational modeling or AI training may lead to structural defects and pose safety risks.

In the Bulgarian context, there is still no comprehensive legal framework addressing automation in design and execution. This necessitates adapting existing national standards in alignment with European and international norms such as ISO 19650 (BIM), ISO 13374 (Condition Monitoring), and ISO 30146 (IoT Framework). Moreover, a dedicated regulatory act is required to define what constitutes an intelligent construction system and to specify liability boundaries when algorithms are used for structural analysis and control.

From an engineering standpoint, one of the most serious challenges is the accumulation of systematic errors in automated workflows, especially when data are poorly verified or sensors are incorrectly calibrated. Therefore, the application of AI and automation must be accompanied by rigorous validation procedures, test simulations, and independent technical audits. Only through such practices can it be ensured that intelligent systems do not compromise load-bearing capacity or structural reliability.

The ethical dimension of digitalization also extends to the ownership and security of data generated throughout a structure's lifecycle. With the growing number of digital twins and online monitoring systems,

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questions arise regarding data possession and accountability, whether it lies with the investor, designer, contractor, or operator. Addressing this issue requires clear information-security regulations and protection mechanisms for engineering data, consistent with European cybersecurity policies such as the EU Cyber Resilience Act. The future of intelligent construction research can be outlined along three major directions:

- Development of adaptive design and management models based on continuous feedback between the digital twin and the physical structure;
- Integration of new smart materials with embedded sensing capabilities that enable self-monitoring of physical and mechanical properties;
- Advancement of hybrid AI systems combining machine learning with engineering expertise for more reliable simulation and prediction.

In conclusion, the evolution of the construction sector toward full digitalization and automation cannot be viewed solely as a technological innovation. It requires the establishment of an ethical and regulatory infrastructure that aligns technological progress with engineering responsibility and safety principles. The future of construction will belong to systems that combine intelligence, adaptability, and transparency, ensuring that technology serves humanity - rather than replacing it.

CONCLUSION

The development of modern construction technologies lays the foundation for a new engineering–scientific paradigm, in which automation, artificial intelligence, and digital modeling become the primary instruments for achieving high precision, sustainability, and efficiency. The transition from traditional methods to intelligent systems is not merely a technological shift but a structural transformation in the way civil structures are designed, constructed, and managed throughout their lifecycle.

This study has demonstrated that the implementation of robotic and additive technologies can significantly reduce labor intensity and production costs while enhancing quality control and safety in construction processes. At the same time, the adoption of structural health monitoring systems and digital twins extends the understanding of structural lifecycle management - from the instantaneous physical state to the long-term behavioral prediction of buildings and infrastructure assets. Consequently, the role of the engineer evolves from that of a traditional executor to that of a data analyst and lifecycle manager, interpreting dynamic feedback about the real performance of the structure.

Special attention must be paid to the Bulgarian context, where automation and 3D printing have not yet reached practical implementation. The absence of a specialized regulatory framework, limited digital competence, and weak industry–academia collaboration create substantial barriers to innovation. Overcoming these challenges requires a targeted national policy promoting technological centers, pilot laboratories, and interdisciplinary projects aimed at validating and adapting advanced technologies to local conditions.

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The scientific potential and engineering priorities for the next decade can be summarized in several key directions:

- Development of national standards for digital and additive construction, harmonized with European regulations such as ISO 19650 and the AI Act;
- Creation of demonstration facilities equipped with integrated sensors and digital twins for research and training purposes;
- Implementation of AI-based methods for structural diagnostics, predictive analysis, and adaptive control of building performance;
- Establishment of ethical and legal principles of engineering responsibility in the context of automated and intelligent systems.

In conclusion, intelligent construction is not merely a technological trend but a new model of engineering thinking – one that emphasizes efficiency, safety, and sustainable development. Implementing this concept in Bulgaria will require systematic institutional support, yet its potential to transform the construction industry is indisputable. The evolution of construction toward an information-driven, intelligent system, governed by knowledge, algorithms, and responsibility, marks the path toward the next generation of Industry 5.0 engineering practice.

Conflict of interests: The authors declare no conflict of interest.

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BULGARIAN BUSINESS AND FULL MEMBERSHIP IN THE SCHENGEN AREA. BUSINESS BAROMETER 2025

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Deyan PUSHKAROV
University of National and World
Economy, Sofia, Bulgaria
deyan.pushkarov@gmail.com
ORCID ID: 0009-0004-9746-166X

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ABSTRACT

The study focuses on the attitudes of Bulgarian enterprises towards Bulgaria's full membership in the Schengen area, based on data from the „Business Barometer 2025" survey. The study covers 800 organizations from all groups – micro, small, medium, and large enterprises. The main objective is to determine how Bulgarian businesses assess entry into the Schengen area and to what extent the size of enterprises influences assessments of the potential economic effects of the removal of border controls and other accompanying restrictions.

In its theoretical framework, the study examines the historical development of the Schengen area and highlights the expected benefits identified in existing European and international studies – reduced logistics costs, increased competitiveness, facilitated movement of goods and people, and promotion of investment. The parallel with Croatia and Romania shows similar preliminary attitudes, particularly dominant neutrality and moderate optimism.

The methodology includes a standardized questionnaire with six possible answers regarding the expected effect of membership. Descriptive statistics and nonparametric tests (Kruskal–Wallis and Mann–Whitney) are applied for analysis to check the influence of company size and market orientation on the assessments.

The comparative analysis confirms that the prevailing attitude is one of moderate optimism, which is stronger among companies with significant international activity. The expected benefits are mainly related to reduced transport costs, faster border crossings, the development of tourism, and the attraction of new investors. Key challenges are also identified: increased competition, the need for infrastructure investment, administrative adaptation, and the potential risk of additional labor mobility.

Bulgarian businesses view membership in the Schengen area as moderately positive but not crucial for economic activity. The biggest problem remains the high level of ignorance, which calls for more active information campaigns, especially for small and medium-sized enterprises. Membership offers significant opportunities, but their realization depends on effective institutional policies and improvement of the business environment.

Keywords: Schengen area, European Union, integration, business, economic interests, state institutions.

JEL classification: F02, F41, H77
Paper type: Research article

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INTRODUCTION

The impact of Bulgaria's full membership in the Schengen area on Bulgarian enterprises is part of a study based on empirical data from the „Business Barometer 2025“, conducted among 800 enterprises of various sizes - micro, small, medium, and large. The aim is to assess the extent to which the size of the company influences the perception of the potential benefits and risks of membership. To examine the attitudes and expectations of Bulgarian enterprises on the threshold of Bulgaria's full membership in the European Union.

The Schengen Agreement was launched on June 14, 1985, with the signing of an intergovernmental project between five EU countries – France, Germany, Belgium, the Netherlands, and Luxembourg. In 1990, the countries signed the Schengen Convention, which regulates the practical mechanism for abolishing border controls and creating a common visa policy.

The Schengen Agreement officially entered into force in 1995, when border checks and controls at the internal borders between the first participating countries were abolished. The set of rules governing the Schengen area is called the Schengen Borders Code.

Over the years, the area has expanded steadily to cover almost all EU member states, becoming the largest economic area for the free movement of people, goods, and capital in the world. Although Bulgaria joined the EU in 2007, it remained outside the Schengen area for a long time.

After more than a decade of negotiations, the country achieved full membership in 2025. This raised the question: what are the expectations and attitudes of Bulgarian businesses regarding the effects of this integration?

Studies on the effects of Schengen show that the removal of internal borders has a predominantly positive impact on economic processes. The European Commission (2024) estimates that member states earn billions of euros annually from free movement (European Commission, 2024, pp. 10–20). The OECD (2022) emphasizes that integrated transport corridors reduce business costs and stimulate cross-border supply chains (OECD, 2022, pp. 75–95). Bulgaria has the potential to become a more attractive logistics hub between Europe and Asia.

Newly acceded countries such as Croatia (2023) are seeing growth in tourism and logistics (National Statistical Institute, 2024, pp. 30-40). Bulgaria is similar in economic structure to Romania, whose businesses also had mixed expectations prior to accession (Institute for Market Economics, 2023, pp. 14-22).

Bulgaria's full accession to the Schengen area is a key institutional act with long-term economic and social implications (Bulgarian Industrial Association, 2024, pp. 9-35). The removal of land border checks is expected to facilitate the movement of people, goods, and services. For businesses, this means a potential reduction in transport costs, shorter delivery times, increased competitiveness, and greater opportunities for international trade (World Bank, 2021, pp. 100–120). Bulgaria is positioning itself as an „internal market“ within the EU, rather than as a periphery (Institute for Market Economics, 2023).

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Despite these optimistic expectations, companies' reactions may vary depending on their size, sector of activity, and orientation towards the domestic or foreign market (OECD, 2022).

METHODOLOGY

The survey was conducted using a standardized questionnaire among 800 companies.

The sample includes:

• 200 micro-enterprises (up to 10 employees);

• 200 small enterprises (11–50 employees);

• 200 medium-sized enterprises (51–250 employees);

• 200 large enterprises (over 250 employees).

The main question in the questionnaire is: „How will Bulgaria's entry into the Schengen area affect your company?“.

The possible answers are: entirely positive, generally positive, no effect, generally negative, entirely negative, I cannot say.

The data were analyzed using descriptive statistics, mean values, the Kruskal–Wallis test for differences between groups (ScienceDirect, 2025), and the Mann–Whitney test for pairwise comparisons (Social Science Statistics, 2025). The data were processed in two steps.

First, we check whether the size of the companies (the independent variable) has a statistically significant effect on the assessment of the impact of the country's accession to the Schengen area (the dependent variable). This is done using the Kruskal–Wallis test for more than two independent samples. Second, if the test shows a significant effect, the Mann-Whitney test is applied to show between which pairs of companies there is a statistically significant difference in size.

EMPIRICAL RESULTS

The main results show that most companies expect either a neutral or positive impact, while negative attitudes remain limited.

The summary results for all companies show that 13.3% assess membership as „entirely positive,“ 22.0% as „generally positive,“ 37% as „no impact at all,“ 6.6% as „generally negative,“ 5.3% as „entirely negative,“ and 15.9% say they cannot assess it (Table 1). This indicates a predominance of moderately positive or neutral attitudes. Particular attention should be paid to the high proportion of uncertain responses, which points to the need for better institutional communication and support.

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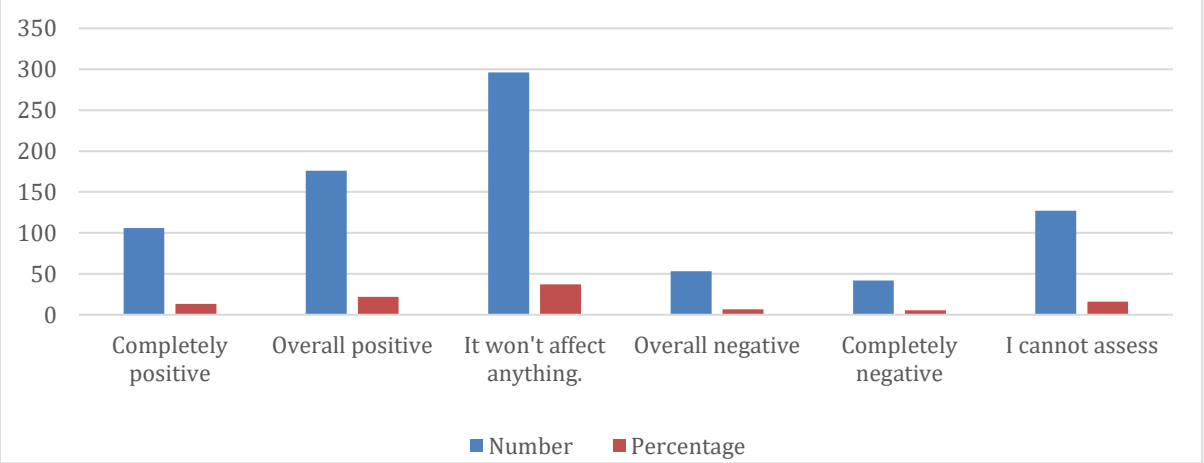
Table 1. Attitude of all companies

Impact on the company	Number	Percentage	Valid percentage	Cumulative percentage
Entirely positive	106	13,3	13,3	13,3
Generally positive	176	22,0	22,0	35,3
No impact whatsoever	296	37,0	37,0	72,3
Generally negative	53	6,6	6,6	78,9
Entirely negative	42	5,3	5,3	84,1
I cannot say	127	15,9	15,9	100,0
Total	800	100,0	100,0	—

Source: Author

Chart 1. Attitude of all companies



Source: Author

Among micro-enterprises, positive assessments are relatively lower and uncertainty is higher (19%). Small and medium-sized enterprises show similar attitudes, while large companies express greater optimism (38% positive assessments).

Despite these differences, statistical tests show that they are not significant after adjustments for multiple comparisons.

Table 2. Micro companies

Impact on the company	Number	Percentage	Valid percentage	Cumulative percentage
Entirely positive	24	12,0	12,0	12,0

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Generally positive	31	15,5	15,5	27,5
No impact whatsoever	69	34,5	34,5	62,0
Generally negative	22	11,0	11,0	73,0
Entirely negative	16	8,0	8,0	81,0
I cannot say	38	19,0	19,0	100,0
Total	200	100,0	100,0	—

Source: Author

Table 3. Small firms

Impact on the company	Number	Percentage	Valid percentage	Cumulative percentage
Entirely positive	27	13,5	13,5	13,5
Generally positive	49	24,5	24,5	38,0
No impact whatsoever	80	40,0	40,0	78,0
Generally negative	9	4,5	4,5	82,5
Entirely negative	9	4,5	4,5	87,0
I cannot say	26	13,0	13,0	100,0
Total	200	100,0	100,0	—

Source: Author

Table 4. Medium-sized companies

Impact on the company	Number	Percentage	Valid percentage	Cumulative percentage
Entirely positive	21	10,5	10,5	10,5
Generally positive	54	27,0	27,0	37,5
No impact whatsoever	71	35,5	35,5	73,0
Generally negative	17	8,5	8,5	81,5
Entirely negative	9	4,5	4,5	86,0
I cannot say	28	14,0	14,0	100,0
Total	200	100,0	100,0	—

Source: Author

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Table 5. Large companies

Impact on the company	Number	Percentage	Valid percentage	Cumulative percentage
Entirely positive	34	17,0		17,0
Generally positive	42	21,0		21,0
No impact whatsoever	76	38,0		38,0
Generally negative	5	2,5		2,5
Entirely negative	8	4,0		4,0
I cannot say	35	17,5		17,5
Total	200	100,0		100,0

Source: Author

The average values range from 2,46 (large enterprises) to 2,85 (micro enterprises), with the lower value indicating more neutral or slightly negative expectations (see Table 6). The Kruskal–Wallis test shows an overall effect of firm size, but the Mann–Whitney test after adjustments finds no significant differences between the pairs.

The Kruskal–Wallis test also did not show a statistically significant impact of the orientation of firms – those working entirely for the foreign market, those working mainly for the foreign market, those working equally for the foreign and domestic markets, those working mainly for the domestic market, and those working entirely for the domestic market - on their assessment of joining Schengen.

Table 6. Average values according to the number of employees

Number of people with permanent employment contracts	Average value	Number (N)	Standard Deviation
Up to 10 people	2,85	162	1,140
11–50 people	2,56	174	0,988
51–250 people	2,65	172	0,995
Over 250 people	2,46	165	1,009
Total	2,63	673	1,040

Source: Author

An interesting result is the high proportion of „I cannot say“ responses, which reaches almost 20% among micro-enterprises. This may be due to limited information about the practical effects of membership, as well

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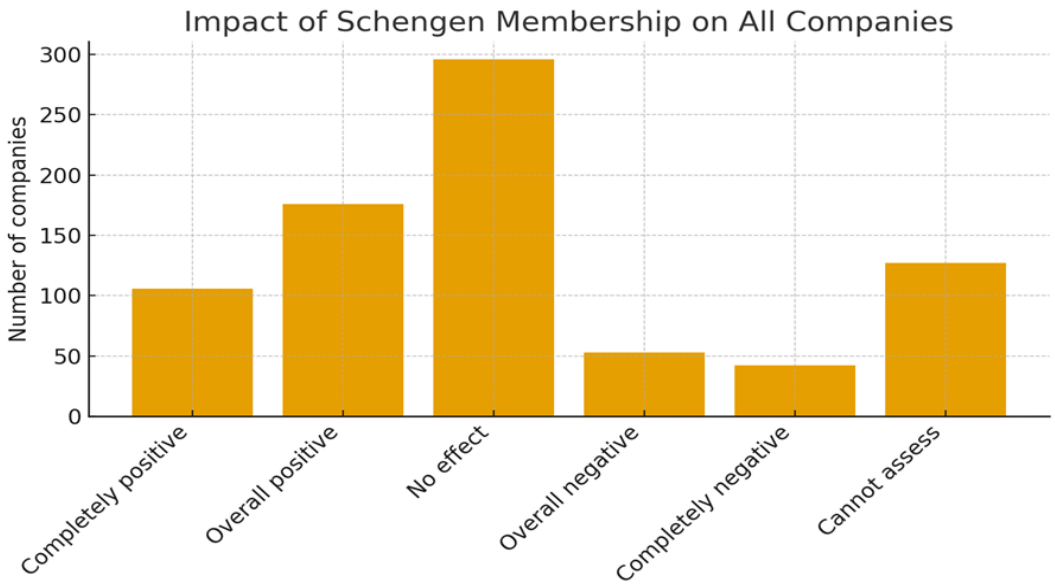
as the fact that the smallest firms often operate mainly in local markets. Large enterprises show greater optimism – 38%, probably because they have active international links and can benefit directly from free movement.

The results call into question the unequivocal perception of membership as an entirely positive factor. For some businesses, it is more of a neutral event – 37%. This highlights the need for targeted policies aimed primarily at small and medium-sized enterprises, which are the backbone of the economy but often find it difficult to adapt to changing economic conditions.

COMPARATIVE ANALYSIS

The following graphs show the main results of the survey. The first diagram shows the overall distribution of responses for all companies, and the second shows a comparison between different groups of companies according to their size.

Chart 2. Impact of Schengen Membership on All Companies



Source: Author

Chart 3 presents a summary comparison of responses according to company size. It can be seen that, regardless of size, the prevailing opinion is that joining Schengen will not have a significant impact. However, large companies show a higher proportion of positive expectations, while micro and small companies show a higher proportion of those who are undecided („I cannot say“). A comparison with other countries shows that Bulgaria is following a similar trajectory to that of Romania and Croatia. In Romania, studies prior to 2023

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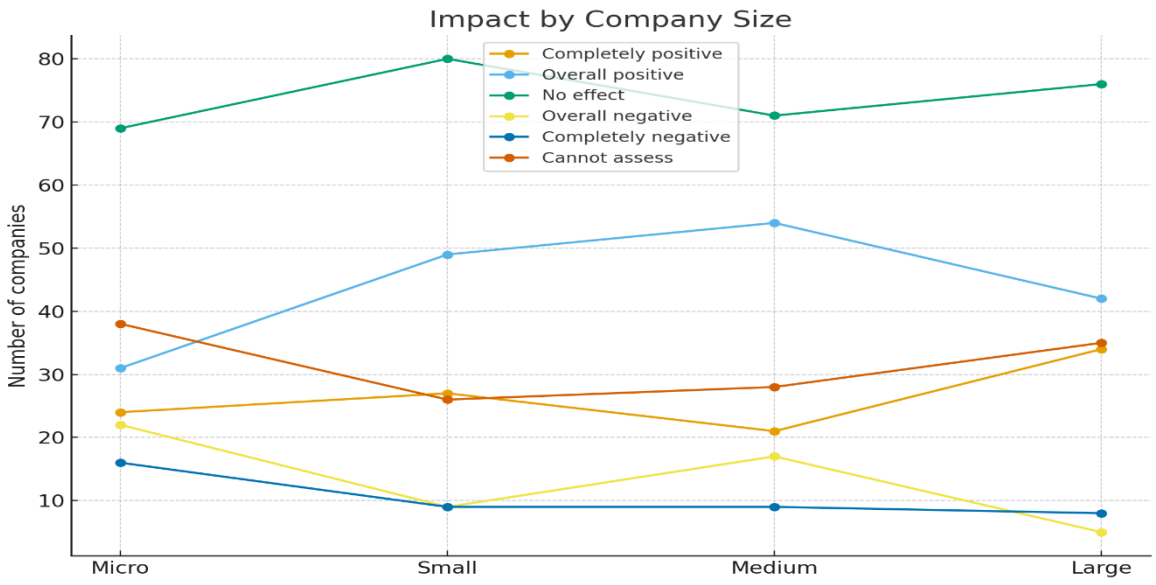
also recorded a high proportion of neutral assessments (Institute for Market Economics, 2023), while in Croatia, businesses were more optimistic, especially in the tourism sector.

Chart 3. Impact by Company Size



Source: Author

This suggests that the impact of membership depends on the economic structure and orientation towards foreign markets (OECD, 2022).

For the transport and logistics sector, the removal of border controls brings the most immediate benefits by reducing delivery times (World Bank, 2021). Tourism is also expected to grow thanks to the easier movement of tourists (Institute for Market Economics, 2023).

On the other hand, smaller companies expect to encounter difficulties in adapting to greater competition, which explains their more cautious attitude and requires targeted support measures from the state and business organizations (Bulgarian Industrial Association, 2024).

Key findings:

• The prevailing opinion is that the effect of joining Schengen will not be significant.

• Large companies are the most positive, with nearly 38% indicating a positive effect.

• Micro and small companies show a higher proportion of those who are undecided - over 19%.

• The statistical tests performed (Kruskal-Wallis and Mann-Whitney) show differences, but these are not statistically significant when adjusted for multiple comparisons.

• Despite the generally positive attitude, the actual differences in company size are minimal and do not show a clear correlation with the answers given.

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CONCLUSION

The study shows that Bulgarian businesses perceive Schengen membership as a neutral or moderately positive event.

The size of the company influences the assessments, but the differences between the groups are not statistically significant.

The most significant challenge is the high level of uncertainty among businesses, which highlights the need for active communication, information campaigns, and practical support measures.

Bulgaria has the opportunity to use its Schengen membership as a catalyst for increasing competitiveness, but success depends on the ability of institutions to support businesses in this process (European Commission, 2024, pp. 10–20).

What will be the benefits for the economy:

- Faster and cheaper transport of goods, especially for exports to the EU;
- Elimination of delays at border crossings - lower logistics costs;
- Attracting investors who prefer countries without border barriers;
- Increasing the competitiveness of Bulgarian manufacturers and carriers;
- Establishing Bulgaria as a strategic logistics and investment center;
- Accelerating economic growth through higher trade and investment activity;
- Expanding opportunities for cooperation between business and scientific and educational institutions for the purpose of innovation.

Main challenges:

- Competition: The entry of new European players into the Bulgarian market may limit the market share of local companies;
- Infrastructure capacity: Investments in roads, rail transport, and border terminals are needed to realize the potential;
- Regulations and security: Strict enforcement of European standards requires adaptation, especially for small businesses;
- Increased labor mobility may exacerbate the shortage of skilled workers in the country.

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„LEAPFROGGING“ VS. „CATCH-UP“ DEVELOPMENT

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Boyan DURANKEV
University of Insurance and Finance
1618, Sofia, 1, Gusla str.
durankev@yahoo.com
ORCID ID: 0000-0001-8689-2596

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ABSTRACT

This study criticizes the theory of „catch-up” development, which is assessed as an ideological model in the system of neoliberalism, recommending the „opening” of national markets for the free movement of goods, capital, people and resources, leading to economic dynamism, social progress and peaceful existence. It is proven that more developed economies have never benefited from the idea of „catch-up” development, but they have always pursued protectionist policies until a point when their production became more competitive than analogues in other countries, after which they insisted on free markets in other countries in order to derive benefits. The alternative to catch-up development is „sovereign” development – the ability of a country to formulate and implement its own industrial and technological policy, meeting its specificities and long-term interests, instead of following universal recipes designed by others. „Sovereign” development is a prerequisite, but not sufficient, for achieving high economic results. What China and other countries have achieved is not only sovereign, but also „leapfrogging” development in key sectors of the economy. The factors and conditions that have allowed the use of the model of sovereign leapfrogging development in China and other countries, are analysed, along with the existing barriers. It is proven that the concept of „leapfrogging” development is fully applicable to weaker and relatively dependent countries (such as Bulgaria), despite global, structural and institutional challenges. The key is in the strategic choice of sectors and the understanding that „leapfrogging” is not simply copying foreign experience but using new technological paradigms and niches.

Keywords: economic development, catch-up development, leapfrogging development, sovereignty, China, underdeveloped countries

JEL classification: E61, F63, O10, O11, O14, O15, O21, O23, O24, O43, O53, O54, P11, P21
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INTRODUCTION

A widespread but false hypothesis continues to persist in economic theory. It concerns the so-called *„catch-up" development*, which is recommended to less developed countries (including Bulgaria) in order to catch up with more developed ones (Angelov, 2018). It is for this reason that macroeconomists (mainly Western, but also a number from the East and South) focus on the rates of economic growth of gross domestic product (GDP), attracting as much foreign investment as possible, creating so-called open and free markets, and imposing what they call liberal democracy (Institut za filosofski izsledvaniya pri BAN, 2004).

If the logic of catch-up development is followed, *why do countries that apply it fail to catch up with more developed countries*? The facts tell a different story: the catch-up development model often fails in practice, despite its theoretical logic. This is because the hypothesis is based on several critically flawed or overly simplistic assumptions.

WHY DOESN'T THE IDEA OF „CATCH-UP" DEVELOPMENT WORK?

Here are at least *five main reasons* why most less developed countries fail to catch up with more developed countries:

1. The theory assumes a free world and the smooth transfer of goods, capital, people, and technology, but in reality, the world is full of barriers.

The concept is that less developed countries can copy technologies, institutions, and practices from developed countries at low cost and grow very quickly („catching-up" effect).

The reality is different: copying is not passive or free. It requires advantages for assimilation – a highly educated workforce, good infrastructure, stable and uncorrupted institutions – which are precisely what are lacking in less developed countries. In addition, developed countries create barriers to access to the latest technologies (intellectual property, export restrictions) and markets (protectionism, subsidies).

2. The fetishization of GDP and foreign investment ignores the quality of growth.

Growth based on raw material extraction or low-tech exports (e.g., oil, textiles) creates few high-paying jobs, exacerbates inequality, and makes the country vulnerable to global price shocks.

Foreign investment often goes toward exploiting natural resources or low value-added sectors, without creating significant technological spillovers in the local economy. It can increase GDP without developing local productive capacity.

3. Open and free markets often lead to deindustrialization rather than development.

If a weak country opens its markets too quickly and asymmetrically (as international financial institutions often impose), its young, inefficient industries collapse under the onslaught of imports from global giants such

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as transnational corporations (TNCs). This opening leads to job losses and turns the country into a permanent importer rather than a competitive producer. This is the process of induced deindustrialization.

4. Liberal democracy (on paper) is not synonymous with effective institutions.

The formal introduction of democratic procedures (elections) often takes place in an environment of weak, corrupt, and ineffective state institutions. What leads to development is not elections themselves, but the rule of law, protection of property, the fight against corruption, and competent state administration – things that can exist under different political systems and take decades to build.

5. Global competition is not static – the goal of developed countries is also variable.

While one country tries to catch up, for example, in manufacturing through the steel industry, developed countries have already moved on to automobiles, then microchips, and now artificial intelligence and bioengineering. The technological frontier is constantly receding. Catching up requires not just copying old technologies, but the ability to innovate, which is much more difficult.

There are *several alternative economic theories that explain the failure:*

1. *Dependency Theory*. It argues that the global system is structured in such a way that the periphery (underdeveloped countries) remains dependent on the center (developed countries) through mechanisms such as unequal trade, control over technology, and financial obligations (Katz, 2022). Research confirms this theory with many facts (Magnelli, Maia, & Martins, 2024).

2. *Evolutionary Economic Geography*. Successful economic models cannot be imported. They must evolve from local specifics, opportunities, and institutions (Boschma & Martin, 2010). Universal recipes are doomed to failure. This theory found wonderful application in China (He & Zhu, 2019).

3. *The practice of state entrepreneurship and industrial policy*. The historical experience of all currently developed countries (including the UK, the US, Germany, South Korea, and China) shows that active, strategic state leadership in protecting and promoting key industries has been crucial. The free market alone has not led to catching up.

Countries that pursue the idea of catch-up development never manage to catch up because *economic development is not a linear racetrack where everyone runs by the same rules*. It is a complex, barrier-filled political process in which global competition, structural constraints, and the lack of a truly sovereign industrial policy often trap less developed countries in traps – such as the middle-income trap or the raw materials trap. The model of catch-up development often turns from a description of an opportunity (which some countries, such as South Korea or Singapore, have indeed realized) into a propaganda slogan used to impose policies that actually preserve or even deepen inequality in the global economic system.

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IF CATCH-UP DEVELOPMENT IS AN IDEOLOGY, WHAT OTHER OPTIONS ARE AVAILABLE TO LESS DEVELOPED ECONOMIES?

More developed economies, of course, have never benefited from the idea of catch-up development. But *they have always pursued protectionist policies until their production became more competitive than that of other countries, after which they insisted on free markets in those other countries in order to reap the benefits*. Nineteenth-century Germany is a wonderful historical prototype. Friedrich List, a German economist, directly attacked the British model of free trade, arguing that newly emerging industries (such as the German one) should be protected by tariffs until they became mature enough to compete (List, 2014). This is called industrial protectionism and has been practiced by all developed countries during their industrialization.

Less developed economies are not doomed to follow a single path – that of neoliberalism. Here are some *real alternative paradigms and strategies that have been implemented* (they do not work individually, one by one, but in combination with each other):

1. *Strategic integration into global value chains (but with aspirations to move up).* Instead of passive opening, the country can identify specific niches or segments it can enter and then try to move towards segments with higher added value (Scholvin, Black, Diez, & Turok, 2019). For example, instead of just producing jeans in its factories, the country is developing its own textile design and branding.

2. *Development based on the domestic market and regional integration*. Before throwing itself into global competition, the state uses the domestic market (often neglected) to build industries that meet basic local needs (food, energy, housing, transport). For example, regional integration with neighbors (such as the African market - AfCFTA) can create a larger market for local companies before they face global giants. Incidentally, the European Union relies on its internal market (Sammut & Mifsud, 2024), as does the United States.

3. *Green and circular transformation as leapfrogging.* Today's business climate requires breakthroughs, not incremental improvements (Kaplan & Goldsmith, 2012). Instead of catching up with its lagging coal industry, a country can invest directly in decentralized renewable energy (from sun, wind, water), electric micromobility, and circular economic models. One example is that in the first six months of 2025 alone, China installed over 250 GW of solar energy. This staggering figure, analyzed by the think tank Ember (Ember, 2025), was measured on a comprehensive basis, including decentralized solar energy, and is slightly higher than the official figure published by the Chinese Energy Administration, which was 212 GW. Newly built solar power plants in China in the last six months of 2025 are more than the total installed in the US. Germany was once the world champion in solar energy production, but the newly built solar power plants in China for those six months are twice as large as Germany's installed capacity. In the first half of 2025, new additions in China were more than twice the installed capacity of the rest of the world this year. India, number 2 in the ranking, installed 24 GW. The US, at number 3, installed 21 GW (Tooze, 2025). This is a chance to leapfrog

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the era of polluting technologies (Lee, The art of economic catch-up: barriers, detours and leapfrogging in innovation systems, 2019). This strategy is called „From hurdling to shepherding“: creating the magic of radical but sustainable transformation in India (Mashelkar & Pandit, 2018). China is a leader among other countries in this regard (Lee, China's Technological Leapfrogging and Economic Catch-up: A Schumpeterian Perspective, 2022). Bangladesh is also following a similar strategy (Hossain, 2022).

3. *State-led development with a focus on specific technologies (Techno-Developmentalism).* This is part of China's model and has also been historically applied in South Korea. The state not only regulates but actively manages, finances, and protects selected strategic sectors (e.g., electric vehicles, batteries, AI) until they become globally competitive (Saetra, 2023). China has rapidly become the world's largest exporter of cars, partly fueled by a surge in sales of electric vehicles (EVs), positioning the Asian country as a key global player. In 2019, China exported 0.7 million cars, but by 2024, that number had increased to 5.5 million, surpassing Japan, Mexico, and Germany in this regard. Electric vehicles accounted for nearly 40% of China's passenger vehicle exports in 2024 and nearly half in the first half of 2025 (McKinsey, 2025)

4. *The economy of well-being, not just GDP growth.* And not just well-being, but also fairness and happiness (Tsao, 2023). The rejection is of the fetishization of growth and the targeting of policies towards specific benefits – air quality, access to education and healthcare, reduction of inequality. This could lead to a more sustainable and stable social model, albeit with a lower GDP per capita. The idea of such a strategy has found enthusiastic supporters in a number of Latin American countries (Rojas, 2020). In Asia, the Indian government is focusing on the welfare of children (Dutta & Das, 2024). The COVID-19 pandemic has accelerated the widespread implementation of this strategy, including in developing countries (Bakar, Low, Razzak, & Jayasingam, 2023). Christian Aspalter successfully counted and classified ten worlds of well-being in capitalist countries (Aspalter, 2023). At the same time, we should not underestimate the fact that in an economy based on profit (capitalist economy), domestic and foreign capital are primarily interested in increasing their revenues rather than solving deepening problems (Allam, Cheshmehzangi, & Jones, 2023), which are not only natural, but also social, cultural, and moral (Welsch, 2022), and require analysis in at least three dimensions – prosperity, adaptability, and sustainability (Wellbeing, Resilience and Sustainability) (Joseph & McGregor, 2020). However, economic development can successfully lead to sustainable growth in prosperity, which is why it is also one of the goals of developing countries, and now also of more developed ones (D'Orlando, Ferrante, & Oliverio, 2021).

It may seem strange, but *these ideas were originally developed in the West* (however flexible the concept of the West may be) by Nobel laureates such as Gunnar Myrdal (Berg, 2025) and Wassily Leontief (Leontief, Carter, & Petri, 1977), and in our time – by Joseph Stiglitz (Stiglitz, Fitoussi, Durand, & ProQuest, 2019), *but found accelerated implementation in the East and South*.

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Let us illustrate this statement with *some facts*.

China's development differs fundamentally from that of countries that follow the idea of catch-up development. *China has never followed the classic recipe for catch-up development* in its neoliberal sense. Its approach is *radically different*:

1. *Sovereignty and control over investments*. China did not open its capital account to the free market and globalization. Foreign investments were only allowed as joint ventures with Chinese partners, under strict conditions for technology transfer. This is the opposite of the policy of attracting any investment at any cost.

2. *Protectionism as a rule, not as an exception*. While exporting massively, China protected its domestic market from the invasion of transnational corporations for its companies through various barriers, giving them enough time to grow and strengthen before letting them compete globally (e.g., the automotive industry, telecoms).

3. *The state maintained and developed its role as a strategic investor and coordinator*. Instead of leaving the economy to the will of the free market, the state, through its five-year plans, state-owned banks, and giant state-owned enterprises (SOEs), directed capital toward infrastructure development (high-speed trains, ports) and selected high-tech sectors (from steel to chips).

4. *A constant priority for technological independence*. The long-term goal of the Chinese economy has always been not just to produce for Western companies and countries, but for young Chinese companies to develop their own technological capacity. From „Made in China“ to „Designed in China“ and „Invented in China“. Programs such as „Made in China 2025“ are a clear expression of this policy.

5. *Economies of scale and benefits of a large domestic market*. The huge domestic market allows China to experiment, reap economies of scale, and impose its own standards.

In other words, *China uses state-capitalist tools* to manage the process of overtaking, rather than submitting to the rules of catching up proposed by developed countries and transnational institutions (in which the West effectively rules).

Let us mention other *successful examples* (apart from China) that did not follow the orthodox recipe of neoliberal doctrine for open markets and catching up:

1. *South Korea*. A classic example of state-led development. In the 1960s and 1970s, the country's authorities imposed strict currency controls and protectionism and directed loans through state banks to family conglomerates (chaebols) in selected heavy and chemical industries. The government literally banned the production of low-quality goods and forced companies to compete on global markets with high-tech products (chips, cars, phones).

2. *Vietnam*. The country follows the Chinese model more closely than any other. The Doi Moi (Đổi Mới) reforms, or Renewal, were a program of economic and social reforms that began in Vietnam in 1986. by the

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Communist Party with the aim of transitioning from a command to a socialist-oriented market economy that combines market mechanisms with state control, allowing private ownership and foreign trade, which led to rapid economic growth, following China's example. The state retained control over strategic sectors while encouraging the private sector and foreign investment in manufacturing. Vietnam did not become a passive importer, but an alternative manufacturing center to China, while maintaining a high degree of sovereignty.

3. *Ethiopia* attempted a state-led industrialization leap between 2000 and 2015. Through large-scale state investments in infrastructure and industrial parks and in close partnership with Chinese companies, Ethiopia attempted to create manufacturing sectors (for shoes, textiles) from scratch in order to move away from a typical agrarian economy. This policy brought several years of double-digit growth but ran into political and ethnic conflicts.

The *common characteristics of the economic policies* of China, South Korea, other similar countries, and historical examples are:

1. An active, strategic role for the state (not only regulatory but also planning).

2. Protectionism and capital controls as temporary but critical instruments.

3. Priority given to building production and technological capacity over short-term financial gain or consumption growth.

4. Use of the global market as a field for realization, but not as the master of domestic economic policy.

Therefore, the alternative to catch-up development (as an ideology) is *sovereign development* - the ability of a country to formulate and implement its own industrial and technological policy that meets its specific characteristics and long-term interests, rather than following universal recipes designed by others.

But many countries around the world are relatively as sovereign as China; why do they not achieve similar economic and social results? It seems that *sovereign development is a prerequisite, but it is not sufficient* to achieve the high economic results that China has achieved. What is the Chinese enigma?

SPECIFIC ASPECTS OF CHINA'S LEAPFROGGING DEVELOPMENT STRATEGY

What China has achieved is *not just sovereign, but rather leapfrogging development in key sectors* of the economy (Harari, 1999). The Chinese puzzle is actually the result of a unique and unrepeatable combination of factors. And it is not unexpected, having been theoretically argued by Schumpeter (Lee, China's Technological Leapfrogging and Economic Catch-up: A Schumpeterian Perspective, 2022), and is applied in various sectors, for example in industry (Sampath, 2020) and in a number of other sectors, as well as countries (Ho, 2014).

The *key elements of the Chinese puzzle that other sovereign countries fail to achieve* are as follows:

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1. *Strong unifying political capacity and long-term continuity* (The Leviathan State). The Chinese macroeconomic apparatus can mobilize resources on a scale that is inaccessible to most countries, even sovereign ones. Examples: the construction of an entire high-speed rail network in a decade, massive urbanization projects that highlight China's coordinating ability. This ability is also reinforced by political continuity, with five-year plans being adopted and implemented consistently one after another, regardless of changes in the leadership of the party and state. This allows long-term strategies to be implemented. In many other sovereign countries (e.g., India, Brazil), political cycles and leadership changes lead to abrupt changes in economic policy.

2. *Unique market size and demographics*. China's huge domestic market allows it to experiment, take risks, and reap economies of scale in everything from smartphone manufacturing to AI development. No other country (except perhaps India) has this opportunity to the same extent. The demographic dividend (especially in the recent past) of young, numerous, and relatively educated workers has created unprecedented competitiveness in the manufacturing sector.

3. *Strategic, rather than dogmatic, use of market mechanisms*. China is not a Soviet-style planned economy. The Chinese economy is a hybrid model in which the state controls the commanding heights (finance, energy, telecoms, strategic sectors) but actively encourages ruthless market competition in other areas and between regions. This system creates a dynamic form of state capitalism with Chinese characteristics, which is both centrally planned and market competitive.

4. *A systematic approach to technological absorption and innovation*. China is characterized by a three-pronged model of innovation: attracting foreign investment with mandatory technology transfer; assimilation and improvement of these technologies through state-funded research and development (R&D) and reverse engineering, which is the process of analyzing a specific product, device, or system to understand its design, construction, or functionality (it involves disassembling, examining, and studying the components and structure of an existing object to create a detailed representation or model of it; innovation in these same areas). This process was systematically and centrally managed.

5. *Focus on applied science and engineering*. The education system and corporate culture are geared towards technical mastery and engineering solutions that directly fuel industrial development. Education in China's STEM system is a world leader.

6. *Wise use of the geopolitical situation and guided globalization*. China joined the World Trade Organization (WTO) at a time when globalization was in full swing and became the main beneficiary of outsourcing by Western transnational corporations. It offered not only cheap labor, but a complete manufacturing ecosystem (the entire factory of the world), which gave it incredible bargaining power.

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The *combination of these six factors* for the development of China's economy allowed it to become an economic giant in the world at a specific moment and in a specific place.

Why can't other sovereign countries replicate such success, even though they are relatively economically independent or apply similar strategies? India has sovereignty, enormous demographic potential (No. 1 in the world), and a huge market, but it does not have the same political capacity for rapid decision-making and has failed to implement large-scale infrastructure transformation due to democratic and bureaucratic barriers. Iran and North Korea also have sovereignty, but they do not have access to global markets, technologies, and capital due to sanctions, so their sovereignty is defensive and isolates them. Russia has sovereignty and possesses vast natural resources and the largest land area in the world, but its economy remains hyper-concentrated in the energy sector, without successful diversification into high-tech manufacturing for the mass market. Many African countries have formal sovereignty but lack the administrative capacity, initial capital, or sufficiently large domestic market to make the leap. Some developed countries also possess some of these characteristics, such as Leviathan states, but due to their geographical location and overreliance on the market, they fail to achieve results similar to those of China. (Paul, 2024). Even powerful Leviathan states – if deprived of the other factors that China possesses—fail to realize their industrial and commercial potential, so that a powerful state is not the only condition for success. (Levinson, 2024).

Leapfrog development is the right term for China's economic (and scientific, social, etc.) development, because it is not only catching up, but in a number of areas is overtaking all other countries:

1. In digital platforms and digital payments (WeChat, Alipay).
2. In electric vehicles and batteries (BYD, CATL).
3. In the speed of 5G implementation and the development of certain AI applications.

Unlike the classic logic of horizontal diffusion of innovation (like a pipeline: fundamental research, applied research, invention, innovation, commercialization, etc.), China has built a system of vertical integration of innovations – a completely *new way of innovating*, in which, figuratively speaking, an interconnected network of pipelines is built (Smith, China has invented a whole new way to do innovation. Extreme vertical integration makes China's research system different than any other., 2025). And since the costs of specialist salaries, materials, and equipment are lower in China in terms of purchasing power parity (PPP), the country actually spends more on research than the US or the EU. Further evidence that Chinese innovation is delivering real results comes from the royalties that the world pays to Chinese companies for licensing their technologies. This amount has increased dramatically since China introduced its new innovation network system, showing that the country produces a huge amount of high-quality technology that the world is willing to pay for (Soyres, Santacreu, & Hunt, 2025).

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So, viewed from the outside, the Chinese enigma can be explained as a *unique combination* of: a sovereign, capable, and stable state (political factor); a huge domestic market (economic factor); strategic integration into globalization on its own terms (geopolitical factor); a mercantilist, targeted technology policy (ideological factor). This is *another type of perfect storm*, but with positive potential, which is historically specific and difficult to replicate in its entirety. That is why other sovereign countries achieve partial successes, but not on the scale and at the speed of China. The Chinese formula for development is more a diagnosis of this country's unique path than a universal recipe that can be followed by other countries. However, it clearly shows that success comes from actively designing and planning one's own economic future, rather than passively following prescriptions from outside, which are often malicious and restrictive.

There is no doubt that China's rise worries those who have always been first – the US. *What is the US response to the Chinese challenge*? Tariff and economic wars. What will be the effect of these? According to Paul Krugman, Trump's chaotic tariff policy has caused three types of economic damage: higher prices for American producers and consumers, economic uncertainty, and a global loss of confidence in America. China is now clearly winning its geopolitical conflict with the United States. America could have counted on the support of its democratic allies. Now it has alienated them and built a reputation as a country that arbitrarily reneges on agreements. America once had unrivalled economic influence. Now the world knows that China has greater influence (Krugman, How We Lost the Trade War. Tariff uncertainty may be waning, but the damage will persist, 2025). Does this mean that the US is losing the race with China for global leadership? No, this race is essentially over (Krugman, China Has Overtaken America, 2025).

WILL CHINA'S ECONOMIC LEADERSHIP BE CURBED?

Researchers are looking beyond the present, searching for trajectories for China's future development. It is most often assumed that the *logic of development* is always the same: integration into the global economic system ≥ economic growth ≥ growth plateau ≥ decline.

Even if we accept, with a low degree of probability, that this logic is correct, the question remains unclear as to what stage of development China is at and *whether there are factors that could knock it off the top of the mountain*.

The changes that China is facing are mainly *demographic and macroeconomic* in nature.

China reached its *peak population in 2022*, when it began to decline for the first time since the 1960s. Official data show a decline of about 850,000 people compared to 2021, due to a combination of low birth rates, rapid aging, and the effects of the One Child Policy.

The *key demographic trends* emerging there are:

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1. *Rapid aging*. The proportion of people over 65 will grow from about 14% (2020) to over 26% by 2050 and to about 35% by 2100. This will put enormous pressure on the pension system and healthcare.

2. *Continued population decline*. A prolonged decline is expected after the peak, with China potentially losing between 200 and 400 million people by the end of the century. Specific UN forecast figures (UN, 2025) for the low/high variant are 1 409 million people in 2023 (current level after the peak), 1 410 – 1 420 million people in 2030 (a slight decrease, but with the peculiarity that China's working-age population will actually grow), 1 310 – 1 350 million people in 2050 (a decline of about 8–10% from the peak) and 770 – 1 000 million people in 2100 (a radical decline according to most forecasts).

The *reasons for these trends and their consequences* are:

1. Very low birth rate. The fertility rate is around 1,2–1,3 children per woman (below the replacement level of 2,1). Urbanization, high costs of raising children, and changing values contribute to the low levels.

2. Demographic legacy of the „One Child" policy. The policy led to a sharp decline in the number of women of childbearing age and a serious distortion of the gender structure (with a larger number and share of men).

3. The economic effects are expected. The declining labor force will slow economic growth and increase the burden on the working-age population (the dependency ratio will worsen).

A declining *labor force* and increased costs of caring for the elderly will pose a challenge to the economy. China has lost its title as the most populous country to India. This will affect its geopolitical influence and domestic consumer market. China is therefore already promoting policies to support fertility (tax breaks, education subsidies), but these have limited effect. China has already entered an era of demographic decline and rapid aging, which will shape its social and economic future in the 21st century. Forecasts up to 2100 show a significant decline in population, which will cause structural challenges, regardless of technological progress.

The most likely outcome, even with such negative demographic trends, is that the 21st century will be China's century, because China will use its power and influence very differently from the usual practices of, for example, the US. Why? Quite simply because the 21st century is also the *century of robotisation*, in which China is once again the leader, which means that not only will the replacement of human labour with robotised labour be on the rise, but also because robots can work 24 hours a day, 365 days a year, unlike humans. An additional argument for the potential for higher employment is the fact that official unemployment among young workers (aged 16-24) reached over 20% before data publication ceased in 2023. This unemployment is probably structural, as there is a mismatch between knowledge and skills and market needs – millions of college graduates are looking for white-collar jobs, while industry needs skilled technical personnel and blue-collar workers.

Let us turn our attention to the *macroeconomic problems* of contemporary China. Most of them are also visible.

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In addition to the crisis in the real estate sector (which is the most severe), China faces a complex set of related macroeconomic challenges, both current and long-term. Here is a quick overview of the *current and medium-term problems*:

1. *Deflationary pressure and weak consumer demand*. There is deflation in producer prices (PPI), which is pushing down corporate profits and reducing opportunities for new investment. Consumer inflation (CPI) is also low, even below 1%, indicating weak domestic demand. Households continue to save rather than spend on new consumption due to uncertainty in the labor market and the deterioration of the demographic structure. There is a noticeable balance sheet recession among households—after decades of high indebtedness, people are focusing on paying off debts rather than consumption.

2. *Local debt crises and fiscal stress*. A number of local authorities are heavily indebted (through so-called LGFVs – Local Government Financing Vehicles), with their debts estimated at over $9 trillion. They rely on land sales for revenue, but demand has fallen sharply as the crisis in the real estate sector deepens. There is a risk of deterioration in the solvency of some local authorities and bankruptcies of regional banks. In addition, the state has also handed out huge subsidies to homogeneous producers, which some researchers have called involution or 内卷 in China (Smith, Can anything knock China off its mountain?, 2025). Reducing excessive investment seems easier than increasing domestic consumption. Net exports, supported by exchange rate management, seem to make up the difference. In 2024, an approach was developed to combat a phenomenon known as the 内卷竞争, which is usually translated as involutional competition (China Daily, 2024). It, involutional competition, refers to the fierce competition between companies for limited resources (Klein, 2025). This competition forces all parties to put in more effort, but it can ultimately lead to increased overall market pressure and reduced efficiency. Such competition does not lead to productivity growth or a more successful economic model. Without significant innovation breakthroughs, the economy falls into a state of internal friction, with increasing complexity but no expansion. Unlike healthy competition that stimulates innovation and efficiency, involution leads nowhere and undermines the health of the industry. The central government has called on authorities at various levels to take necessary measures to encourage industries to strengthen self-discipline and prevent fierce involutionary competition.

3. *Production of geopolitical uncertainty and de-risking.* Trade tensions with the US/EU and the policy of de-risking or decoupling are leading to a reorientation of supply chains outside of China. This process includes sanctions and restrictions on technologies (semiconductors, AI) that hinder technological ascent. De-risking is a geopolitical and economic term (U.S. Department of State, 2025) popularized after 2022–2023, which refers to a strategy to reduce the dependence and vulnerability of one country or economic bloc on another country, considered a strategic competitor or potential threat, without completely decoupling from it, i.e. it is not a complete separation. Unlike the complete severance of economic ties (which is extreme and expensive),

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decoupling aims to selectively reduce dependence in critical sectors and is applied primarily in areas related to national security, technological sovereignty and critical supply chains. Decoupling sounds confrontational and implies a full-scale economic war, which would be destructive for both countries. Both strategies have been applied primarily by the West (the US, the EU and their allies) in relation to their dependence on China. They are and have been applied in the following areas: critical raw materials and materials (rare earth metals, critical minerals, active pharmaceutical ingredients, the extraction or processing of which is concentrated in China); security-critical high-tech sectors such as semiconductors (reducing dependence on Taiwanese TSMC and Chinese manufacturing capacity through subsidies for local production, e.g. CHIPS Act in the US, European Chips Act) and artificial intelligence, quantum computing, biotechnology (to limit the transfer of sensitive technologies); critical infrastructures (exclusion of Chinese suppliers such as Huawei, ZTE from 5G networks in Western countries due to espionage and cybersecurity concerns); supply chains of key goods (diversifying production outside of China to avoid shutdowns such as during COVID-19).

Derisking is practically implemented through *domestic policies* (subsidies, tax breaks and regulatory support for the development of local production through reshoring/friendshoring); *foreign policies* (restrictions on the export of sensitive technologies, such as the US's expanded controls on the export of chips and equipment to China); *diplomacy* (building alternative partnerships with allies to secure supplies, e.g. rare earth metal deals with countries outside China); *new corporate strategies* (some global companies are diversifying their production bases to Vietnam, India, Mexico or Eastern Europe).

China sees *derisking as a discriminatory and protectionist policy* aimed at holding back its technological development. Derisking is the dominant geoeconomic strategy of the West towards China after 2023. It represents selective, targeted and strategic disengagement in key sectors while trade and investment in non-strategic areas (such as consumer goods) continue. It is the Western response to the perceived strategic risks of over-reliance on a competing sovereign economic entity like China. However, the threat of derisking is enormous, as it could divide the global economy into competing technological blocs (Western and Chinese), undermining global cooperation and making it more difficult to address common global problems.

China's future long-term macroeconomic and structural problems can be sought in other directions:

1. *The middle-income trap in a new context*. China aims to move from a production model to one driven by innovation and domestic consumption, but this transition is very difficult and slow. Competition from other developing countries (Vietnam, India, Mexico, etc.) for low-tech production is and will be fierce.

2. *Insufficiently growing productivity*. After the exploitation of easy growth (urbanization, transfer of agricultural labor to industry), China needs growth through productivity, which requires deep institutional reforms and innovations aimed at intensive development.

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3. *Financial instability and weak banks*. The banking system is exposed to great risk from the real estate crisis and local debts. The risk of liquidity or confidence crisis is particularly high in small and medium-sized banks.

4. *Environmental constraints and a slow transition to a green economy*. Decarbonization goals are expensive and require large-scale investments that are never sufficient. Environmental problems (water, air, and environmental pollution) continue to carry health and economic costs.

5. *Systemic risk from state intervention*. Antitrust campaigns and sudden regulatory strikes create unpredictability and deter some private investment, both domestic and foreign.

How is China trying to respond to medium- and long-term challenges? A system of measures is underway to block or circumvent these challenges. For example, through additional consumption incentives (increasing household incomes and financing public services); through support for strategic sectors (massive subsidies for semiconductors, electric vehicles, green energy); through macromanagement of the real estate crisis (gradual loosening of policies and attempts to stabilize the market); through foreign policy to retain investment (successful attempts to convince foreign companies not to leave the country).

Clearly, China's challenges and problems are *systemic and interconnected*: demographics are hurting consumption, deepening deflation, which is increasing the real value of debt, which is threatening the financial sector. The solution requires not just short-term stimulus, but a painful restructuring of the economic model – from debt-investment to consumption-innovation, which will lead to relatively slow growth (of about 5-6%, which is high growth compared to the rest of the world) in the coming years. This is the biggest economic challenge for China since the reforms of the late 1970s.

We cannot help but agree with *several conclusions*. China is in a certain macroeconomic crisis, related to restructuring and the transition from an extensive to an intensive growth model. But this would not constitute a collapse for China, nor even a decline from the economic Everest in the world that it occupies. In other words, China's economic problems are reason to believe that its peak may not be high enough, but it is far from dethroning it from its position as a leader. (Smith, Can anything knock China off its mountain?, 2025).

The *15th Five-Year Plan (2026-30)* is on track to reach broader consumption opportunities and accelerate innovation.

Strange as it may seem to the West, China has achieved these successes and is moving forward on its own, *without a Marshall Plan from the US*! With overtaking instead of catching up.

CONCLUSION

OPTIONS FOR THE „LEAPFROGGING" DEVELOPMENT OF COUNTRIES THAT ARE ECONOMICALLY WEAKER AND RELATIVELY DEPENDENT

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The *concept of „leapfrogging" is fully applicable* to weaker and relatively dependent countries (such as Bulgaria), despite structural and institutional challenges. The key is in strategic choice of sectors and understanding that leapfrogging is not simply copying the Chinese experience but using new technological paradigms and niches.

The opportunity for Bulgaria and similar countries is real for the *following reasons*:

1. *The legacy of quality human capital*. Solid education in STEM sciences, mathematics and medicine.

2. *The advantages of the „late mover"*. Ability to implement the latest technologies without the costs of replacing outdated infrastructure (e.g. directly to 5G, renewable energy, cloud computing systems).

3. *Membership in the EU or other international organizations*. Access to funds, a common market, regulatory stability and opportunities for cooperation.

4. *Easier management of the transformation*. Smaller scale allows for faster testing and implementation of innovations (one side can be a lab).

The *sectors with the strongest potential* for „leapfrogging" development is the following:

1. *Digital economy and AI*:

- Software engineering, cybersecurity and AI/R&D centers - already with established capabilities. Can target niches such as quantum software, specific applications of AI for finance, agriculture, education and healthcare.
- Digital state and e-Governance. Opportunity to overtake Western Europe in wireless, transparent, blockchain-based administrative services (e-identity, digital notaries, automated tax systems).
- Digital finance (FinTech) and crypto-assets. Regulatory clarity and attraction of companies in this area can position the country as a center in the EU.

2. *Green and circular economy*:

- Energy transformation. Direct jump to a decentralized energy system based on renewable sources (solar, wind, green hydrogen), smart grids and energy storage systems (batteries). Avoiding investments in new gas capacities.
- Circular agriculture (Circular Agritech). Precision farming with drones and IoT, vertical farms for bioproducts, and applications of biotechnology to reduce waste.

3. *High-tech manufacturing and industry 4.0*:

- Additive manufacturing (3D printing). For rapid prototyping and production of small series with complex geometry (medical implants, auto and aero components).
- Robotics and automation. Not for mass production, but for specialized robots (for medicine, recycling, food and beverage industry).

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- Batteries and energy storage technologies. In view of rich deposits of necessary metals in the region (such as lithium and copper).

4. *Biotechnology and specialized medicine*:

- Genetic testing and personalized medicine. Use of good medical education for niches such as bioinformatics and telemedicine for the region.
- Software development and data analysis for clinical research. Positioning as a center for clinical research in the EU with low costs and high quality.
- Biopharmaceuticals and production of generic drugs. Expansion to more complex biological preparations.

Conditions and challenges for the implementation of „leapfrogging" development, critical for weaker and dependent countries:

1. *Focus on the ecosystem, not just on companies*. Preemption requires synergy between education (adapted curricula), financing (bold venture capitalists), infrastructure (5G, computing power) and another type of regulation (Agile Regulatory Sandbox). An Agile Regulatory Sandbox is an experimental regulatory framework that allows innovators to test products under the supervision of regulators in a limited environment, accelerating economic growth and improving regulatory policy. Agile Regulatory Sandboxes are a key concept in modern innovation policy (Goo & Heo, 2020).

2. *Connecting technologies as critical infrastructure*. High-speed internet, cybersecurity and quantum computing (for cloud access) are the basis for all other sectors.

3. *Strengthening institutions and fighting corruption*. In order to attract strategic investors, low corruption and high predictability are key factors. This has been the biggest obstacle during the years of transition for Bulgaria.

4. *Openness to talent*. Policies to attract qualified personnel from all over the world (not just local retention).

5. *Strategic partnership, not the search for „absolute" sovereignty*. Instead of striving for complete independence (impossible for a small country), the country should position itself as an indispensable hub in regional and global value chains in selected niches.

6. A new role for the state. Not through directive planning („public procurement"), but in the role of a catalyst, creating conditions, a first investor in risky projects and a smart buyer (smart public procurement) of innovations (Debono, 2019).

Yes, „leapfrogging" development *is possible* for less developed and less sovereign countries like Bulgaria, but it will be sector-specific and in the context of the European or other similar ecosystem, and not as a national catch-up project. The country can transform from a „catch-up" actor into a „leapfrogging" in a niche in areas such as digitalization of government, green energy, IT services and R&D centers for specific technologies.

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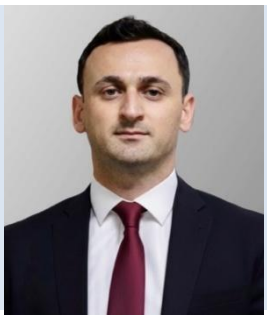
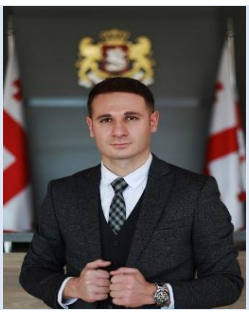
THE EVOLUTION OF INTERNATIONAL TRADE RULES AND THEIR IMPACT ON GLOBAL ECONOMIC RELATIONS





Giga ABUSERIDZE
Caucasus University,
1 Paata Saakadze Str,
0102 Tbilisi, Georgia
gabuseridze@cu.edu.ge
ORCID ID: 0000-0003-2868-8719

Mariana PETROVA
St. Cyril and St. Methodius University of Veliko Tarnovo, 5003 Veliko Turnovo,
2 T. Turnovski str., Bulgaria
m.petrova@ts.uni-vt.bg
ORCID ID: 0000-0003-1531-4312

Goga KIKILASHVILI
International Black Sea University,
2, David Agmashenebeli Alley,
0131 Tbilisi, Georgia
gkikilashvili@ibsu.edu.ge
ORCID ID: 0009-0008-0043-7102

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ABSTRACT

The evolution of international trade rules has been a defining factor in shaping contemporary global economic relations, particularly through the establishment of a rules-based multilateral trading system. Against this background, the present study examines the institutional role of the World Trade Organization (WTO) and its influence on both developed and developing countries. The objective is to analyze how international trade rules affect economic stability, predictability, and equitable participation in global trade, while identifying key legal and institutional challenges facing the multilateral trading system.
The research employs a qualitative approach based on doctrinal legal analysis, complemented by analytical and comparative legal methods. Core WTO agreements and selected multilateral, bilateral, and regional trade instruments are examined, together with relevant WTO practice and scholarly literature.
The results indicate that adherence to binding commitments, the credibility of the dispute settlement mechanism, and the growing participation of developing countries significantly contribute to the effectiveness of the rules-based trading system. At the same time, stalled multilateral negotiations, the influence of domestic interest groups, and the proliferation of regional trade agreements pose persistent challenges to the coherence of global trade governance.
Overall, the study concludes that the future of global economic stability depends on the continued effectiveness and adaptability of international trade rules, as well as on a renewed commitment of WTO members to multilateral cooperation. Strengthening the rules-based trading system remains essential for ensuring fairness, predictability, and inclusive integration into the global economy.

Keywords: *dispute resolution mechanism, multilateral trading system, rules-based trading system.*

JEL classification: F13, F53, K33, K40, O19
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INTRODUCTION

The historical development of international trade rules has been a cornerstone in shaping modern global economic relations. In the eighteenth, nineteenth, and early twentieth centuries, countries commonly adopted protectionist strategies, using tariffs as a primary tool to shield domestic industries from foreign competition. These tariffs, which imposed taxes on imported goods, served not only as a revenue source for governments but also as a way to enhance the competitiveness of local products. Protectionist measures were intended to foster national industries, but they also restricted cross-border economic interactions, limiting the growth of global trade.

The mid-nineteenth century marked a significant turning point as a shift toward free trade emerged. Nations began to recognize the economic benefits of reducing trade barriers, which included fostering international economic cooperation and promoting growth. This shift was anchored in the principle of reciprocity, where trade concessions between countries were balanced, encouraging broader participation in trade liberalization. The drive for free trade also aligned with aspirations for global peace, as increased economic ties were seen as a means to reduce tensions and conflicts between nations. Multilateral negotiations and agreements played a crucial role in establishing common rules and practices, leading to a gradual opening of markets (Buterbaugh & Fulton, 2008).

The institutionalization of global trade rules became more structured with the advent of various trade agreements and the establishment of key organizations. The World Trade Organization, founded in 1995, became a pivotal body in regulating international trade. It provided a framework for negotiating trade agreements, resolving disputes, and promoting a rules-based trading system. The WTO's role has been particularly significant in creating a more predictable trading environment, offering countries both developed and developing a platform to engage in global trade discussions. This has contributed to a more stable international trade system, despite ongoing debates about the organization's effectiveness and inclusivity.

The discussion of these dynamics is structured into two main parts. The first part offers a comparative analysis of historical and contemporary trade rules, while the second part delves into the implications of these rules on global economic relations. Through this structure, the article aims to provide a comprehensive understanding of how legal norms have evolved and their impact on the broader global economy.

RESEARCH METHODOLOGY

This study employs a qualitative research methodology based on doctrinal legal analysis, complemented by comparative and analytical approaches. The research focuses on the evolution of international trade rules and their impact on global economic relations, with particular emphasis on the institutional and legal framework of the WTO.

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At the first stage, a doctrinal legal analysis is conducted to examine the normative foundations and development of international trade law. This stage focuses on core WTO agreements, including the Marrakesh Agreement Establishing the World Trade Organization, the General Agreement on Tariffs and Trade (GATT), and related multilateral trade instruments. The analysis assesses their regulatory objectives, internal coherence, and role in shaping a rules-based trading system.

At the second stage, an analytical method is applied to evaluate the effectiveness of international trade rules in promoting legal certainty, predictability, and fairness in global trade relations. This stage involves identifying key challenges affecting the functioning of the multilateral trading system, including tensions between developed and developing countries, the influence of domestic interest groups, the impact of stalled negotiations, and the increasing role of regional trade agreements. Relevant WTO practice and scholarly literature are used to assess how these issues affect the operation of trade rules in practice.

At the third stage, a comparative legal method is employed to place the multilateral trading system within a broader international context. This stage compares multilateral trade regulation with selected bilateral and regional trade agreements in order to assess convergences and divergences in regulatory approaches. The comparative analysis focuses on issues such as market access, dispute settlement mechanisms, and the balance between trade liberalization and regulatory autonomy.

The combined use of doctrinal, analytical, and comparative methods enables a comprehensive assessment of how international trade rules have evolved and how they shape contemporary global economic relations. This methodological framework allows the study to identify systemic challenges and to evaluate the capacity of the rules-based trading system to remain effective in a rapidly changing global environment.

Framework of International Trade Regulations

The effective management of globalization and international trade is paramount for the benefit of humanity as a whole. Former GATT and WTO Director-General Peter Sutherland articulated in 1997: "The greatest challenge facing the world is the need to create an international system that maximizes global growth while achieving a greater measure of equity, one that integrates emerging powers and assists currently marginalized countries in their efforts to engage with global economic expansion" (Sutherland, 1997).

The role of legal norms, particularly those at the international level, in facilitating international trade is multifaceted. Four interrelated reasons underscore the necessity for international trade rules. First, it is imperative to restrain countries from adopting trade-restrictive measures that may serve short-term interests but ultimately hinder global economic welfare. National policymakers often face significant pressure from influential interest groups advocating for such measures. By binding themselves to international commitments, states can effectively resist the temptations posed by domestic rent-seeking entities.

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Second, the requirement for security and predictability in international trade is paramount for traders and investors. The existence of established international trade rules provides this security, thereby enabling economic actors to forecast how member countries will address matters affecting their operations.

Third, the complexities of globalization render it challenging for national governments to navigate these issues independently. International trade rules play a crucial role in ensuring that countries maintain only those regulatory measures necessary for safeguarding essential societal values (Jackson, 1998). Moreover, these rules may foster a degree of harmonization among domestic regulatory frameworks, thereby promoting effective international protection of these values.

Finally, international trade rules are essential for achieving equity in global economic relations. Without binding and enforceable trade regulations that acknowledge the specific needs of developing countries, these nations would likely struggle to fully integrate into the international trading system and secure equitable shares of trade benefits.

However, for international trade legal rules to fulfil these multiple roles, they must be observed. It is evident that international trade rules are not always adhered to. All countries and their citizens benefit from the existence of rules governing international trade, which enhance the predictability and stability of the trading environment. If these rules consider the specific interests and needs of developing countries typically with limited economic, political, and military power such nations should benefit even more from a rules-based international trading system. Weaker countries are likely to suffer most where the law of the jungle prevails; they are more likely to thrive in a rules-based rather than a power-based system.

International trade law consists, on one hand, of numerous bilateral or regional trade agreements and, on the other, multilateral trade agreements (Bartels & Ortino, 2006). Numerous examples of bilateral and regional trade agreements exist, such as the North American Free Trade Agreement and the Mercosur Agreement. The Trade Agreements between the United States and Israel or the Agreement on Trade in Wine between the EU and Australia exemplify bilateral trade agreements. The number of multilateral trade agreements is more limited and includes the 1983 International Convention on the Harmonized Commodity and Coding System (the Brussels Convention) and the 1973 International Convention on the Simplification and Harmonization of Customs Procedures, as revised in 2000 (the Kyoto Convention) (Depledge, 2022). The most important and comprehensive of all multilateral trade agreements is the Marrakesh Agreement Establishing the World Trade Organization, concluded on April 15, 1994. The law of this agreement constitutes the legal framework of the WTO.

The WTO, by virtue of its competence, is undoubtedly one of the key organizations regulating international trade and economic relations globally. It serves as a crucial legislative body in modern international relations, which, despite widespread criticism, remains an exemplary successful international organization.

According to the authors, several questions arise regarding the complexity and impact of the WTO's framework on global economic relations:

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How does the intricate structure of the WTO facilitate the negotiation and enforcement of international trade agreements among its member states? What challenges arise from the complex architecture of the WTO in terms of ensuring equitable representation and participation of developing countries within the organization?

To address these questions, the second part of the analysis delves into the historical, legal, and economic dimensions of the WTO's architecture. It explores how states have collaborated through this organization to develop a structured approach to sustainable global trade, thereby enhancing economic integration and stability in the global marketplace.

The Complex Architecture of the World Trade Organization

As Aristotle wisely noted, "Even when laws have been written down, they ought not always to remain unaltered. As in other sciences, so in politics, it is impossible that all things should be precisely set down in writing; for enactments must be universal, but actions are concerned with particulars" (Abuseridze, 2021). This profound assertion highlights the intricate relationship between abstract thought and practical action, emphasizing that the evolution of the multilateral trading system was deeply rooted in conceptual frameworks that preceded its formal establishment. Without the intellectual groundwork, the complex reality of global trade governance would not have been possible.

The World Trade Organization represents far more than the realization of a single, unified vision. Instead, it embodies a dynamic intersection of three interrelated yet sometimes conflicting domains: law, economics, and politics. These domains have alternately fuelled and restricted the ability of member states to collaborate, shaping a rules-based trading system designed to integrate members with varying degrees of economic development and political influence. At its core, the WTO aims to reduce trade barriers and promote equitable opportunities for all participants. However, this process is inherently complex, as it requires balancing diverse national interests and economic conditions within a coherent legal framework. In this multifaceted endeavour, the legislative mechanisms of the WTO play a crucial role in crafting a more inclusive and efficient trading environment for its members (Hoekman, & Mavroidis, 2015).

Aristotle might have praised the decision-making processes intrinsic to the multilateral trading system for their inherent flexibility and adaptability. These processes demonstrate a capacity for innovation and a preference for pragmatic norms over rigid formalism. A strict, textual interpretation of the General Agreement on Tariffs and Trade of 1947, along with the Agreement Establishing the World Trade Organization, provides only a partial picture of how decisions are actually made within the WTO (Chalmers, 2023). Over the decades, these procedures have evolved organically, shaped by cumulative experience, practical improvisation, and a spirit of compromise among diverse stakeholders. Yet, this organic evolution has faced numerous obstacles. Different regional and economic blocs frequently advocate for modifications or more substantial reforms

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concerning how deliberations are conducted, decisions are reached, and member commitments are enforced, reflecting the dynamic and often contentious nature of international trade relations (Caliendo & Parro, 2023).

Strengthening the multilateral trading system is especially important from a sustainable development perspective. Over the past six decades, the system has provided an unprecedented level of stability and predictability in the way WTO members conduct their trade operations. It has also provided particularly since the establishment of the WTO a credible and solid mechanism to adjudicate trade disputes, one that is guided by law rather than power. This rules-based approach has been pivotal in fostering a sense of security among member states, ensuring that their economic engagements are governed by mutually agreed-upon norms (Shaffer, 2021).

Today, the WTO is composed of 166 member countries and autonomous customs territories, and its regulatory framework extends to around 95% of the world's trade. Its agreements cover not only the exchange of goods and services but also address critical areas such as the protection of intellectual property rights. The organization's near-universal membership emphasizes its centrality in the global trading system, especially given that many non-member nations are in the process of negotiating their accession to the WTO. What sets the WTO apart is its role as the preeminent platform for trade negotiations, where discussions translate into binding international agreements. These agreements are backed by a highly efficient and unique quasi-judicial dispute resolution mechanism, ensuring that member states adhere to their commitments (Paz et al., 2024).

A key development in the evolution of the WTO has been the active participation of developing countries, many of which had previously remained outside the multilateral trading system during the GATT era. With their accession to the WTO, these countries have transformed the organization from a limited "club" of industrialized nations into a truly globally accepted framework of values and rules. Developing countries have increasingly leveraged the system to their benefit, contributing significantly to the shaping of new negotiation outcomes. Indeed, they have been involved in more than half of the 500 plus trade disputes addressed by the WTO, demonstrating their growing influence and stake in the global trading system (Abuseridze, Agapova, & Petrova, 2024)

However, the WTO stands at a critical juncture. A renewed sense of international cooperation among its members is essential for addressing long-standing challenges, beginning with the stalled Doha negotiations. Completing the Doha Round would not only enhance the credibility of the multilateral trading system but also allow the WTO to pivot towards addressing more pressing issues (Sinha, 2021). These include defining a new set of negotiating modalities for future trade talks, re-examining the role of the private sector (especially the business community) in the WTO's activities, and adapting to the proliferation of regional trade agreements, particularly the emergence of so-called mega-regional agreements. Such challenges necessitate a strategic and forward looking approach, as the multilateral system navigates a rapidly changing global trade landscape.

The expansion of international trade, which has grown at a pace that far outstrips that of global GDP, along with other dimensions of economic interaction such as cross-border investments, has deepened the economic

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interdependence of nations. This growing interconnectedness has underscored the necessity of a robust and predictable legal framework to manage trade relations between states (Abuseridze, 2023). The WTO, as the embodiment of the multilateral trading system, has become the cornerstone of this framework, fostering cooperation and providing stability amidst the complexities of global trade. It helps to mitigate the inherent uncertainties of international markets, offering a structured approach to resolving trade disputes and maintaining an environment conducive to growth and innovation.

The WTO's relevance extends well beyond its regulatory functions; it is a manifestation of the international community's collective aspiration to maintain a rules-based order that adapts to the evolving challenges of global trade (Adolph & Hospodar, 2024). By providing a platform for dialogue, negotiation, and the peaceful settlement of trade disputes, the WTO plays a vital role in ensuring that the principles of fairness, transparency, and predictability are preserved in the global economic arena. In this sense, the WTO not only facilitates trade but also serves as a guardian of the norms and values that support a stable and just international trading system. Through its efforts, it remains central to the ongoing project of shaping an equitable global economy that benefits all its participants, while ensuring that sustainable development goals remain integral to its agenda.

CONCLUSION

The evolution of international trade rules has profoundly influenced global economic relations, emphasizing the critical role of a rules-based system in maintaining stability, predictability, and fairness. The World Trade Organization serves as a cornerstone of this framework, offering a structured legal environment for negotiations and the resolution of trade disputes. Despite criticisms regarding the efficacy of the WTO - such as those concerning the stalled Doha negotiations and the rise of regional trade agreements - its influence remains crucial for integrating both developed and developing nations into the global trading system, ultimately impacting global economic relations.

The active participation of developing countries has transformed the WTO into a more inclusive institution, enabling these nations to leverage the international trading regime to their advantage. This involvement enhances their access to global markets, which contributes to a more equitable distribution of trade benefits. Moreover, the WTO's legally grounded dispute resolution mechanism has enhanced the credibility of global trade governance by fostering adherence to international trade commitments. This ensures a more equitable environment where legal norms prevail over power dynamics, especially for less economically powerful nations.

However, the complexities of globalization and the evolving nature of global trade necessitate adaptable international trade rules. The rise of new economic powers and the increasing significance of cross-border investments have deepened global economic interdependence, requiring updates to regulatory frameworks to address both present and future challenges. The authors believe that a renewed commitment to multilateralism

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and cooperative efforts among WTO members is essential for maintaining the organization's relevance in a rapidly changing global landscape.

In conclusion, the impact of international trade rules on global economic relations is profound, influencing trade flows, investment patterns, and economic growth trajectories across nations. The authors assert that the future of global economic stability hinges on the continued effectiveness and adaptability of international trade rules, as well as the willingness of countries to collaborate within established frameworks. Reinforcing a legal order that accommodates diverse economic contexts and promotes equitable participation is essential for fostering sustainable economic growth, resilience, and a fairer global trading system that benefits all participants.

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CHINA – THE ECONOMIC FOUNDATION OF BRICS

Adrian MOTAHAR

St. Cyril and St. Methodius University of Veliko Tarnovo
5003, 2 T. Turnovski str., Veliko Tarnovo
e-mail: D1590@sd.uni-vt.bg
ORCID ID: 0009-0002-7712-2770

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ABSTRACT

This paper examines China's economic development and its role as the economic foundation of the BRICS alliance. PRC has changed its image in every aspect over the past decades, transforming itself from a poor country into an economic powerhouse that rivals the G7 countries. The idea is to determine the sentiments and desires of China for development, as well as its place in the BRICS alliance and the world stage, during the pandemic and post-pandemic periods. Both internal and external indicators that have influenced the overall state of the country are examined. China is the second most developed economy in terms of GDP in the world, and analyzing its development in recent years is key to determining its direction of growth. Many of the indicators analyzed are strongly influenced by the cultural ethics of the people and strong political intervention at all levels, with the aim of controlled regulation in the face of all factors of influence. ***Objectives:*** *Through an analysis of key macroeconomic indicators, the dynamics of the country for the period 2020-2024 are tracked.* ***Methods:*** *Method for processing data by collecting and converting data into usable information is used.* ***Results:*** *The results highlight the country's sustained growth, labor market stability, and ability to attract investment, despite challenges.* ***Conclusion:*** *China proves that despite all the challenges in the areas of healthcare, economy, and politics during the period under review, it can continue to develop as a country for the benefit of its people and for its place in turbulent times of political change*

Keywords: China, BRICS, macroeconomic indicators, tendency

JEL classification: F63, O11, P17

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INTRODUCTION

In recent years, the world has undergone significant changes economically, politically, socially and in terms of health. China was the first country to face the COVID-19 outbreak (Vasiev, Bi, Denisov, & Bocharnikov, 2020). For this reason, the development of the country's manufacturing capacity and its position in the BRICS alliance make this topic **relevant** for this analysis. **The purpose** of this paper is to determine the dynamics of key macroeconomic indicators it sets the following **tasks**:

- Analysis of indicators, determining their development
- Monitoring the economic consequences of the pandemic
- Determining China's position in relation to BRICS in the economic space of the union

By examining key economic indicators, a comprehensive and in-depth assessment is made of the country's position both globally and in terms of the domestic market. The selected factors are GDP, GDP at PPP, FDI, inflation, unemployment, and government debt. China officially adopted GDP as an indicator of economic performance in 1993 when the country abandoned its Marxist-inspired national accounting system and joined the internationally harmonized System of National Accounts (Heijster & DeRock, 2022). Given China's rapid development, becoming a major manufacturer and exporter of commodities in almost every sector, it is no coincidence that "China is rapidly becoming the world's factory" (Mees, 2016). China's long economic boom has raised the living standards of nearly a quarter of the world's population and has brought hundreds of millions of people out of poverty (Kroeber, 2020). China has been the biggest contributor to global growth since the 2008 financial crisis (Lowe, 2016). A major constraint on the country's acceptance as a trusted partner is its political form of government, which according to the Chinese constitution is defined as a "people's democratic dictatorship." This causes uncertainty in many partner countries about China's participation in the global market economy and its liberal and democratic policies. However, favorable economic conditions have attracted companies from around the world to relocate their manufacturing facilities and maximize their profits. As an emerging and transforming market, China has emphasized the key role of technological innovation and industrial structural change in economic growth (Zhou, et al., 2021). If China handles the challenges appropriately and deepens its structural reforms, it has the potential to continue to play its role as a leading force in supporting a multipolar global economic architecture that benefits both developing and high-income countries in various ways (Lin, 2011).

Analyzing key and interrelated economic indicators is particularly important for optimally and accurately describing the trends of a given economy. The PRC also accounts for about two-thirds of the economic power of the BRICS alliance, calculated in terms of GDP. This responsibility to other member countries is and additional incentive to control the stable and strong Chinese economy that has been built.

THEORETICAL PART

Main macroeconomic indicators for China

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During the survey period, the movement of some macroeconomic indicators is visible (see Table 1)

Table 1. China's macroeconomic indicators for the 2020-2024 period

Year	GDP (nominal, billion $)	GDP at PPP (billion $)	Foreign Direct Investment (FDI, % of GDP)	Inflation (%)	Unemployment (% of labor force)	Government debt (% of GDP)
2020	14 862,6	25 547,1	42,86	2,49	5,62	70,16
2021	17 759,3	28 722,5	43,29	0,92	5,12	71,85
2022	17 848,5	31 678,1	43,23	1,98	5,58	77,39
2023	17 758,0	34 540,9	41,56	0,23	5,22	84,38
2024*	18 273,4	37 072,1	41,99	0,42	5,10	90,12

Source: International Monetary Fund (IMF, 2024)

Note: The data for 2024 is indicative, as the information used by the IMF is from October 2024 – World Economic Outlook Database, October 2024

In 2020, the pandemic slowed down the global trade, and China, as an exporter, was also affected. Due to its strict policy, none of the reviewed indicators show worrying results, and China quickly managed to reverse the long-term consequences of the situation. The following year saw a sharp increase in GDP and GDP at PPP, demonstrating the rapid response and overcoming the possible stagnation of the economy. It is interesting to analyze the difference in the values of the two indicators as presented graphically in Figure 1.

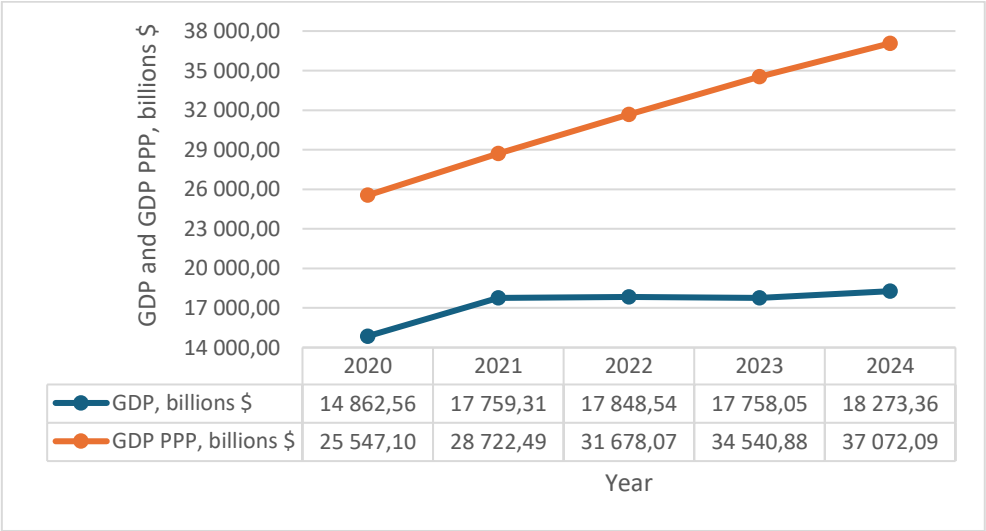

Figure 1. GDP and GDP at PPP of China for the period 2020-2024
Source: Author's illustration

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The differences between nominal GPD and purchasing power parity values are significant, amounting to 72% for the first year analyzed. Generally accepted statistical calculations are made in the official international currency, the US dollar, but China's economy is not driven by world events as much as by its domestic market and the development of its population. At the end of the period analyzed, this difference increased to 103%, confirming the shift away from US currency. GDP growth was 23%, while GDP at PPP growth for the same period was 45%. This trend calls into question the statistical methods of analysis, as the political structure is specific and perhaps using the same method to determine the economic share of each country is not optimal. Regardless, both indicators show growth, and China continues to grow systematically both economically and as a global political power (although from 2021 to 2024, GDP values will not change by more than 3%).

Another important indicator for analyzing confidence in country's economic development is foreign direct investment. China has become the largest recipient of FDI among the developing world and globally the second only to the U.S. since 1993 (Zhang & Song, 2001). Peculiar to the People's Republic of China is the country's political and economic structure, as "the specifics of China's FDI can be understood and interpreted through knowledge of the Chinese political and economic model, which has no analogue in the world" (Christova-Balkanska, Kostadinov, Bobeva, & Peneva, 2022). China has pursued a historically unique FDI policy that has long-term implications for both Chinese and international businesses (Lau & Bruton, 2008). Due to the rapid state intervention in regulating the situation created by COVID-19, investors are turning to China, as many other countries have not yet found a definitive solution to overcome the consequences of the pandemic. In 2021, there was a 20.7% increase in FDI in absolute terms compared to the previous year, precisely because of the rapid anti-epidemic measures. An important element for a better analysis of FDI is also the comparison of data not only with GDP but also with GDP at PPP for the reasons described above, as illustrated graphically in Figure 2.

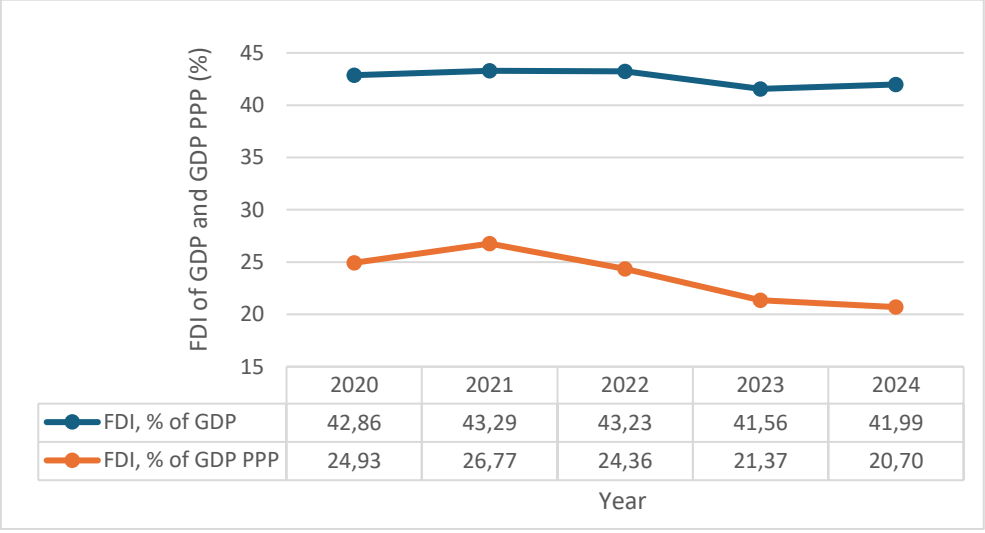

Figure 2. Foreign Direct Investment for China for the period 2020-2024
Source: Author's illustration

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Figure 2 shows that FDI as a percentage of GDP remained stable throughout the period, which is an indicator of stable, consistent investment, but also of a lack of economic incentives to attract further investment. On the other hand, after 2021, there is a decline in FDI relative to GDP at PPP of over 6%, which raises the question of whether China is moving towards stimulating its own market. The fact is that FDI in absolute terms does not change significantly for the period 2021-2024, while GDP at PPP shows significant growth, which explains the visual decline in the curve.

Inflation and unemployment are domestic economic indicators which, due to the structure of political power in PRC, do not allow the behavior of these indicators to be largely predictable. During the period examined, unemployment in the country remained virtually unchanged, demonstrating the stability of the labor market even during a social and health crisis. Statistically, the data appears stable, but an important factor that should not be underestimated is the size of the population. China is the second most populous country in the world (after India), and a slight change in the unemployment rate affects a much larger population than in other countries. Regardless, unemployment remains at a good level as the main challenge for the country, and the working-age population consists of young and educated people who can work in suitable positions, something that has been a problem for many years and attempts are being made to remedy it. Inflation rates in the PRC have fluctuated throughout the period, reaching their highest level in 2020 at the beginning of the pandemic – 2.49%. Of course, this inflation is optimal in relation to accepted economic norms, but the other inflation data shows a very low rate, which is almost bordering on deflationary trends. The development of GDP in PPP terms should have created high inflation at one point, but this did not happen. One of the reasons for this is the use of time-lag currency to stimulate urbanization and modernization through its strategies for issuing and using this currency without causing high levels of inflation (Yang & Cao, 2025).

The PRC's national debt has been affected by the pandemic, as in many other countries, and is projected to grow by 22.4% in absolute terms in 2021. This further contributes to the rapid regulations of the economic and social situation in the country. An important factor is the analysis of the data in relation to both GDP and GDP at PPP (see Figure 3).

For the period 2020-2024, the ratio of government debt to GDP shows an increase of almost 20%, which raises the question of whether the country's economic growth is slowing down. In terms of GDP at PPP, the values from 2021 have been maintained until the last year under review. This difference in the data can be explained by the method of analysis in relation to the absolute values of government debt. The growth of GDP at PPP is significantly higher than GDP, and when comparing public debt as a percentage of the other two indicators, visible differences emerge.

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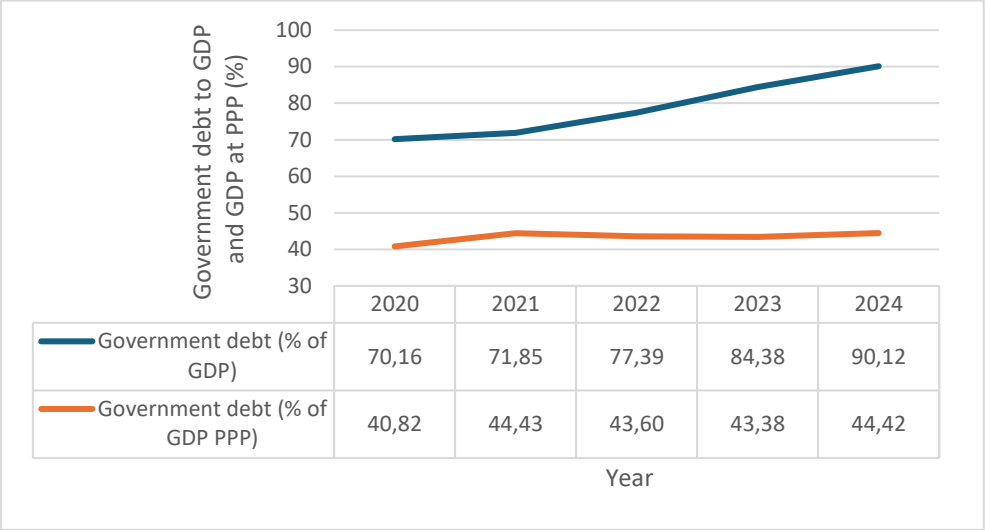

Figure 3. China's government debt for the period 2020-2024
Source: Author's illustration

In 2024, the ratios of government debt to GDP at PPP terms increase significantly, reaching more than double the difference (90.12%/44.42%). This demonstrates the PRC's departure from the generally accepted method of analyzing data and comparing it with GDP. An interesting coincidence is the percentage increase in public debt and GDP at PPP for the period 2020-2024. Government debt measures a growth of 29.06%, and GDP at PPP – 29.07%, with the differences being within the statistical error.

China in BRICS Union

Amid the evolving global economic landscape, the BRICS nations (Brazil, Russia, India, China, and South Africa) have emerged as proponents of economic multilateralism, challenging traditional paradigms of economic governance and integration (Nach & Ncwadi, 2024). In a highly interdependent and globalized era, the BRICS economic regionalism exhibits the implementation of institutional arrangements that is designed to facilitate the free flow of goods and services and coordinates foreign economic policies (Shameem & Jayaprasad, 2020). China plays a key role in the economic space of the BRICS union, as it generates most of the GDP and GDP at purchasing power parity. Because of its politico-economic weight, China exerts great weight on the BRICS exceeding that of its partners (Hooijmaaijers, 2021).

China sees BRICS as a major asset in its effort to become a major world power and to reform the international system so that it becomes fairer and better serve its interests (Lukin & Xuesong, 2019). The relationship between the countries is reciprocal, as they help each other in every possible aspect. The BRICS group finds its origin and synergy precisely in China's enormous need for natural resources and food, which has a significant positive impact on the BRICS economies, contributing to their economic success (García, 2014). The role of the country in the union is particularly important due to BRICS' desire for de-dollarization and withdrawal from the US payment system.

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Another important element that China possesses is its highly industrialized and developed manufacturing sector, contributing to the independence that the PRC and BRICS are increasingly seeking. The large population, which has greatly increased its intellectual power in recent years, helps to attract a large part of the world's population to the union and fuels the desire to change the world order. BRICS countries (Brazil, Russia, India, China, South Africa) over the next 50 years could become the driving force in the world economy (Gusarova, 2019). An interesting factor for the development of the countries of the Union is that "BRICS may increase their influence through their achievements on the social front and their soft power" (Agarwal & Kumar, 2023).

CONCLUSION

The development of the People's Republic of China in the period 2020-2024 clearly demonstrates its sustained pursuit of economic stability and growth despite the global challenges posed by the pandemic, geopolitical tensions, and structural internal problems. The macroeconomic indicators analyzed reveal the complex nature of China's economy, which strives to strike a balance between domestic consumption and external influence. A comparative analysis of nominal GDP and GDP at purchasing power parity highlights the significant role of the domestic market and the move away from dependence on the US dollar. China is the first major economy to show a recovery after a slowdown induced by the COVID-19 pandemic (Wang & Zhang, 2021).

Despite the slowdown in economic growth in nominal terms in recent years, China continues to report significant improvements in real measures of economic well-being. Labor market stability, low inflation, and sustained levels of FDI underscore the country's ability to regulate and maintain economic predictability, even amid global shocks. At the same time, growing government debt suggests a need to focus on long-term fiscal sustainability and continued structural reforms. As being the world's second largest economy and largest developing country, China's leading role in the BRICS has been widely recognized for its strategy adjustment from the international community (Wang, Zhang, & Xi, 2022). China is not only consolidating its position as the economic foundation of BRICS but is also emerging as a leading force in the construction of an alternative global economic architecture. The combination of political stability, technological development, and global economic ambitions makes the PRC a key factor for the world economy in the coming decades.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author

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FROM IMMIGRATION TO NATIVENESS IN DIGITAL LITERACY: A MIXED-METHODS STUDY in TURKİYE

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Mustafa KOCAOGLU
Necmettin Erbakan University
Faculty of Applied Sciences,
Konya, Turkiye
mustafakocaoglu@erbakan.edu.tr
ORCID ID:0000-0002-9341-6341

Nezahat KOCYIGIT
Necmettin Erbakan University
Faculty of Applied Sciences,
Konya, Turkiye
nkocyigit@erbakan.edu.tr
ORCID ID:0000-0003-3332-3642

Mehmet Burak CERAN
Necmettin Erbakan University
Faculty of Applied Sciences,
Konya, Turkiye
mbceran@erbakan.edu.tr
ORCID ID:0000-0002-6242-2642

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ABSTRACT

The term literate is used for individuals who can read and write. Digital literacy is the ability to use the internet and digital technologies effectively. People's ability to adapt to the production of information, developing at an unprecedented speed, is possible with digital literacy. The rapid dissemination of information via the internet can produce misleading results for individuals and societies.
This research aims to identify the digital literacy skills of digital immigrants and natives. The main question is: What is the level of digital literacy in individuals? Another question is whether there is a difference between digital natives who grew up with technology from the moment they were born and use digital language as their mother tongue, and immigrants who try to learn digital language but cannot get rid of the influence of their past habits and use this language with an accent.
Qualitative and quantitative research methods are both used in the study. In the qualitative study, data were collected from 42 headmen in the central neighbourhoods of Selçuklu District using semi-structured interview questions. In the quantitative study, data were collected from individuals born after and before 1990, residing in the district, using survey questions based on the digital literacy scale. According to the findings, the concept of digital literacy is not yet known, individuals aged 21-30, men, singles, and students have higher digital literacy levels. Problems arising from the inability to access opportunities such as digital technologies, due to infrastructure problems, should be resolved by providing communication training.

Keywords: Digitalization, digital literacy, information technologies

JEL classification: *M10, M12, M15*
Paper type: Research article

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INTRODUCTION

With the widespread availability of information and communication technologies (ICT) after the pandemic, changes and necessities have emerged in healthcare, education, and many other sectors, as well as in daily life. Weaknesses such as infrastructure deficiencies and resource shortages have come to light in technology-based systems. The use of technology has become mandatory in every field. However, being forced to use technology does not mean that it is being used properly or that there is sufficient knowledge about it. Therefore, digital literacy that is related to thinking and problem solvinghas become one of the basic competencies of the age and (Cabero- Almenara, et.al., 2023; Damayanti, et.al., 2025; Reddy, et. al.,2023). Digital literacy encompasses the awareness, ability, and attitude of individuals to use digital tools and resources appropriately to identify, access, manage, analyze information, construct new knowledge, and create media expressions (Ng, 2012; Sitepu & Rajagukguk, 2022; Nahdi et.al., 2022; Jantavongo, 2022). It is suggested that there are several types of literacy included in the concept of digital literacy, and these include the following dimensions (Ng, 2012: 1066-1067):

- Visual Literacy: Learning to read from images.
- Reproductive Literacy: The use of digital tools with the ability to organize or combine new and pre-existing materials (text, audio, video) into new works.
- Information Literacy: The ability to think critically and effectively search, find, and evaluate web-based information.
- Socio-Emotional Literacy: Literacy related to the emotional and social aspects of socializing, collaborating, and undertaking daily tasks in online environments. For example, consumers should be cautious when online purchasing, avoiding scams, and protecting against viruses. Digital literacy gives young people the ability to take advantage of the wealth of emerging opportunities associated with digital technology, while protecting against the various dangers that technology can pose to.

In Turkiye, despite high household information and communication technologies access (TUİK, 2024), digital literacy remains moderate. When looking at the digital literacy levels of young people, we see that they are low. Screen addiction is also a concern, and the socioeconomic status, education, and occupational status in the family significantly influence digital literacy levels (RTUK, 2021). research shows that digital literacy is unevenly distributed across demographic groups, influenced by factors such as age, gender, education, and place of residence (Urbancikova et al., 2017; He, et. al., 2025; Choudhary & Bansal, 2022).

The digital native and digital immigrant distinction, which was first described by Prensky (2001), suggests generational differences in familiarity with digital media. He described digital natives as people born in or after 1980 who live their lives with a focus on digital technology, and who learn differently from previous generations. They have a culture of connectivity and online sharing, such as blogging, downloading music,

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socialising via social media networks, and playing online games (Ng, 2012). On the other hand, digital immigrants — people who turn to the internet for information second rather than first — were socialised differently from their children and are still learning a new language, namely, technology (Creighton, 2018). Empirical evidence reveals that digital immigrants often struggle with basic digital tasks, while digital natives may still lack competencies in ethics, security, and critical thinking. A number of factors are necessary for the development of these competencies. For example, strong cultural capital and family support in learning and knowledge have a positive effect on digital competence of people (Ng, 2012; Hatlevik & Christophersen, 2013).

Internationally, researchers emphasise disparities in digital literacy, demonstrating the moderating role of educational support and digital literacy programmes in overcoming socio-demographic obstacles, especially among older adults aged 55 and older (Tirado-Morueta, et al., 2018). Van Deursen & Helsper (2015) investigated whether individuals with a higher social status could gain more from digital interaction than those with a lower status, thereby exacerbating existing offline inequalities. Other studies have researched whether the adult population uses social networks, e-commerce and mobile payment (Baric-Selmic, 2022; Thangavel & Chandra, 2024; Agárdi & Alt, 2024).

In the Turkish context, there are few studies on the comparative digital literacy of these two groups, particularly regarding their use of essential online services such as e-government, online shopping and online banking. In Turkiye, the studies by Baturay & Yastibas (2022) indicated that, despite being technologically immersed (n=38), Turkish digital native EFL students had a medium level of digital literacy and that most of the participants could use educational technologies. Furthermore, the aim of Adalı (2023)'s study is to investigate whether there is a significant difference in attitudes towards digital advertisements between digital natives and digital immigrants. The authors drew attention to social media posts about the importance of accurate data sharing and preventing manipulation, which became painfully evident during the February 6, 2023, earthquakes in Turkiye, and analyzed the data they obtained from Twitter (X Space), a social media platform. Based on their findings, they have suggested what should be considered in such situations where digital literacy skills are required for crisis and emergency management and quick decision-making (Kocyigit, et al., 2023).

Additionally, research on digital citizenship in Turkiye indicates moderate levels associated with socio-demographic factors such as gender, age, managerial position, and education (Akduman et al., 2024). There is a knowledge and literature gap regarding how these factors correlate with digital literacy among digital natives and immigrants.

The lack of comparative evidence on digital natives and immigrants in Turkiye, and the insufficient exploration of the link between socio-demographic factors and secure digital practices, represent a significant

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research opportunity. This study aims to address this gap by offering empirical insights from a Turkish perspective.

Accordingly, the research focuses on the following questions:

1.Are there significant differences in digital literacy levels between digital natives and digital immigrants?

2.How do socio-demographic variables such as gender, age, level of education and place of residence influence digital literacy?

3.What is the relationship between digital literacy levels and individuals' secure and conscious digital practices?

To answer these questions, survey data were collected from 42 neighbourhood headmen and 391 participants in Konya city, Selçuklu District of Turkiye, and the findings were analysed using statistical methods, e.g., regression and SPSS.

The results are expected to contribute to the global and local body of literature on digital literacy by providing empirical evidence from Turkiye, as well as offering practical insights for local policymakers who are looking to strengthen digital adaptation, reduce inequalities in digital competence, and promote the safe and effective use of online services.

METHODOLOGY

This study aimed to employ a mixed-methods design combining qualitative and quantitative approaches to gain a comprehensive understanding of the differences in digital literacy levels between digital natives and immigrants.

1. Qualitative Research

Semi-structured interview forms (see Appendix 1) were used to explore participants' knowledge of digital literacy and their technology usage levels. These interviews were conducted with 42 neighbourhood headmen from the central neighbourhoods of the Selçuklu district between 25 April and 15 November 2024. The interviews took place face-to-face in the neighborhood headmen's offices, and the data was recorded either via audio recording (with the participants' consent) or manually on the prepared forms. Where responses were not sufficiently detailed, probing questions were used to elicit deeper insights.

2. Quantitative Research

For the quantitative research, survey questions were developed based on the Digital Literacy Scale (Ng, 2012) and distributed online. The survey consisted of two sections: the first part included demographic questions (gender, age, marital status, level of education, neighbourhood, and income level), while the second part measured participants' digital literacy through scale-based statements. The main research question addressed

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was: 'What are the digital literacy levels of participants, and how do they differ between digital natives and digital immigrants?' The complete list of items is provided in Appendix 2.

The target population consisted of the 682,514 residents of the Selçuklu district. Information about the participants was obtained from the District Population Directorate and local neighbourhood headmen to identify two key groups: digital natives (born after 1990) and digital immigrants (born before 1990).

The survey form was distributed online as one of the systematic, primary, and reliable data collection instruments. A total of 391 valid responses were collected and deemed suitable for statistical analysis.

Participation was voluntary, and all respondents were informed about the purpose of the study, the confidentiality of their responses, and their right to withdraw at any time. Informed consent was obtained from all participants before any interviews or surveys were conducted. For interviews, additional consent was sought for audio recording. Data were anonymised during transcription and analysis to ensure confidentiality and privacy. All data collected were securely saved on the research team's computers and in their cloud storage accounts.

Data Analysis

Both qualitative and quantitative analyses were conducted to enable comparative interpretations of the data.

Quantitative analysis: Survey data were analysed using the Statistical Package for the Social Sciences (SPSS), version 25. Descriptive statistics were employed, with a focus on frequency analysis. The analysis included the percentage distribution of repeated variable frequencies, used the arithmetic mean to determine central tendency, and used the standard deviation to measure variability and dispersion from the mean.

Qualitative analysis: Interview data were analysed using MAXQDA, a computer-assisted qualitative data analysis programme. This software facilitated systematic coding and categorisation, enabling a faster, more structured, and more reliable interpretation of the qualitative dataset.

Limitations

This study has certain limitations. First, the research is limited to the Konya City Selçuklu District in Turkiye, which may reduce the generalizability of the findings to other regions in Turkiye or internationally. Second, as participation was based on self-reported data, survey responses may contain bias or mistakes. Third, while a mixed-methods approach strengthens validity, differences in the depth of qualitative and quantitative data might create challenges in fully integrating the two datasets.

RESULTS

1. Quantitive Findings

The data obtained in the study were analyzed using the free trial version of SPSS Statistics (Statistical Package for Social Sciences) for Windows 25.0. Descriptive statistical methods (number, percentage, mean, standard

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deviation) were used to evaluate the data. The normality of the data depends on the skewness and kurtosis values being within ±2 (George, D., & Mallery, M., 2010). The skewness and kurtosis values of the scale and its subscales were found to be within the ±2 range, indicating a normal distribution. Parametric tests were used for the scale.

An independent sample's t-test was conducted to test whether the scores obtained from two unrelated samples of our quantitative variables differed significantly from each other. An ANOVA (F) test was conducted whether the means of more than two unrelated samples differed significantly, and Tukey HSD was applied for multiple comparisons. A "Reliability Analysis" was conducted to test the reliability of the scales. In the study, p-values below 0.05 were considered significant. (Five outliers affecting the normal distribution were removed from the data set.)

Table 1. Reliability analysis results of the scale used in the study

Scale	Number of Items	Cronbach's Alpha
Attitude	7	0,806
Technical	6	0,830
Cognitive	2	0,604
Social	2	0,688
Digital literacy scale	17	0,894

Source: Own calculations

The reliability analysis results of the scale used in the study are presented in Table 1. The reliability coefficient was found to range from 0.604 to 0.894. Cronbach's Alpha values greater than 0.6 indicate that the scales used are reliable. This shows that the internal consistency of the scale used in the study is acceptable. In reliability analysis, the Cronbach's Alpha (α) coefficient value, which ranges from 0 to 1, indicates that the scale is unreliable if it is between 0.00 and 0.40, indicates low reliability if it is between 0.40 and 0.60, indicates high reliability if it is between 0.60 and 0.80, and indicates very high reliability if it is between 0.80 and 1.00 (Tavşancıl, 2005: 19).

It was observed that 53.9% of the participants were male and 46.1% were female. It was determined that 48.7% of the participants were in the 21-30 age group and 32.4% were in the 20 or under age group. It was observed that 80.6% of the participants were married. It was determined that 66.8% of the participants were college graduates. It was determined that 13.7% of the participants lived in the Şeker neighborhood, 12.7% in the Yazır neighborhood, 9.8% in the Selçuk neighborhood, and 6.7% in the Horozluhan neighborhood. It was observed that 63.7% of the participants were students, and 22.0% were employed. It was determined that 72.3% of the participants had a medium/high income level.

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The mean scores for the scale in the study were found to be 28.44 for attitude, 24.54 for technical skills, 8.29 for cognitive skills, 7.41 for social skills, and 68.68 for digital literacy. The skewness and kurtosis values for the scale were found to range from -2 to +2. (Table 2).

Table 2. Distribution of the average digital literacy and its sub-dimensions

Scale	Min	Max	$\overline{X}$	SS	Skewness	Kurtosis
Attitude	13	35	28,44	3,89	-0,684	1,282
Technical	13	30	24,54	3,48	-0,502	0,504
Cognitive	3	10	8,29	1,26	-0,827	1,693
Social	3	10	7,41	1,61	-0,250	-0,313
Digital literacy scale	39	85	68,68	8,39	-0,286	0,455

Source: Own calculations

Table 3. Distribution of Digital Literacy Scale and sub-dimension scores according to participants' characteristics

Variables		Attitude		Technical		Cognitive		Social		Digital literacy	
		$\overline{X}$	SS	$\overline{X}$	SS	$\overline{X}$	SS	$\overline{X}$	SS	$\overline{X}$	SS
Gender	Female	28,28	3,76	23,99	3,46	8,28	1,23	7,30	1,59	67,85	8,03
	Male	28,57	3,99	25,01	3,43	8,30	1,28	7,50	1,62	69,39	8,64
	t	-0,734		-2,905		-0,171		-1,226		-1,798	
	p	0,464		0,004*		0,864		0,221		0,073	
Age	20 and under (1)	28,67	3,58	24,66	3,23	8,37	1,14	7,30	1,61	68,99	8,05
	21-30 (2)	28,61	3,83	25,04	3,09	8,32	1,25	7,64	1,50	69,61	7,61
	31-40 (3)	27,41	4,42	23,39	4,40	8,06	1,55	7,31	1,67	66,18	10,14
	41 and over (4)	28,05	4,55	22,23	4,16	8,14	1,17	6,36	1,97	64,77	10,39
	F	1,536		6,748		0,891		4,765		4,028	
	p	0,205		0,000*		0,446		0,003*		0,008*	
	Tukey HSD			4<1,2; 3<2				4<2		4,3<2	
Marial Status	Married	27,89	4,44	23,47	4,39	8,05	1,43	7,17	1,74	66,59	9,97
	Single	28,57	3,74	24,80	3,17	8,35	1,21	7,47	1,57	69,19	7,90
	t	-1,354		-2,475		1,844		-1,432		-2,105	
	p	0,177		0,015*		0,066		0,153		0,038*	
Educational Status	High School and Below	28,55	4,44	23,69	4,37	8,24	1,33	7,06	1,80	67,55	10,01
	College	27,15	3,94	23,83	3,48	8,24	1,16	7,37	1,55	66,59	8,50
	Undergraduate	28,54	3,60	24,72	3,07	8,32	1,17	7,43	1,54	69,02	7,57
	Postgraduate	29,00	4,73	25,16	4,48	8,21	1,76	7,76	1,84	70,13	10,80
	F	1,860		2,193		0,143		1,410		1,673	
	p	0,136		0,088		0,934		0,239		0,172	
Working Method	Doesn't work (1)	27,76	3,97	23,18	3,62	7,94	1,39	6,73	1,64	65,61	8,81
	At school/student(2)	28,51	3,84	24,92	3,13	8,35	1,18	7,49	1,59	69,27	7,91
	At work (3)	28,74	3,76	23,96	3,84	8,35	1,21	7,36	1,48	68,42	8,69
	At home/hybrid (4)	27,50	4,71	24,50	4,75	7,91	1,85	7,77	2,07	67,68	10,93
	F	0,964		3,520		1,823		2,597		2,032	
	p	0,410		0,015*		0,142		0,052		0,109	
	Tukey HSD			1<2							
Income status	Lower	28,02	4,40	24,56	3,29	8,09	1,26	7,24	1,52	67,92	8,92
	Middle/High	28,60	3,66	24,53	3,55	8,37	1,25	7,48	1,64	68,97	8,18
	t	-1,314		0,077		-1,937		-1,278		-1,110	
	p	0,190		0,939		0,054		0,202		0,267	

Source: Own calculations

Note: *p<0,05

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To determine whether the mean scores on the digital literacy scale and its sub-dimensions differed based on the characteristics of the study participants, independent samples t-tests, ANOVA (F) tests, and Tukey's HSD test for multiple comparisons were applied. A statistically significant difference was found in the mean scores on the technical dimension of the digital literacy scale by gender ($p<0.05$). Accordingly, men had higher technical scores than women.

A statistically significant difference was found in the mean scores on the technical and social dimensions of the digital literacy scale and its sub-dimensions by age ($p<0.05$). Accordingly, those in the 21-30 age group had higher technical, social, and digital literacy scores than the other groups. Multiple comparisons revealed that the 20 and under, and 21-30 age groups had higher technical scores than those in the 41 and above group, while the 21-30 age group scored higher than those in the 31-40 age group. The 21-30 age group was found to have a higher social score than the group aged 41 and above. The 21-30 age group had a higher digital literacy score than the 31-40 age group.

A statistically significant difference was found in the participants' mean scores on the technical dimension of the digital literacy scale, and its sub-dimensions, based on marital status ($p<0.05$). Accordingly, singles had higher technical and digital literacy scores than married individuals.

A statistically not significant difference was found in the participants' mean scores on the digital literacy scale and its sub-dimensions based on their educational background ($p>0.05$).

A statistically significant difference was found in the participants' mean scores on the technical dimension of the digital literacy scale, based on their employment status, ($p<0.05$). Accordingly, the mean technical score of those in the school/student group was higher than those of the other groups. Multiple comparisons revealed that the mean technical score of the school/student group was higher than that of the unemployed group. It was determined that the mean scores of the digital literacy scale and its sub-dimensions did not show a statistically significant difference according to the income status of the participants ($p>0.05$).

Generally, the quantitative findings showed that digital literacy levels vary significantly across gender, age, marital status, and working status, whereas educational background and income do not appear to affect a significant influence.

2. Qualitative Findings

The findings from the qualitative interviews conducted to clarify the research problem are presented under this heading. A total of 42 participants took part in the qualitative phase of the study. Participants were coded as K1-K42.

Neighborhood headmen perspectives on digitalization under the overarching theme of “Digitalization”, evaluated eight categories: evaluation of training, personal rights, digital literacy, purposes of use, technology

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and security, challenges in use, neighboord Headmen Information Systems (MUBIS) usage, and evaluation of technology.

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- Many neighborhood headmen reported frequently using social media platforms, while others admitted to using technology only when necessary. This reflects a divide between proactive and reactive users of digital tools. “We use it when needed for the public,” K17, Facebook.” *For example, I created a WhatsApp group for the administrators of my neighborhood. I created a WhatsApp group for the website tasks and a group called the Hacı Kaymak group on Facebook. I always posted about funerals, illnesses, important matterslike that, or when the municipality or we made a decision about the neighborhood, or when permissions were issued during the pandemic, etc.I always posted it there." K35.)*
- Regarding MUBIS, some participants found it functional for communication with municipalities, while others criticized it due to technical restrictions and low responsiveness. *("No problem. Calling directly is faster than using MUBIS." K33, “The word count in the request is limited. I mean, I haven't counted yet, but I mean, it's a very small number of words, maybe 120 words. Maybe 140, I don't see that enough. It's like this didn't exist before. It seems like there was a letter restriction later. For example, I could not enter the entire detailed content." K11, “Of course I do. I use it quite well. I report minor issues in the neighborhood through MUBIS. We report them through the Selçuklu Municipality's White Desk and the Metropolitan MUBIS. MUBIS already reports municipality-related matters. We used to submit petitions, which was challenging. Now we're more comfortable in front of the computer. When I report any malfunction on any street, I am directed to the authorities." K2.)*
- Challenges in technology use included poor infrastructure, internet connectivity problems, and concerns over data privacy and security. Several neighborhood headmen also mentioned adverse effects of technology on family and children. *("I just created a page, and the information about it came back.") Someone used it in my name. They created another page in my name. They insulted someone. Because of this, I'm being summoned to court as a defendant. Yet, I'm the victim. When I learned about this, I reported it to the cybercrime authorities. I filed a criminal complaint. They decided not to prosecute or investigate. However, the other party filed a lawsuit against the person who insulted him, and I am being summoned as a defendant. This is difficult for me. As a man who has worked in the police force for 38 years, including in the fight against terrorism, retiring and then*

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appearing before a judge in such a situation would be an injustice, and I'm experiencing it." K35, They go down to the village center; there's no phone signal. I don't understand why they don't mention that. Because they pass through high ground, our village is a hollow. In high places, there is no phone signal. People can't use the internet. Children can't study. We resort to cable internet. K14).

- Concerning digital literacy, a significant portion of participants was unfamiliar with the concept. Those who were aware associated it with correct and conscious use of technology, and the ability to access reliable information. *("I've never heard of it. I don't know if he's an internet user. The answer is I don't know." K32, A person who uses a smart-phone can use every program available." K10).*
- In terms of training, while some neighborhood headmen found current programs adequate, others expressed the need for further training in legislation, communication, and digital tools. *("The Metropolitan Municipality provided all of these to us."K3, "We are receiving adequate training. We attended a 15-day training course on the earthquake emergency. We received both written and oral training."K5, "Even if we were educated and conscious about computers, for example, most of us do not have literacy skills. Additionally, including psychology training might enhance the curriculum. Education in Public Relations and Law is important for understanding laws and regulations." K23).*
- Personal rights emerged as another point of divergence: some participants were satisfied with current benefits, whereas others demanded additional financial resources and clearer responsibilities. "It's insufficient. There should be an increase in the authority given. For example, there's a hole here. Things don't work with phrases like 'we will do...we will go'. We need to be given a little more time and authority for such things." (K11).

These findings suggest that, although neighborhood headmen are becoming more integrated into digital governance systems, structural barriers such as inadequate infrastructure and institutional responsiveness, as well as knowledge gaps, are limiting their effective engagement.

The density matrix of the codes for the theme of muhtars and digitalization according to the participants is presented in Table 4. Accordingly, participants with codes k15 for technology use k35 for social media tools, k26 for using them, and k31 for preferring face-to-face/phone conversations made intense statements. Additionally, codes k14 and k38 were for problems arising from technological infrastructure; k13, k16, and k30 for not finding them reliable; k20 for announcements and communication; and k11 for increasing responsibilities and authorities.

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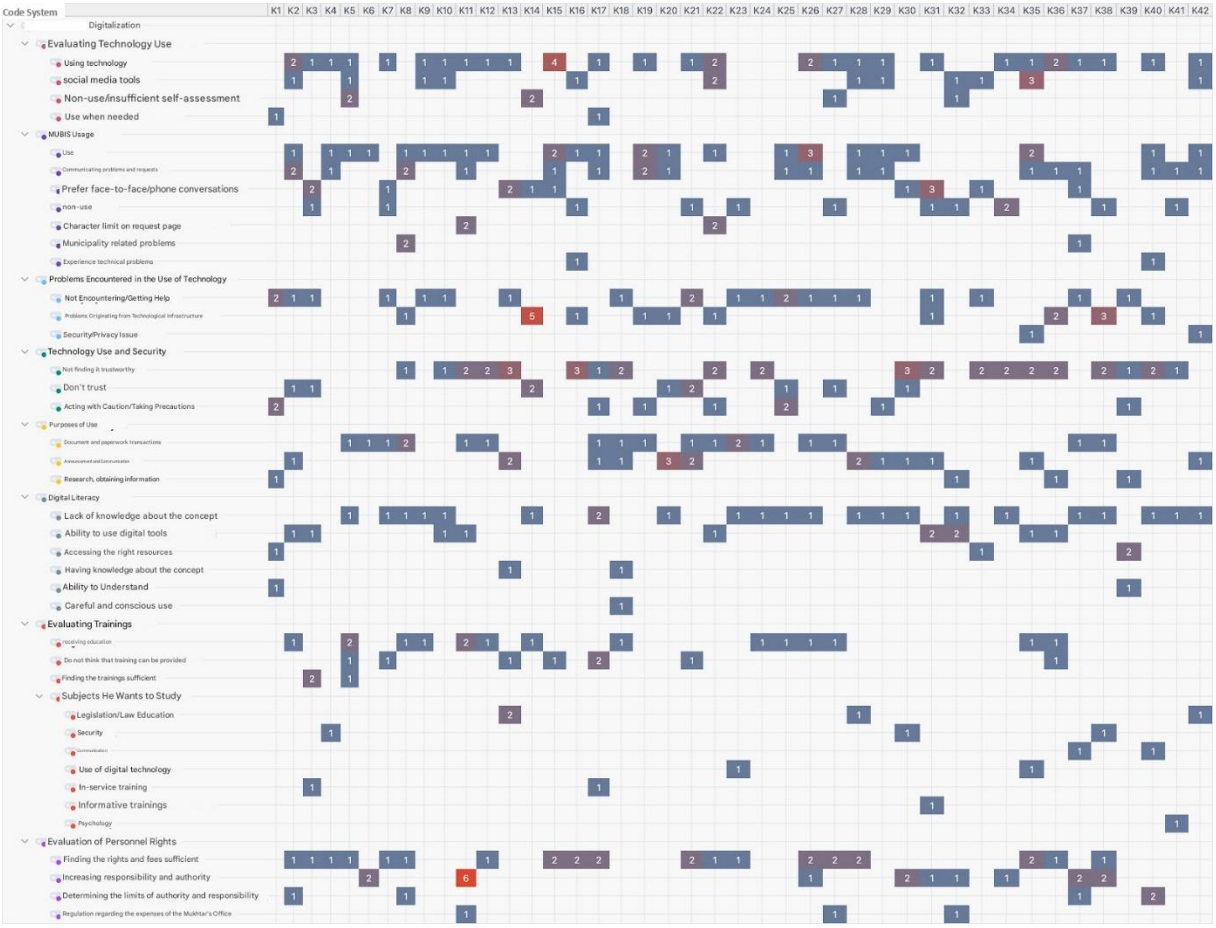

Figure 1. Digitalization Theme Code Matrix Display
Source: Own calculations

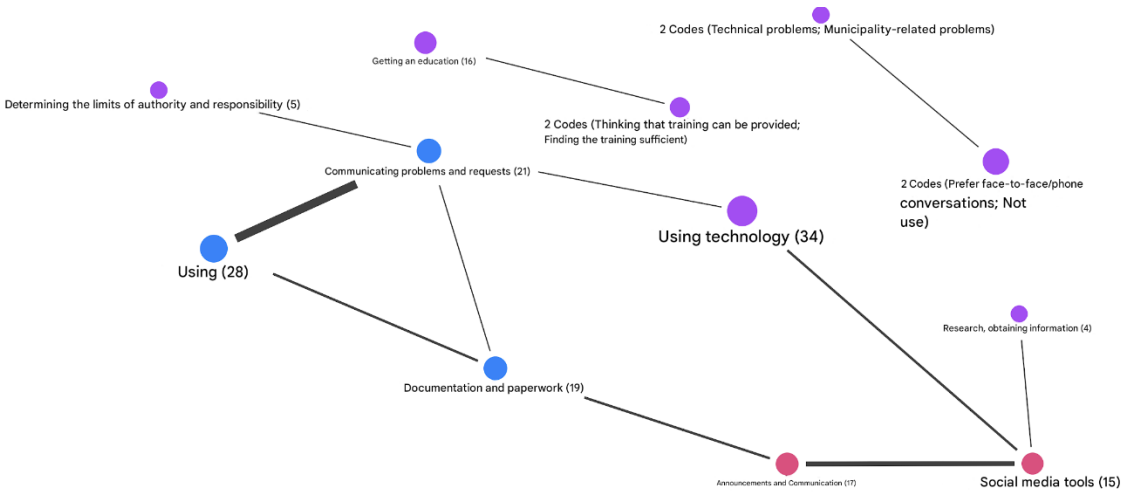

Figure 2. Code Map
Source: Own calculations

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The codes most frequently mentioned by participants are shown in Table 5. The map shows the relationships between the codes, indicating which ones were frequently mentioned together. The lines are wider to reflect the relationship between the more frequently mentioned codes.

Integrated Assessment

Taken together, the quantitative and qualitative findings demonstrate that digital literacy is a multidimensional concept influenced by both individual characteristics, such as age, gender, marital status, and employment status, and structural factors, such as infrastructure, training and institutional support. Consistent with patterns of generational digital divides, younger and single participants show higher levels of digital literacy. However, qualitative insights suggest that even those with higher technical literacy can encounter obstacles when institutional systems are not fully functional. These results highlight the need for policy interventions combining individual capacity building with systemic improvements, such as better training, enhanced infrastructure and clearer institutional frameworks for digital engagement.

DISCUSSION

In this era, the concept of literacy has evolved far beyond the simple act of reading and writing on paper, now encompasses competence in a process dominated by cognitive skills such as meaning, interpretation, synthesis, and translation. An individual's digital literacy is understood as their adaptation to new or emerging technologies.

The results suggest that digital literacy is influenced by both individual factors (demographics, lifestyle, culture) and structural factors (infrastructure, training, institutional responsiveness). However, income plays a diminished role in shaping competence. Quantitative findings confirm gender and generational differences (between digital natives and immigrants), while qualitative findings reveal challenges beyond individual competence.

The study emphasizes that digital skills require supportive infrastructures and responsive governance systems.

Digital literacy should be viewed by many governments as a strength and opportunity. It should be treated as a priority in education. Efforts should be made to determine policies and curricula aimed at improving students' digital literacy skills. The contributions of local and governmental authorities to the digital ecosystem are crucial in this regard. Higher education institutions should also assume responsibility and undertake various initiatives to improve digital literacy. In this regard, a new learning method has become increasingly popular, especially after the pandemic. Many educational institutions around the world have made the mandatory transition to online learning. The low level of digital literacy skills, which play a significant role in distance education, has led to challenges in its implementation. To improve and develop strategies and policies,

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public institutions, private sector organizations, civil society organizations, policymakers, and academics should work collaboratively.

This study has several limitations. The qualitative research was limited to local managers and digital immigrants. Comparative studies across different local actors or countries could provide significant information.

In the quantitative phase, self-reported data may be influenced by bias. Future research should include observation. Additionally, psychological factors like digital transformation anxiety, motivation were not examined and should be examined in future studies.

The study makes a valuable contribution to the existing literature by establishing links between competencies and structural conditions. For policymakers, it emphasises the importance of targeted, inclusive interventions that combine the development of individual skills with improvements in digital governance. For academicians, it provides a dual-level framework integrating the personal and institutional dimensions of digital literacy, thereby encouraging comparative and longitudinal research.

Author Contributions

For research articles with several authors, the following statements should be used “Conceptualization, M.K. and N.K and M.B.C.; methodology, N.K.; software, M.B.C.; validation, M.K., N.K. and M.B.C.; formal analysis, N.K.; investigation, N.K.; resources, M.B.C.; data curation, M.B.C.; writing—original draft preparation, N.K.; writing—review and editing, M.B.C.; visualization, M.K.; supervision, M.K.; project administration, M.K.; funding acquisition, M.K. All authors have read and agreed to the published version of the manuscript.”

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Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the ethics committee of the (Necmettin Erbakan University/ Social and Human Sciences Ethics Board), (approval number: 2025/801, 19/09/2025).

Conflict of interests: The authors declare no conflict of interest.

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Informed Consent Statement

Informed consent was obtained from all the participants involved in the study.

Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy issues.

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BULGARIAN JOURNAL OF BUSINESS RESEARCH

DOI: 10.46656/bposoki

GUIDELINES FOR AUTHORS

The submission template must be used in a mandatory manner. This journal register in the submission metadata the ORCID iD for each of the authors.
There is no charge of any amount, either in the submission of articles.
We adopted the system of continuous flow of publishing with closing of the editions in the months of **April** and **November**.

Contribution to definition of authorship

The recognition of authorship is based on a substantial contribution, related to the following aspects:

(i) designing and delineating the study, analysis and interpretation of the data;
(ii) writing or critical review relevant to the intellectual content of the manuscript;
(iii) final approval of the version to be published;
(iv) responsibility for all aspects of the work, including ensuring its accuracy and integrity. All those designated as authors must meet the four criteria for authorship, and all those who meet the four criteria should be identified as authors.

At the submission checklist, is required that everyone's participation in the preparation of the manuscript and publicly assume responsibility for its content. At the end of the text of the manuscript, a paragraph should be included with the information on the contribution of each author to its elaboration.

Throughout the text, the international system of units (IS) should be used to indicate measures.
The article should have the following structure:

a) Introduction;
b) Materials and Methods;
c) Results and Discussion;
d) Conclusion or Final Considerations;
e) References.

Other sections and subsections are accepted, such as the Bibliographic Review, however, the above sections are mandatory. The availability of a template for submission aims to standardize the submission format text of the journal, reducing the publishing period, and making possible the scheduled periodicity. The list of references should be presented at the end of the text, in a specific section.
Do not use footnotes!

General requirements for submission formatting

The language of the article: English.
The article should be prepared and submitted of the journal in word processing program Microsoft Office Word 2003, in ".doc" format, with tables and figures included in the body of the text.

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Section headings should be set in bold.

METADATA

- the author's name, surname (it is obligatory to give the author's name and surname in English according to passport data or any other IDs);
- the author's information (place of work or study, city);
- the title of the article;
- the abstract;
- key words (should not duplicate words from the title of the article);
- JEL Classification;
- e-mail;
- Identifier ORCID;
- references.

REQUIREMENTS FOR THE TEXT FORMATTING

Requirements for the structure of the article (elements with text highlighting):

- general problem statement and its connection with main scientific and practical tasks (Introduction);
- analysis of recent researches and publications, which contain background for solution of the given problem and which the author relies on (Analysis of recent researches and publications);
- highlighting of previously unsettled problem constituent that is a part of the main problem, which the article is dedicated to (Previously unsettled problem constituent);
- formulation of the purpose of the article (Main purpose of the article);
- presentation of the main research material with full argumentation of received scientific results (Results and discussions);
- conclusions of the given research and perspectives for further researches in the given direction (Conclusions and further researches directions);
- References;

Requirements for the article formatting:

- the length of the article is from 10 to 15 pages (8000 words including spaces, but excluding an abstract and references)[*];
- page format – A4 format (210 x 297 mm) page;
- page guidelines: top – 25 mm, bottom – 25 mm, left and right – 20 mm.
- Alignment Justify, Line Spacing Single, Paragraph Before 0 pt, After 0 pt, Indentation Right/Left 0 pt. First paragraph under Heading is not intended. Second paragraph is intended with Tab of 5 mm.
- Do not use the numbering of pages.
- the article font guidelines: font size – 11-point, font type - Times New Roman, 1,5 line spacing.

[*] Exceptionally, a smaller volume is allowed for doctoral students, but at least 8 pages

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Requirements for formatting of the article structural elements:

- JEL Classification (without paragraph indent, semi-bold, centered-alignment): font size – 10-point, font type – Times New Roman;
- the author's name and surname (one line space, without paragraph indent, semi-bold, centered-alignment): font size – 12-point, font type – Times New Roman;
- job of author (without paragraph indent, in italics, centered-alignment): font size – 10-point, font type – Times New Roman, line spacing – 1,5;
- e-mail (without paragraph indent, in italics, centered-alignment): font size – 10-point, font type – Times New Roman;
- the title of the article (one line space, capital letters, without paragraph indent, semi-bold, centered-alignment): font size – 14-point, font type – Times New Roman, line spacing - 1;
- the abstract and key words (one line space, in italics, justified-alignment): font size – 10-point, font type – Times New Roman, line spacing - 1, paragraph indent – 1 cm;
- the text of the article (one line space, justified-alignment): font size – 11-point, font type – Times New Roman, line spacing – 1,5;
- references: font size – 10-point, font type – Times New Roman, line spacing - 1; Paragraph spacing: before 5pt, after 5 pt; ech publication should be started on a new line, hanging by 0,75 cm
- identifier ORCID – end of paper (in about the authors), without paragraph indent, left-alignment: font size – 10-point, font type – Times New Roman;
- Author Photo – JPG/JPEG format with resolution not less than 300 dpi

Requirements for formatting the abstract and the author's resume in English (Abstract):

Abstract should be not less than 250 words (not less than 2500 characters), arranged in one column 10 pt, font type – Times New Roman; line spacing - 1.

Background of the research should be explained in few sentences.

Objectives: Objectives of the paper should be clearly stated in 1-2 sentences. **Methods/Approach:** Methods used in the paper should be explained in 1-2 sentences. **Results:** Results of the research should be presented in 1-2 sentences.

Conclusions: Main conclusions should be debriefed in 1-2 sentences.

Requirements for formatting the references (References):

- REFERENCES are formatting according to international bibliographical standard APA-2010 style in accordance with the specimen and requirements set on the website of the Journal.
- References should include not less than 20 sources, covering important previous works realised in the given area of interest on an international scale. References covered by major citation databases are preferred (Scopus, Web of Science).
- The reference be listed alphabetically and names of all authors should be given. Do NOT use "et al." in the list of references!
- The titles of Cirilic periodicals (journals, collections and others) are given by transliteration, and they are given in parenthesis in English;
- with obligatory citations in the text of the article, which are given in brackets in the text (alphabetically) and they appear in an order of citation or reference;

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- references for the personal author's works or articles (self-citation) should not exceed more than 10% from the general number of sources.

Requirements for drawing tables, pictures and formulas:

- tables should have a serial number and a title in the middle (Table 1. Title): font size - 10, interline spacing - 1, font type - Times New Roman;
- text in table: font size - 9, font type - Time New Roman; interline spacing - 1;
- pictures/ drawings must have a serial number and a name in the middle (Figure 1. Title): font size - 10, interline interval - 1, font type - Times New Roman;
- drawings are made in graphic editors, compatible with Word in the format JPG with a resolution of not less than 300 dpi;
- mathematical formulas are provided using the built-in Microsoft Equation formula editor;
- Equations and formulas are arranged in the center of the line, the number of the formula (in round brackets, on the right-hand side of the page, separated by blank lines): font size - 10, interline spacing - 1, font type - Times New Roman.