

UNRAVELING THE LAYERS OF DIGITAL COMPETITIVENESS IN THE ECONOMIC SYSTEMS

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The subject of digitization and its impact on all aspects of life is the subject of daily discussions. However, the effect that the digitalization process has on socio-economic systems remains in the background. More specifically, increasing their competitiveness contributes to their more efficient functioning. The article's main purpose is to trace the evolution of the understanding of the nature and aspects of the manifestation of digital competitiveness.

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1 Before the Introduction

This article is the first step and a kind of foundation of scientific research dedicated to the evaluation of the digital competitiveness of Bulgaria's socio-economic system. For this reason, the following text does not have the typical (adopted in recent years) structure but is an unveiling of the concept of digital competitiveness today - from the standpoint of the different levels of its manifestation, as well as the specific factors that impact it.

2 From Economic Competitiveness to Digital Competitiveness

One of the constantly discussed topics directly related to the development of economies and societies is that of competitiveness. The category of competitiveness has been the subject of numerous theoretical and practical studies since the 1970s. Michael Porter (Porter, 1998), for example, defines competitiveness as a process based on productivity and focuses on the microeconomic foundations of competitive advantage that underpin productivity in nations, regions, and clusters. In this period, the competitiveness of economic systems was mainly studied from the standpoint of the efficiency of production activity, efficient use of resources, etc.; nowadays, the topic related to the concept of "digital competitiveness" is gaining wider popularity.

As already indicated, the topic of digital competitiveness is relatively new compared to the background of traditional understandings of competitiveness. In this sense, a correct understanding of the nature of digital competitiveness is crucial to the research. Although it is a new category in the literature and practice, there are various definitions and concepts, and understanding of which is crucial to the study. They help to understand how countries position themselves and compete in the opportunities the digital age offers. Some of the most summarized definitions for digital competitiveness define it as:

Table 1: Main definitions of digital competitiveness

Author	Definition
IMD (IMD, 2023)	The capacity of an economy to adopt and explore digital technologies leading to the transformation in government practices, business models, and society in general.
Stankovic, Marjanovic, Drezgic, Popovic (Stankovic, Marjanovic, Drezgic, & Popovic, 2021)	A multidimensional structure that encompasses various factors of the process of digital transformation through the ability of learning and application of new technologies, technology factors that enable digital transformation, and digital readiness factors that assess the preparedness of an economy and citizens to assume digital transformation.
Bukht and Heeks (Bukht & Heeks, 2017)	A country's capability not only to create and use digital innovations but also to obtain positive effects from the development of the so-called digital economy
Mlynarzewska-Borowiec (Mlynarzewska-Borowiec, 2021)	The country's ability and readiness to create and use digital technologies and benefit from the development of the ICT sector.

Source: Author's table

These definitions make it possible to derive the main characteristics of digital competitiveness: *economic and social impact* (ECDC, 2024); *competitiveness based on digitization*; *competitiveness based on implementation and use of digital innovations*; *people's participation in the digitization process*. Digital competitiveness not only predetermines and strengthens an economy's ability to apply and use digital technologies to innovate and improve business processes but also influences its ability to adapt to ever-changing global market conditions. In addition, digital competitiveness is also a key factor in the development of society and increasing its well-being.

In this context, looking at digital competitiveness at different economic levels offers a unique perspective for analysing the state and development potential of countries in the digital era. It enables the systematic approach to be applied in the implementation of the analysis, through which approach the specific aspects and connections between the different levels can be deduced. This article aims to explore the key components that shape digital competitiveness at the global, national, regional, and corporate levels and to analyse the current trends and challenges that socio-economic systems are facing and will face in the future.

The main levels at which digital competitiveness can be studied are: global, national, regional, industry, company and individual. Each of these levels provides unique opportunities to analyse and understand the key factors that influence the ability of economies to take advantage of digital technologies.

Figure 1 presents the main levels (layers) of digital competitiveness and the relations between them. As can be seen in the figure, each of the presented lower levels (systems, as elements of the system at the previous level) have a different degree of participation in the formation of the degree of digital competitiveness of the higher system. At the same time, an important clarification that needs to be made is about the presence of two-way relationships, also expressed through the impact of the degrees of digital competitiveness and its manifestation of the higher-ranking system on the lower-ranking system.

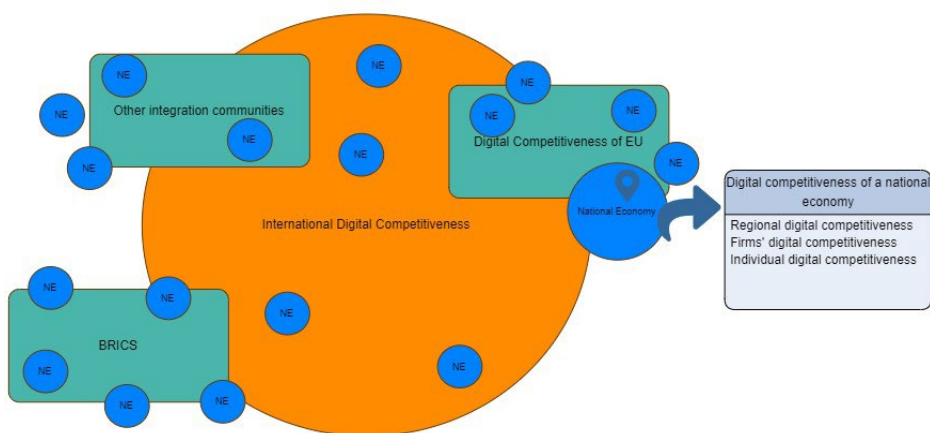


Figure 1: Main levels (layers) of digital competitiveness

Source: Author's figure

At the global (international) level, trends and dynamics of digital competitiveness between the countries of the world economy are analysed. International rankings, global indices (e.g. EU Digital Economy and Society Index, IMD Digital Competitiveness Index) are explored and digital development strategies are compared. The focus at the national level is on an analysis of the digital competitiveness of individual countries. National policies, regulations, infrastructure, investment in technology, the level of digital skills among the population, and the digital inclusion of businesses are explored.

Examining digital competitiveness at the regional level provides information on how different areas or regions within a country are coping with digital transformation. This includes an analysis of regional differences in digital infrastructure, broadband

access, regional innovation ecosystems, and local digital education initiatives. The digital competitiveness of the various economic sectors and branches is examined at the sectoral level. The specific challenges and opportunities for digitization in industries such as finance, manufacturing, healthcare, education and others are analysed.

The company level focuses on the analysis of the digital competitiveness of individual companies. It assesses how companies apply digital innovation, technology, and business models to improve their competitive position, operational efficiency, and customer service. At the lowest level (individual), research focuses on individual's digital skills and competencies and their ability to use and benefit from digital technologies in personal and professional contexts.

Each of these layers provides a different perspective and allows researchers, policymakers, and business leaders to identify strengths and weaknesses as well as opportunities for improvements in the context of the digital economy. The following presentation provides an in-depth review of the main concepts related to digital competitiveness at different levels. The main purpose of this report is to identify the specific characteristics of digitalization and digital competitiveness in the Bulgarian socio-economic system.

3 The Bedrocks of the Digital Competitiveness

The presence of different levels (layers) at which the concept of digital competitiveness is considered also implies the presence of relevant specifics regarding the factors that affect the levels of competitiveness formed by the processes of digitalization in the respective system. However, several factors can be deduced, the impact of which is considered at each of the investigated levels of manifestation of digital competitiveness. Of course, the direction, intensity and power of impact and manifestation of each of these factors vary depending on the level of its manifestation. A summary of the factors is presented by Figure 2.

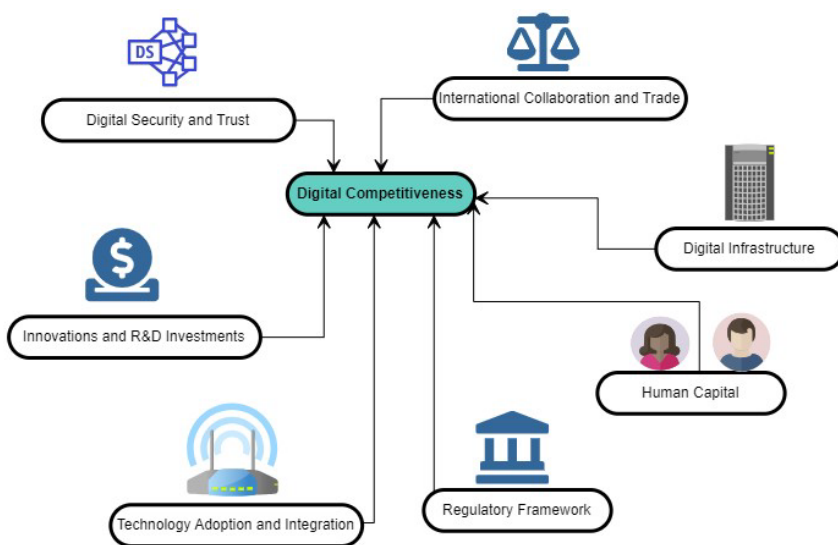


Figure 2: Main factors that affect the digital competitiveness

Source: Author's figure

3.1 Digital Infrastructure

The main factor that affects the level of the digital competitiveness is the **digital infrastructure**. It is the foundational layer upon which the digital economy is built and thrives. Digital infrastructure encompasses many physical and virtual assets like high-speed broadband networks, mobile telecommunications, data centers, cloud computing resources, and IoT (Internet of Things) platforms. They enable efficient data storage, management, and transmission, supporting everything from everyday internet usage to complex, data-intensive processes in businesses and governments. The availability and quality of digital infrastructure directly influence a country's ability to provide digital access to its citizens and businesses. High-speed internet and robust mobile networks are crucial for ensuring widespread digital connectivity, which is fundamental for accessing online services, participating in the digital economy, and fostering social inclusion. Countries with extensive, reliable, and affordable digital infrastructure can achieve higher levels of digital literacy and participation, essential components of digital competitiveness.

At the company level, the digital infrastructure catalyzes economic growth and innovation. It enables businesses to operate more efficiently and to innovate by leveraging digital technologies such as cloud computing, big data analytics, and AI. Countries that prioritize the development of advanced digital infrastructure create fertile ground for start-ups and innovation hubs, attracting investment and talent. That is why we can conclude that digital infrastructure is more than just a technical necessity; it is a strategic asset that underpins national digital competitiveness. It influences a country's ability to innovate, participate in the global digital economy, and ensure prosperity and inclusivity for its citizens.

3.2 Human Capital

The second factor of digital competitiveness is **human capital**, which includes the human intellect, creativity, skills, and knowledge that drive innovation, technological advancement, and the efficient use of digital technologies. Human capital in the context of digital competitiveness encompasses a broad spectrum of competencies, ranging from basic digital literacy to advanced technical skills in areas such as artificial intelligence (AI), machine learning, data science, and cybersecurity. However, it's not solely the technical skills that matter; equally important are the soft skills, such as problem-solving, critical thinking, and adaptability, which enable individuals to navigate the rapidly changing digital landscape.

Digital literacy at an individual level refers to an individual's ability to use information and communication technologies to find, evaluate, create, and communicate information. It is the lower but essential layer in the structure of national competitiveness.

Beyond basic digital literacy, developing advanced technical skills is crucial for fostering innovation and maintaining competitiveness. Specialized skills in software development, cloud computing, AI, and big data analysis are in high demand across industries. Countries that invest in higher education and vocational training programs in these areas are more likely to produce a workforce capable of leading digital innovation and contributing to the nation's digital economy.

One of the elements of the traditional external environment that impacts the development of a system (national, regional, company) is the regulatory framework of a country or/and the regulatory framework of the international system. This topic

is even more important when we discuss the development under the process of digitalization.

This framework, which encompasses laws, policies, and regulations governing the use of digital technologies and the internet, serves as either catalysts for growth and innovation or barriers that hinder progresses in the national economic system. For instance, regulations encouraging the development and adoption of emerging technologies, such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT), can significantly boost a nation's competitiveness. By providing clear guidelines and support for research and development (R&D), these frameworks not only foster innovation but also attract investments from both domestic and international tech companies eager to operate in a supportive regulatory environment.

3.3 Digital Security and Trust

Digital security and trust are central to the adoption and effective use of digital technologies. Regulatory frameworks that prioritize cybersecurity, data protection, and privacy not only protect individuals and businesses but also enhance trust in digital platforms and services. Regulations such as the General Data Protection Regulation (GDPR) in the European Union have set global benchmarks for data protection, compelling companies worldwide to elevate their privacy standards. By establishing clear rules for data handling and consumer protection, countries can create a secure digital environment that fosters growth and innovation.

The essence of technology adoption transcends the basic use of digital tools; it involves a holistic transformation of business processes, government operations, and societal functions. This transformation is characterized by the strategic implementation of technologies such as artificial intelligence (AI), the Internet of Things (IoT), blockchain, and cloud computing across various sectors. At the core of technology adoption is the drive toward an innovation-led economy. Countries that successfully integrate new technologies into their economic not only boost productivity but also pave the way for new industries and job creation.

3.4 Innovation and R&D Investments

Innovation in the digital realm encompasses a broad spectrum of activities, from developing cutting-edge technologies like artificial intelligence (AI), blockchain, and quantum computing to the creative application of existing digital solutions in new or improved products, services, and processes. It's the lifeblood of the digital economy, ensuring that a nation remains competitive, adaptable, and forward-looking. Nations that cultivate a strong culture of innovation are better positioned to solve complex problems, enhance the efficiency of their industries, and improve the quality of life for their citizens.

The R&D investments are crucial for fostering innovation as they enable the exploration of new ideas, the development of breakthrough technologies, and the improvement of existing digital solutions. By investing in R&D, countries signal their commitment to advancing their technological capabilities and securing a competitive edge in the global market.

R&D investments contribute to digital competitiveness in several key ways: *attracting talent; supporting start-ups and SMEs; enhancing collaboration; driving economic growth.*

3.5 Internal Collaboration and Trade

When talking about national digital competitiveness, internal collaboration and trade emerge not merely as components but as the very threads that interweave to strengthen the digital economy. This intricate relationship underscores the importance of cohesive interaction among businesses, government entities, and educational institutions within a country, as well as the fluidity and efficiency of trade among these internal stakeholders.

Internal collaboration refers to the synergistic efforts between various sectors within a country, including public, private, academic, and non-profit organizations, to foster a conducive digital ecosystem. This collaboration is instrumental in nurturing innovation, streamlining regulatory processes, and facilitating the seamless exchange of knowledge and resources.

Internal trade, or exchanging goods, services, and information within a country, is equally critical for digital competitiveness. The ease with which businesses can trade internally

4 Conclusion

Digital competitiveness is proving to be a critical element in the modern economy, determining the ability of countries, regions, and organizations to use digital technologies to achieve economic growth, innovation and improve the quality of life. This competitiveness is underpinned by multiple factors, including the development of digital infrastructure, the quality of human capital, the regulatory and legal environment, the degree of adoption and integration of digital technologies, and the ability to innovate and collaborate internally.

To remain competitive in a rapidly changing digital world, countries and businesses must invest in expanding their digital infrastructure, train and develop their human capital in digital skills and technologies, and create an enabling regulatory and legal environment that promotes innovation and protects both businesses and consumers. Furthermore, the importance of domestic and international collaborations cannot be understated, as they facilitate the exchange of knowledge, technology, and best practices.

Ultimately, digital competitiveness is driven by a vision for the future and the ability to adapt to the ever-changing digital ecosystem. It requires a commitment to continuous learning, innovation, and collaboration at all levels - from individual to national. Only through joint efforts and strategic planning can countries build sustainable and thriving digital economies that will not only withstand the challenges of today's world but also make the most of the opportunities that digitization offers for tomorrow.

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