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THE THEORETICAL FOUNDATIONS OF THE NATIONAL ECONOMY DIGITALIZATION

Oleksandr Kovalchuk[1]

Abstract. *Purpose of the article.* The purpose of this study is to develop and theoretically substantiate a comprehensive mechanism for the digitalization of the national economy that integrates key scientific approaches and modern technological drivers to ensure stable economic growth and social adaptability under conditions of martial law and subsequent post-war recovery. The author aims to systematize the economic effects of implementing digital technologies and to demonstrate the priority of the institutional approach as a foundation for forming the state's digital resilience during periods of extreme uncertainty. *Research methodology*. The methodological framework of the study is based on a systemic analysis of the evolution of scientific thought in the field of digital transformations. The work utilizes a comparative analysis of major theoretical schools: the theory of the information society and network logic (M. Castells), the concept of Industry 4.0 (K. Schwab), institutional theory (E. Brynjolfsson), the platform economy paradigm (M. Cusumano), and the theory of digital capital (N. Srnicek). To visualize and structure the interconnections between theories and technologies, the method of graphical modeling (Fig. 1) and a tabular method of data systematization were applied. Particular attention is paid to adapting global theoretical developments to the specific conditions of Ukraine, taking into account the factors of military aggression. *Results.* As a result of the study, a multi-level digitalization mechanism (macro-, meso-, and micro-levels) was developed, functioning as an adaptive ecosystem. It is proven that under wartime conditions, the institutional approach becomes dominant, as it allows for the realization of the "state as a service" (GovTech) concept and ensures the survival of state institutions through the migration of registries to the "cloud". It is established that network structures are more resilient to targeted strikes compared to hierarchical ones, as they enable businesses to promptly restore logistics chains through horizontal linkages. A correlation is established between specific technological drivers (AI, Blockchain, IoT, Big Data, Cloud Computing) and the corresponding theoretical schools, ensuring the practical implementation of scientific concepts. *Practical implications.* The practical significance of the research lies in the possibility of applying the proposed mechanism to optimize public administration and support the real sector of the economy during crises. The implementation of digital monitoring tools based on blockchain and Big Data ensures transparency in the distribution of international aid and reconstruction funding, which is critical for budget replenishment. The work substantiates the effectiveness of using digital platforms (such as "Diia") for the rapid disbursement of aid to IDPs and the registration of damaged property. In the agro-industrial complex, the use of Industry 4.0 drivers (drones, satellites) allows for resource savings of up to 20–30%, directly impacting national security. *Value/Originality.* The scientific novelty of the work lies in the development of a non-linear digitalization mechanism where, according to the principle of element interchangeability, the weakness of one driver (e.g., technical connectivity) is compensated by a high level of digital capital (the qualification of specialists). For the first time, the digitalization of the national economy is interpreted not as a "convenience bonus" but as a fundamental "technology of survival" under martial law. The proposed integration of theoretical approaches into a single system creates a solid foundation for long-term strategic planning and countering global and regional crises.

Keywords: digitalization, digital resilience, economic efficiency, GovTech, institutional approaches, martial law, national economy, technological drivers.

JEL Classification: B31, B41, O14

[1] Black Sea Research Institute of Economy and Innovations, Ukraine
E-mail: kov.mp.science.2025@gmail.com
ORCID: https://orcid.org/0009-0005-0643-2327

1. Introduction

The current stage of global civilizational development is characterized by total digital transformation, which fundamentally alters the architecture of national economies. Digitalization has ceased to be merely a technological trend, evolving into a fundamental factor for ensuring national security, economic stability, and state competitiveness. These processes are particularly relevant for Ukraine, where, under martial law, digital tools have become a "technology of survival". This allows for the continuity of public administration, remote business operations, and the preservation of human capital amidst extreme uncertainty.

The theoretical foundation of this study is based on the evolution of scientific thought, ranging from the concepts of post-industrialism by Daniel Bell (1973) to the theory of the network society by Manuel Castells (1996), who identified information as the primary production resource. The technological aspect of transformation through the prism of "Industry 4.0" was thoroughly analyzed by Klaus Schwab (2016), while institutional changes and the "productivity paradox" were examined by Erik Brynjolfsson and Andrew McAfee (2014). The paradigm of the platform economy and ecosystems was explored by Michael Cusumano (2019) and Nick Srnicek (2016). Significant contributions to adapting these theories to Ukrainian realities, particularly in the agro-industrial sector and at the level of the institutional environment, have been made by Ukrainian scholars such as K. Shaposhnykov (2023), V. Lagodiienko (2023), O. Pavlov (2022), and Yu. Tochylina (2023).

Despite a significant number of studies, the integration of basic technological drivers (AI, Blockchain, IoT, Big Data) into a cohesive mechanism for managing the national economy under wartime conditions remains insufficiently explored. There is a need for a clear systematization of the economic effects of digitalization and a justification for the priority of the institutional approach as a tool for ensuring the state's digital resilience.

The Purpose of the Study is to develop and theoretically substantiate a mechanism for the digitalization of the national economy that integrates key scientific approaches and technological drivers to ensure economic growth and social adaptability during martial law and post-war recovery.

2. Key Theoretical Approaches

First, we shall examine the Theory of the Information Society and Network Logic. This scientific approach is fundamental, as it identifies information as the primary production resource, superseding capital and energy. One of the most cited scholars in this field, Manuel Castells, who introduced the concept of 'informationalism', noted: “In the conditions of informationalism, the generation, processing, and transmission of information become the fundamental sources of productivity and power... The new economy is a network economy because its core activities are organized in global-scale networks” (Castells, 1996). The proponents of this theory maintain that global integration and the overcoming of geographical barriers should be the key effects of implementing its ideas. Furthermore, the development of IT services enables a country to export 'intellect' without incurring physical logistics costs, thereby creating a positive trade balance. Additionally, the network effect becomes evident: the more entities (enterprises, citizens) are connected to digital networks, the higher the value of the entire economic system becomes. A prominent example is the growth of freelance platforms and remote work, which facilitates the attraction of capital into regions with low economic activity.

The next is the Concept of the Fourth Industrial Revolution (Industry 4.0). This approach focuses on technological convergence and automation, which fundamentally alters the architecture of national economies. Klaus Schwab, the founder of the World Economic Forum in Davos, states: “The Fourth Industrial Revolution is not just about improving machines; it is a systemic transformation that changes the ways value is created, transported, and consumed” (Schwab, 2016). According to the proponents of this concept, its key effect is a radical increase in productivity and resource efficiency, accompanied by production optimization (for instance, the implementation of 'smart factories' minimizes defect rates and energy consumption) and predictive maintenance (the use of IoT sensors on industrial equipment allows for predicting failures

before they occur, thus avoiding industry-wide downtime). For example, in the agro-industrial complex, the use of drones and satellite monitoring (Precision Agriculture) enables savings of up to 20–30% on fertilizers and fuel, thereby enhancing the competitiveness of the national product (FAO, 2023).

Equally significant is the Institutional Theory (or the Theory of Institutions and Digital Transformations), which examines how digitalization alters the 'rules of the game' (institutions) and reduces transaction costs. Erik Brynjolfsson, a researcher from MIT who studies the 'productivity paradox', asserts: "Digital technologies are general-purpose technologies (GPTs). Their true impact on the economy becomes apparent only when they are accompanied by organizational innovations and new business models" (Brynjolfsson, McAfee, 2014). The prominent Ukrainian economist K. Shaposhnykov, who focuses on regional and institutional aspects, notes: "The effectiveness of the digitalization of the national economy directly depends on the readiness of the institutional environment to adopt digital innovations, which necessitates a revision of regulatory mechanisms and models of interaction between the state and business" (Shaposhnykov & other, 2023). Proponents of this scientific school of thought consider the de-shadowing of the national economy and the mitigation of corruption risks to be the key effects of digitalization. This is achieved through transaction transparency, specifically the transition to cashless payments and blockchain-based registries, which makes financial flows visible to the state and expands the tax base. Furthermore, the development of e-governance leads to the automation of public services (for instance, registering a business within minutes via the Diia platform), thereby reducing the administrative burden on entrepreneurs. Prominent examples include the Diia platform, as well as the digitalization of the tax and customs systems, which minimizes the impact of the human factor and accelerates the turnover of goods at the border.

The Theory of the Platform Economy and Ecosystems is of particular interest within the context of our study. This is a contemporary scientific approach according to which the National Economy is being transformed into a set of digital platforms that unite producers and consumers. Michael Cusumano, an expert in platform strategies, maintains the following thesis: "Platforms are not just software; they are marketplaces and ecosystems that redefine the boundaries of the firm and the industry" (Cusumano, Gawer, Yoffie, 2019). O. Pavlov, a Ukrainian researcher of agricultural economics and rural areas, emphasizes the importance of integrating rural territories into broader economic systems, which, in the context of digitalization, can be realized through the use of digital platforms and tools (Pavlov, Pavlova, Pavlov, Junior, 2022). In the context of the Platform Economy and Ecosystems, the key effect of digitalization is the democratization of markets and the creation of new niches, which is attributed to the lowering of entry barriers, as small and medium-sized enterprises gain access to millions of consumers through marketplaces without investing in their own retail networks. Furthermore, collaborative consumption (the Sharing Economy) becomes accessible, leading to a more efficient utilization of existing assets (such as vehicles and real estate), which in turn stimulates domestic demand. A prominent example is the creation of National Logistics Platforms that integrate small-scale carriers into a unified system, thereby optimizing routes and reducing the cost of goods delivery across the country.

Finally, among the most prominent today, let us examine the Theory of Digital Capital and the Human Factor, which emphasizes the changing role of the individual in an automated economy. Nick Srnicek, the author of the concept of 'Platform Capitalism,' notes: "Data is the raw material of the digital economy. Whoever controls the infrastructure of data collection controls modern capitalism" (Srnicek, 2016). Undoubtedly, the key effect of digitalization within the framework of this theory is the capitalization of knowledge and the adaptability of the labor market. The digitalization of education (EdTech) allows for the rapid retraining of personnel in accordance with the needs of the new economy, while the availability of Big Data enables scientists and analysts to develop new products and territorial development strategies more efficiently. A practical example of this theory's implementation is the introduction of digital literacy programs, which enhances the Human Development Index (HDI) and increases the nation's resilience to global crises.

3. Comparative Analysis of Theories and Their Adaptability to Wartime Conditions

This theoretical foundation allows for viewing the digitalization of the national economy not merely as a set of technical solutions, but as a comprehensive transformation of the country's socio-economic landscape. Let us now systematize the economic effects resulting from the implementation of the key theoretical approaches examined above.

The analysis demonstrates that under martial law, the Institutional approach (viewed through the lens of digital resilience and transparency), combined with Network Logic and the Theory of Digital Capital, proves to be the most adaptive, viable, and critically important. While the Technological Approach (Industry 4.0) provides an advantage on the battlefield, it is specifically institutional digitalization that enables the state and the economy to function as a single organism amidst conditions of extreme uncertainty.

Below, we shall analyze the reasons for the priority of this approach. The Institutional Approach to the digitalization of the national economy perceives the state as a service (GovTech). Under wartime conditions, physical presence in government institutions becomes dangerous or impossible due to occupation, shelling, or the destruction of buildings. In our view, digital institutional resilience comes to the fore here, meaning the migration of state registries to the 'cloud' and the automation of services, which allow institutions to operate independently of the integrity of physical office spaces. Concurrently, the de-shadowing of the national economy occurs and resource control is optimized; given limited financial resources, digital tax and customs monitoring tools become the primary means of ensuring budget revenues. The social function plays a vital role in this process, as the rapid disbursement of aid to Internally Displaced Persons (IDPs) or the registration of damaged property via digital applications represents the realization of the state's institutional role in a digital format.

The Network Society Theory effectively describes the wartime economy, as network structures are significantly more resilient to targeted strikes than hierarchical ones. In this context, horizontal linkages come to the fore; when logistics chains are disrupted, digital networks enable businesses to rapidly identify new suppliers or sales markets (for instance, through platforms for volunteer assistance or business relocation). Furthermore, remoteness is a vital attribute, as the ability to work remotely preserves human capital within the country, allowing specialists to generate GDP while staying in safer regions. In combination with the advancements of the Theory of Digital Capital, this will create a robust foundation for the functioning of the economy. If the digitalization of the national economy is considered an instrument of national security, it is the Institutional Approach that comes to the fore; as a result, digitalization is transformed from a 'convenience bonus' into a 'technology of survival'.

4. Technological Drivers of the National Economy Digitalization and the Formation of a Corresponding Mechanism

For scientific research, it is crucial to understand that each theoretical approach 'rests' on a specific set of technologies that make its practical implementation possible. Below, we present a correspondence table demonstrating how the basic drivers of national economy digitalization ensure the viability of the fundamental economic theories we examined earlier.

At the same time, it is crucial to remember that digitalization also carries risks of a 'digital

Table 1
Economic Effects of Implementing Key Theoretical Approaches of the National Economy Digitalization

Theoretical Approach	Economic Effect	Measurement Indicator
Network-based	Growth in service exports	IT export volume, share of GDP
Technological	Reduction in production costs	Labor productivity index
Institutional	Reduction in the shadow economy share	Share of cashless payments, Doing Business ranking
Platform-based	Development of SMEs (Small and Medium Enterprises)	Number of newly registered entrepreneurs
Theory of Digital Capital and the Human Factor	Growth of added value through intellectual labor; reduction in structural unemployment	Human Development Index (HDI), share of high-tech exports, R&D expenditure

Table 2

Correspondence between Theoretical Approaches and Technological Drivers of the National Economy Digitalization

Theoretical Approach	Key Emphasis of the Theory	Priority Technological Drivers	Interaction Mechanism
Information Society and Network Logic	Information as the primary resource; network structure of the economy	Cloud Computing, 5G, Big Data	Creation of a global infrastructure for the instantaneous exchange of knowledge and data, regardless of borders
Fourth Industrial Revolution (Industry 4.0)	Convergence of technologies; automation and cyber-physical systems	IoT (Internet of Things), AI, 5G	Sensors collect data (IoT) and transmit it instantaneously (5G), while algorithms (AI) manage production without human intervention
Institutional Approach (Transaction Costs)	Reduction of interaction costs; transparency and trust	Blockchain, Big Data	Blockchain guarantees the immutability of agreements (smart contracts), while Big Data allows the state to monitor compliance with rules
Platform and Ecosystem Paradigm	Creation of digital marketplaces (platforms) that unite economic agents	Cloud Computing, AI, Big Data	Cloud technologies scale the platform to millions of users, while AI analyzes their behavior to offer superior service
Theory of Digital Capital (The Human Factor)	Development of competencies and intellectualization of labor	AI, Cloud Computing (EdTech)	AI algorithms personalize learning, while cloud services provide access to knowledge from anywhere in the world

divide' (innovative inequality between countries or regions) and threats to the privacy of personal data. Returning to the fact that the critical feature of the digitalization of the national economy for Ukraine at the current stage is the ongoing military conflict, we note that in this study, we propose a corresponding mechanism specifically tailored to martial law. To develop a scientifically grounded scheme for the mechanism of national economy digitalization under martial law, we will integrate all the elements previously examined: key theoretical approaches, technological drivers, and levels of implementation.

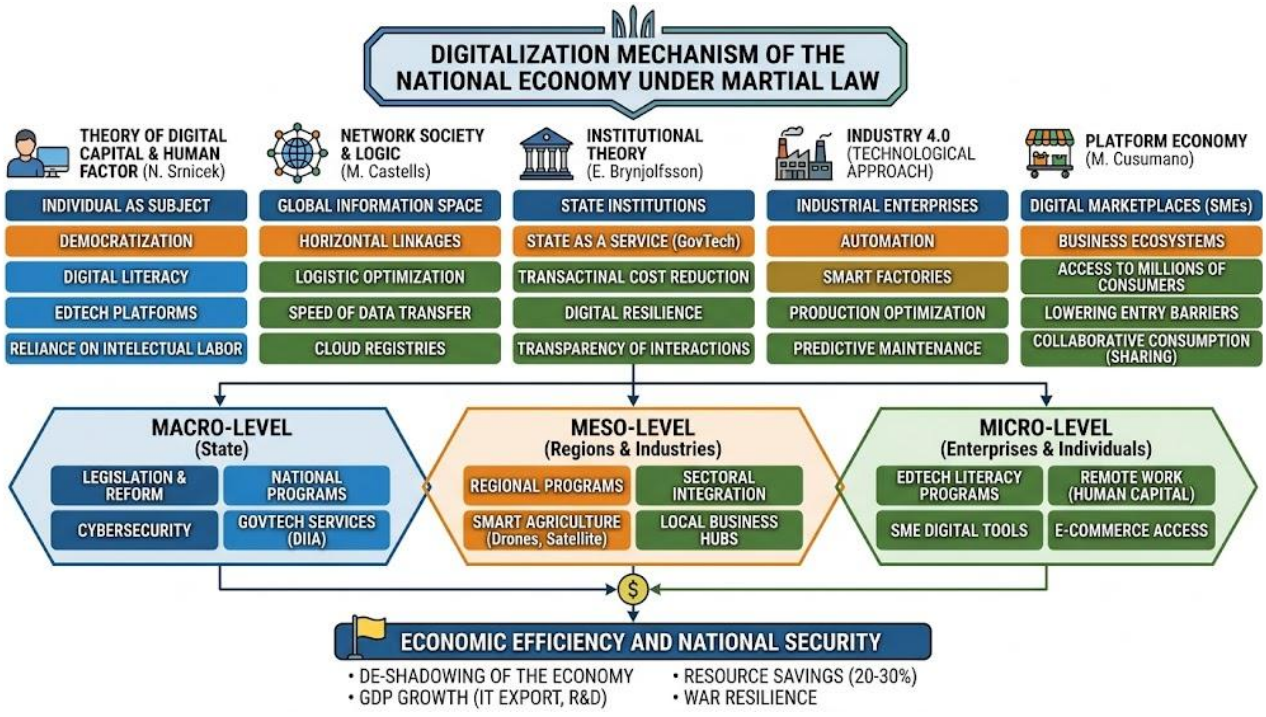

Fig. 1. The Digitalization mechanism of the National Economy Under Martial Law

This mechanism functions as a closed-loop system that accounts for wartime risks, where theory defines the strategy, technological drivers provide the toolkit, and institutions establish the enabling environment. Under wartime conditions, this mechanism acquires specific characteristics. First, priority is given to cloud technologiesto minimize the risk of physical data destruction. Second, the speed of data exchange (network approach) and the instantaneous synchronization of registries for aid disbursement and resource mobilization become crucial. Third, blockchain control is widely utilized, as transparency in the use of international assistance and reconstruction funding becomes paramount. The proposed mechanism is non-linear; it is an ecosystem where the inefficiency of one driver (e.g., weak 5G connectivity) is compensated by another (e.g., a high level of digital capital – the qualifications of specialists), which allows the system to maintain its viability.

5. Conclusions

The conducted research confirms that the digitalization of the national economy in modern conditions is not merely a technological update but a fundamental transformation of the entire architecture of socio-economic relations. In the course of this work, a holistic digitalization mechanism was theoretically substantiated and developed, integrating leading scientific approaches and technological drivers adapted to the challenges of martial law and the tasks of post-war recovery.

Theoretical Convergence and Systemic Analysis. The analysis of the evolution of scientific thought – from M. Castells' Theory of the Network Society to N. Srnicek's concept of "platform capitalism" – demonstrated that information has become the primary production resource, neutralizing geographical barriers and creating new sources of productivity. The systematization of theoretical approaches allowed for the identification of specific economic effects for each:

– The Network-based approach ensures growth in the export of services and intellectual capital;

– The Technological approach (Industry 4.0) focuses on reducing production costs through automation and predictive maintenance;

– The Platform paradigm democratizes markets by lowering entry barriers for small and medium-sized enterprises;

– The Theory of Digital Capital emphasizes the capitalization of knowledge and the increase of the Human Development Index (HDI).

Priority of the Institutional Approach under Wartime Conditions. A key conclusion of the article is the substantiation of the priority of the institutional approach under conditions of military aggression. It is proven that the digitalization of state institutions (GovTech) is transformed from a tool of convenience into a "technology of survival". Digital resilience, realized through the migration of state registries to the "cloud" and the automation of public services (as seen in the Diia platform), enables the state to maintain its operational capacity even in situations of physical destruction of administrative buildings or temporary occupation of territories. Furthermore, institutional digitalization acts as a powerful tool for the de-shadowing of the economy and increasing the transparency of financial flows. Given limited resources, the use of blockchain technologies and Big Data systems to monitor tax and customs revenues, as well as to control the targeted use of international aid, becomes critically important for budget replenishment and defense financing.

The Digitalization Mechanism as an Adaptive Ecosystem. The mechanism proposed in the study (Fig. 1) is presented as a multi-level ecosystem covering the macro- (state), meso- (regions and industries), and micro-levels (enterprises and individuals). The main features of this mechanism under martial law include:

1. Migration to cloud storage to protect critical data from physical destruction.
2. Development of horizontal network linkages, which are more resilient to targeted strikes than hierarchical structures, allowing businesses to rapidly adapt logistics.
3. Preservation of human capital through the implementation of remote work forms and EdTech platforms, enabling specialists to generate GDP while remaining in safe regions.

An important theoretical finding is the proposition regarding the non-linearity and interchangeability of the mechanism's elements. It has been established that digital transformation can remain viable even if individual drivers are temporarily ineffective (e.g., connectivity issues) due to a high level of digital capital and the adaptability of the actors involved.

Practical Significance and Prospects. The practical implementation of the proposed mechanism allows for a synergistic effect: from direct economic benefits (growth in the share of IT exports, resource savings in the agro-sector by 20–30%) to the strategic strengthening of national security. Prospects for further research are seen in a deeper analysis of "digital divide" risks between regions and the development of specific algorithms for using artificial intelligence to forecast socio-economic dynamics during the post-war recovery process. In summary, digitalization should be viewed as the foundation for building a transparent, high-tech, and resilient national economy capable of effectively resisting global and regional crises.

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