

MATHEMATICAL METHODS, MODELS AND INFORMATION TECHNOLOGIES IN ECONOMY

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ANALYSIS OF THE CURRENT TRENDS IN DIGITAL TRANSFORMATION¹

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Introduction. At the current stage of economic development, digital business transformation has gained significant importance, which necessitates monitoring its latest trends and directions. Existing business models are dynamic structures that undergo constant transformations and need to be adapted to ensure their relevance and compliance with market requirements. Adjustments and modifications to these models are necessary to maintain their competitiveness and meet the needs of the modern business environment. Effective business development requires the use of quick solutions that help transform a company's business models and achieve results. This process requires constant attention and adaptation of digital transformation strategies in line with market changes and innovative technologies. Systematic analysis and refinement of strategic directions of digital transformation allows businesses to update their vision of development in line with the changing nature of the modern business environment. Such an analysis facilitates the selection of optimal solutions for future changes, contributing to the efficiency and competitiveness of enterprises in the digital economy.

Analysis of recent research and publications. Many researchers are currently studying the theoretical, methodological, methodological and practical aspects of digital business transformation. They form the basis and study the directions and features of digital transformation, as well as the mechanisms for its implementation. For example, [1] states that digital transformation is the process of using digital technologies to create new or modify existing business processes, culture and customer experience in response to changing business and market requirements. Rethinking business in the digital age is digital transformation.

He defines digital transformation as a company's definition of how it uses technology, people and processes to create value for its customers. Thus, companies seek to create business models that are sustainable and generate more revenue. According to the author, the main areas of digital transformation are as follows [2]:

- A Customer Data Platform (CDP) as a unified source of customer data that can be used to create more personalised and engaging marketing campaigns for customers;
- multi-cloud architecture, which provides for the distribution of software and workloads in an organisation using one or more private or public clouds

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- automation, which enables companies to accelerate the pace of digital transformation in their organisations by automating more processes;
- data analytics and data mining activities that can be used by different departments within the company to find solutions to complex problems, such as predicting customer behaviour, optimising supply chain processes, optimising the sales funnel, etc;
- transition to contactless solutions and digital payments, which requires reliable support of digital infrastructure and acceleration of digital transformation.

According to Statista [3], global spending on digital transformation is expected to reach \$3.4 trillion by 2026. In the author's opinion, the priority expenditures of enterprises on digital transformation technologies include:

- 5G (fifth-generation mobile communications technology) and the Internet of Things (IoT);
- Zero Trust security, based on the principle of strict access control and default distrust of anyone;
- Software 2.0, which automatically generates source code based on a requirements document;
- Data Fabric. According to MarketsandMarkets, the global Data Fabric market is expected to grow to \$4.2 billion by 2026;
- Hyper-automation, aimed at significant automation of business and IT processes;
- Total experience, which involves the synthesis of experience to transform business models and achieve a world-class level of customer and employee protection;
- Everything-as-a-Service (XaaS). This area of digital transformation promotes the "as-a-service" model;
- Generative artificial intelligence (AI). This area of AI uses existing content (images, texts, audio, video) to create similar but original content;
- AR Cloud (augmented reality cloud) is a digital 3D copy of the real environment created using its spatial properties.

The authors of [4] note that every year there are numerous promising areas of digital transformation that have the potential to accelerate business growth.

According to [5], the Fourth Industrial Revolution has led to fundamental changes in the way we live, work and interact with each other. It represents a new chapter in the development of mankind, facilitated by extraordinary technological advances. These advances are bringing the physical, digital and biological worlds together, creating significant opportunities and potential risks. The speed, scale and depth of this revolution is forcing us to rethink how countries develop and how organisations create value.

The author [6] points to the existence of the current Fourth Industrial Revolution Network (C4IR Network), consisting of 18 centres that are committed to improving technology management and transforming their industries. This network is unique in its ability to adopt common principles for the use of new technologies and apply them locally in a flexible and collaborative way.

It has been noted [7] that digital working methods are becoming increasingly important as social innovators use new ways to deliver their services, ranging from smart healthcare to microfinance and resource management. For many social innovators, this is not only about making their businesses more sustainable, but also about preparing the communities they work with for the Fourth Industrial Revolution and the decarbonisation of the economy, ensuring that vulnerable groups are not left behind as traditional industries transform.

The need for digital transformation is driven by three main external factors [8]. First, the emergence and global spread of the World Wide Web has led to the growth of related technologies (e.g. broadband, smartphones, Web 2.0, SEO, cloud computing, speech recognition, online payment systems and cryptocurrencies), which is driving the development of e-commerce. Secondly, these new digital technologies have significantly changed competition, disrupting retail by shifting sales to relatively young digital firms. Third, consumer behaviour is changing in response to the digital revolution: market data shows that consumers are shifting their shopping to online retailers, and digital touchpoints play a crucial role in the customer journey, influencing both online and offline sales.

It is emphasised [9] that digital infrastructure today extends from back-office servers to direct operations due to the development of cloud computing, mobile technologies, middleware, miniaturisation and smart sensors. The Internet of Things (IoT) allows not only to identify and localise objects, but also to collect, process and transmit contextually relevant data in real time, creating new opportunities for product and service development. Almost any event can be digitised, analysed and monetised. Data collected from used products allows providers to effectively monitor products and offer after-sales service. By analysing data from multiple, interconnected products, flows and processes can be scrutinised to identify

patterns and behaviours. The developed algorithms can make decisions on service provision or process optimisation. Thus, the Internet of Things enables the creation of situational, intelligent, attractive and efficient products and services.

The author [10] highlights how the Internet of Things and big data are changing management and marketing strategies through digitisation, which represents a new threshold for business competitiveness, often referred to as Industry 4.0. These new paradigms have fundamentally changed not only human relationships and daily activities, but also the way companies are run and managed. To survive and compete, businesses need to integrate Industry 4.0 strategies into their operations, but to do so, they must change their management, organisation and production methods. The reengineering approach is a suitable method to achieve this goal. Reengineering, which originated in the IT sector, has evolved into a broad process of redesigning core business processes to improve organisational efficiency. Reengineering approaches provide a conceptual framework for rethinking and redesigning business processes through digitisation.

Thus, the Fourth Industrial Revolution has led to fundamental changes in the way we live, work and interact. An analysis of recent research and publications shows that in the digital age, businesses are reassessing and redesigning their processes through digital transformation. Consumer behaviour is changing in response to the digital revolution. Digital ways of working are becoming increasingly important for social innovators, and digital infrastructure is expanding from back-office servers to frontline operations thanks to IoT and the development of digital technologies. There are different approaches to implementing digital business transformation processes, and it is important to choose the path that will help create business models that are sustainable and generate more revenue.

Objectives of the article. Previous research on digital transformation has provided valuable insights into various aspects of its implementation and business impact. However, there are still unresolved issues that require further research. The purpose of this article is to analyse the directions, features, forms and identify key stages of digital business transformation. This will help expand the existing knowledge of digital transformation and allow businesses to make informed decisions and thrive in a dynamic digital environment.

The main material of the study. Analysing the areas of digital transformation at the current stage of economic development allows us to answer an important question: where businesses should direct their investment resources to improve their business models and gain competitive advantages in both the short and long term. In the world of digital transformation, solutions that are relevant today may become obsolete tomorrow. The process of incorporating modern elements into the business model requires simultaneous management of existing business operations and implementation of new functionalities.

Table 1 identifies four categories of remote work that complement current trends in digital business transformation. These categories stem from an analysis of how meetings, partner presentations, and staff training can be delivered regardless of location.

Table 1

Categories of Remote Work Participation

Category	Features of Remote Work
Zoom, Google Meet, Microsoft Teams, etc.	These platforms enable employees to conduct meetings, present partners and provide remote training to the staff.
Augmented and Virtual Reality (VR)	Facilitates learning and enhances the company's operational efficiency regardless of the location.
Employee geolocation model	Enables employees to move away from the epicenters of their companies, providing a more diverse choice of personal location.
The ability to be in the office for part of the workweek and remote for the rest.	Enables teams to collaborate in person during a certain part of the week and also increases their productivity by reducing commuting time.

Source: compiled by the authors

When analysing the directions of digital transformation and building a new business model, companies need to pay attention to the categories of remote work participation to achieve efficient use of working time, as defined in Table 1. Technology in the workplace can both improve and degrade employee well-being. Now, more than ever, to compete globally and contribute to a more equitable future of work, business leaders, including CEOs, IT and HR professionals, and legal counsel, must work to implement human-centric workplace technologies that benefit both employers and their employees. Involving employees in the process of defining

and implementing workplace technologies can build trust in new forms of work organisation, increase employee loyalty and engagement, and improve productivity and reduce time-related costs.

To remain competitive in a dynamic marketplace, organisations must quickly adapt their strategies and implement changes that are likely to have a significant impact on the customer experience. This means keeping up with the latest digital transformation trends. Successful companies have a clear vision of where they want to be in three to five years and a well-defined roadmap for how they will get there [11].

Table 2 shows the main areas and technologies of digital business transformation at the current stage of economic development, as well as their evolving and complementary features.

Table 2

Areas and technologies of digital business transformation

Directions and technologies	Features
Blockchain	In addition to the financial sector, it is already used in various industries: logistics, operations, security and many other practical areas.
Data protection and security	The more people become Internet users, the higher the demand for data protection and security.
Artificial Intelligence (AI)	The more business solutions that use AI, the more relevant and targeted advertising becomes, the better customer support becomes, the more efficient the workforce becomes, and the higher the potential revenue.
5G	It is fundamentally changing the rules for the development of mobile devices and technology, transforming various types of economic activity.
Hybrid workplace	Characterises different categories of participation in remote work, as shown in Table 1.
Hyperautomation	It involves the identification, verification and automation of as many business and IT processes as possible, using a variety of technological tools and platforms. In the future, more and more business solutions will be based on artificial intelligence for analytics, data protection, security and search algorithms.
Digital banking	The concept of digital banking, where financial transactions are carried out using digital technologies.

Source: compiled by the authors based on [2; 3]

The innovations listed in Table 2 can enable:

- reliable digital connectivity between people and devices anywhere;
- solutions for rapidly scaling digital creativity anywhere;
- innovative opportunities to accelerate business growth beyond the present.

Analysing the interconnections between the areas of digital transformation, it is worth noting that most of these areas are interconnected, as shown in Figure 1.

It should be noted that Figure 1 demonstrates the active development of hyper-automation with data protection and the use of blockchain technology. A blockchain is a distributed database shared by computer network nodes that stores information in a digital format [12].

Considering data protection as the process of preserving valuable information from damage, compromise or loss, and data security as the protection of digital information from internal and external, malicious and accidental threats [13], at the current stage of economic development, businesses must constantly pay attention to data protection and security issues.

AI refers to the modelling of human intelligence in machines that are programmed to think and act like humans [14]. In combination with other areas and technologies, it can help build more efficient business models and achieve long-term strategic advantages.

5G wireless communication technology is designed to provide higher peak data rates, ultra-low latency, greater reliability

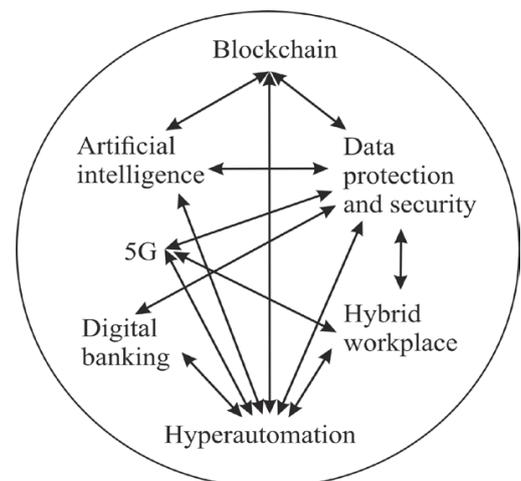


Figure 1. Interconnection of digital transformation areas

Source: compiled by the authors

and huge network capacity. 5G is called the "network of networks" because it aims to unify various existing standards and cross different technologies and industries as a means of enabling Industry 4.0. 5G has the potential to create better remote working opportunities for employees, saving time and increasing productivity as the need to travel is reduced. Network segregation will also allow companies to have their own dedicated networks according to their specific needs, and the increased speeds and reduced latency will have a positive impact on operational efficiency and, as a result, productivity.

Hyper-automation plays a key role in analysing the interconnections of digital transformation areas. It is a controlled and disciplined approach that organisations use to quickly identify, validate and automate a large number of business and IT processes. Hyper-automation involves the organised use of multiple technologies, tools or platforms [15]. Figure 1 illustrates its interaction with all other areas. Thanks to this interaction, hyper-automation can take advantage of the fundamental directions of digital transformation.

The hybrid workplace model combines office and remote work, providing flexibility and support for employees. In a hybrid workplace, employees tend to have more autonomy and can achieve a better work-life balance, leading to greater engagement with the company [16]. On the other hand, employers benefit from a more productive, healthy and stable workforce. As illustrated in Figure 1, the hybrid workplace requires attention to data protection and security, plays a vital role in hyper-automation, and increases company efficiency when combined with 5G technology.

Digital banking encompasses the entire management mechanism of a firm and involves conducting financial transactions using digital technologies. It can take many forms, ranging from checking current accounts online to large corporations transferring funds and data around the world. Digital banking has greatly simplified business operations, and accounting software and digital payment technologies have made money processing much more efficient [17].

When analysing the directions of digital transformation, it is worth highlighting Web 3.0 as a separate tool. It represents the next iteration or phase of the Internet's evolution and combines blockchain, artificial intelligence and machine learning for digital business transformation. This can lead to the creation of a distributed enterprise where shared expertise is used to unify and improve every aspect, based on the principles of virtuality and remoteness. On the one hand, remote workers can benefit from increased flexibility thanks to these improved tools. On the other hand, customer satisfaction may become unavailable through traditional physical means.

Based on the analysis of the directions, features and forms of digital transformation, the main stages of this process can be identified, as shown in Table 3.

Table 3

The main stages of business digital transformation

Stage	Features
Current status is unchanged	Businesses continue to operate in the old fashioned way, for example, by not moving to an "as-a-service" model.
Moving on to active action	Businesses have recognised the need for transformation and may be trying to implement various technologies, but these efforts are not organised. There is a need to create a structured approach to digital transformation to ensure more effective attempts to implement change.
Formalised	Such an approach involves continuous, organised experimentation with new digital transformation technologies and requires significant effort to enable the company to overcome the barriers imposed by corporate culture. Implementing this approach requires the company to initiate internal changes.
Strategic	Certain business groups have initiated digital collaboration and are investing in business-transforming technologies. At this stage, it is necessary to develop a strategic roadmap with the formation of a special working group to ensure the company's actions are aligned to achieve strategic goals.
Innovative and adaptive	This stage is characterised by the implementation of digital transformation as a continuous process in which businesses are well positioned to continue exploring new technological paths and easily adapt to change.

Source: compiled by the authors

Analysing the main stages of digital business transformation shown in Table 3, we can conclude that the earlier a business initiates a formalised phase of changes in corporate culture, the more actively it will move towards developing a strategic roadmap and engaging in digital cooperation.

Conclusions. The study has led to the following results and conclusions. The analysis of the areas of digital transformation at the current stage of economic development in terms of the introduction of new technologies in business shows that companies need to determine which areas of change to implement now and which to postpone for the long term in order to maintain existing and gain new strategic advantages. As you go through the stages of digital business transformation, it is important to constantly monitor what has changed, what new opportunities have emerged, and how they can be used to achieve success and results in the company.

Creating a hybrid workplace model will help change corporate culture, and hyper-automation will enable digital collaboration between different business groups. Given the growing number of AI-based business solutions available, it is crucial to analyse them and start implementing them in operations. Businesses need to constantly make decisions about data protection and security, as well as analyse new processes as part of this area of digital transformation.

The use of blockchain technology and the introduction of Web 3.0 require special attention in terms of the practical implementation of new business models. Distributed enterprise and shared experience are already changing the process of introducing new technologies and creating the need for constant analysis of digital transformation directions. Every digital transformation investment project requires the creation of mechanisms for managing digital business transformation to enhance positive effects and mitigate negative consequences. The development of these mechanisms is the subject of further research in this area.

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Kostiantyn Zavrazhnyi, PhD in Economics, Scientific Associate at the Department of Economics, Entrepreneurship and Business Administration. **Anzhelika Kulyk**, Postgraduate Student at the Department of Financial Technologies and Entrepreneurship, Sumy State University. **Analysis of the current trends in digital transformation.**

The article is devoted to the study of the directions of digital transformation at the current stage of economic development in order to identify the best ways to improve business models and gain competitive advantages in both the short and long term. The study includes an analysis of the categories of remote work participation and key areas and technologies of digital business transformation. The research findings highlight the importance of focusing on the categories of remote work for efficient use of working time and successful integration of modern elements into business models. The main areas of digital transformation include hyper-automation, hybrid workplace model, digital banking, 5G technologies, artificial intelligence (AI) and Web 3.0. The interaction between these areas determines the prospects for successful implementation of digital innovations. The study shows that companies that initiate changes in corporate culture and implement digital transformation at an early stage are more likely to move towards strategic development and achieve success.

Key words: digital transformation, blockchain, hyper-automation, hybrid workplace, artificial intelligence, 5G technologies, Web 3.0, digital banking.

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Завражний Костянтин Юрійович, кандидат економічних наук, молодший науковий співробітник кафедри економіки, підприємництва та бізнес-адміністрування. **Кулик Анжеліка Костянтинівна**, аспірантка кафедри фінансових технологій і підприємництва, Сумський державний університет. **Аналіз актуальних напрямів цифрової трансформації.**

Стаття присвячена вивченню напрямів цифрової трансформації на поточному етапі економічного розвитку з метою визначення оптимальних шляхів для покращення бізнес-моделей та здобуття конкурентної переваги у короткостроковій та стратегічній перспективі. Дослідження включає аналіз категорій участі у дистанційній роботі та основних напрямів і технологій цифрової трансформації бізнесу. Результати дослідження підкреслюють важливість зосередження на категоріях участі у дистанційній роботі для ефективного використання робочого часу та успішного впровадження сучасних елементів у бізнес-модель. Основними напрямками цифрової трансформації є гіперавтоматизація, гібридна модель робочого місця, цифровий банкінг, 5G технології, застосування штучного інтелекту (AI) та Web 3.0. Взаємодія між цими напрямками визначає перспективи успіху впровадження цифрових інновацій. Дослідження показує, що компанії, які почнуть впроваджувати зміни у корпоративну культуру та застосовувати цифрову трансформацію на ранніх стадіях, будуть активніше рухатися у напрямку стратегічного розвитку та досягнення успіху.

Ключові слова: цифрова трансформація, блокчейн, гіперавтоматизація, гібридне робоче місце, штучний інтелект, 5G технології, Web 3.0, цифровий банкінг.