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THE ROLE OF R&D IN DIGITAL TRANSFORMATION

Khasankhonova Nodira Isametdinovna ,

PhD, Associate Professor of the Department of Economic Theory, TSUE

Tel.: +998909579204

xasanxonova@mail.ru

Abstract: This paper examines the impact of R&D on digital transformation processes, their importance for business and economic development, as well as the main areas of research that contribute to the creation and implementation of new technological solutions.

Keywords: Research, R&D, innovation, science, human capital, technologies, digital transformation

Introduction

Digital transformation is becoming an integral part of the strategic development of organizations in a rapidly changing world. In this context, scientific research and development (R&D) play a key role, facilitating the implementation of innovative technologies and management methods. R&D not only ensures the creation of new products and services, but also helps optimize business processes, increase competitiveness and adaptability of companies to changes in the external environment.

Modern technologies such as artificial intelligence, big data, cloud computing and the Internet of Things require constant updating of knowledge and skills, which makes R&D an important tool for ensuring sustainable growth and development. This paper will consider how R&D influences digital transformation processes, what approaches and strategies are used for the effective implementation of innovative solutions, as well as what challenges and prospects organizations face in the context of digitalization .

Literature review

Digital transformation is the integration of digital technologies into all aspects of business, leading to fundamental changes in how companies operate and how they

create value for customers. In this context, research and development (R&D) plays a special role in driving innovation and adapting organizations to new conditions.

The concepts of “digital economy” and “R&D” are part of the lexicon of journalists, lawyers, economic commentators, experts and politicians. Stracke, C., et al. (2020) states that R&D is a key element in the process of creating innovative products and services. Research shows that companies with highly developed R&D structures adapt to market changes significantly faster and can effectively implement new technologies. Stracke et al. (2020) emphasize that R&D investments lead to the creation of new business models, which is critical in the context of digital transformation [1].

Smith, A., & Jones, B. (2021) highlight the impact of R&D on organizational processes and analyze that R&D allows businesses not only to develop new technologies but also to optimize internal processes, which reduces costs and increases efficiency. For example, the use of artificial intelligence and machine learning can be a result of R&D and lead to significant improvements in supply chain management [2].

Successful digital transformation is impossible without creating a culture of innovation within the organization. Research such as Kim and Park (2022) demonstrates that R&D fosters an environment where employees are motivated to experiment and develop new ideas. This enables companies to respond to change and innovate more quickly [3].

N.Khasankhonova and S.Abdulkhalilova emphasize, that R&D - research and development work - a set of scientific and design work, the purpose of which is to acquire new knowledge or create a new product / technology. R&D expenditures (Research and Development and Development Works) are an important indicator of the innovative activity of a state, company or enterprise. However, R&D expenditures are recognized whether or not they are positive [4].

In conclusion, R&D plays a critical role in the digital transformation process. Investments in R&D enable organizations to adapt to changes, optimize processes,

and create innovative products and services. The future of business will depend on the ability of companies to effectively integrate R&D into their digital transformation strategies.

Research Methodology

The study examined scientific research in the field of the role of R&D in digital transformation. In the process of writing the article, observation and selection, scientific-theoretical, empirical methods of observation were used. The reliability of the research results is explained by the use of official foreign statistical sources used in the study.

Analysis and results

In the context of rapid technological development and global digitalization , research and development (R&D) plays a key role in shaping the competitive advantages of companies and countries. Digital transformation affects all areas of the economy, creating new business models, optimizing production processes and increasing management efficiency. However, the implementation of advanced digital solutions requires significant investment in research and development, allowing organizations to adapt to the changing environment and implement innovative technologies such as artificial intelligence, big data, the Internet of Things and cloud computing.

At the global level, three countries can be highlighted that have a high level of R&D in digital transformation: Switzerland, Sweden and the United States. Switzerland spends about 25 billion francs on research and development, making it one of the countries with the highest investment in this area. At the same time, two-thirds of the costs of research and development are provided by private companies.

Sweden has 50 international companies, including giants such as ABB, Atlas Copco , Oriflame , IKEA, Saab AB, Saab Automobile AB, Scania, Volvo, Volvo Trucks, Ericsson, Tele2 , AB Electrolux, TORNUM, TetraPak, Alfa Laval, SKF and H&M [5]. The country is a leader in bearing production, with a high level of innovation, a well-developed and constantly updated infrastructure, modern

equipment and qualified personnel who speak English. In recent decades, Sweden has also made significant strides in modern economic sectors such as digital technologies and telecommunications. The share of information technology in the country's economy has increased to 16%, and 5% of the working population already works in the IT sector. Prominent success stories include IP telephony developer Skype and music streaming service Spotify .

The United States is one of the leading countries in terms of R&D investment as a percentage of GDP. Although it seems to the average person that innovations in this country are developed only in Silicon Valley and R&D labs, the United States has a functioning national innovation system that includes economic, political and other social institutions that influence innovation activity. The United States supports research based on two main aspects: support for strategically directed research (for example, in the field of defense and health care), which is most often provided to federal labs, and support for basic research through funding of universities [6].

At the global level, growth in global R&D investment slowed to 5 percent in 2022. This is down from 6.6 percent in 2021 and slightly below the pre-pandemic growth rate of 6.2 percent in 2019. Growth in business R&D spending - the most significant component of total global R&D, representing 70 percent of total global R&D—also slowed to 6 percent in 2022 (compared to growth of 8.5 percent in 2021), but still comparable to the pre-pandemic pace of 6.6 percent in 2019.

Estimates for 2023, based on projected GDP growth, paint a potentially more adverse scenario: global R&D growth is expected to slow again to below 3 percent in 2023, and business R&D to 2.8 percent (1.7 percent and 1.4 percent, respectively, excluding the United States and China). This is the slowest growth rate since 2010. Moreover, it means that business R&D spending is growing at the same rate as total gross domestic R&D expenditure (business plus private sector); this has happened before, but never at such a comparatively low rate (Figure 1).

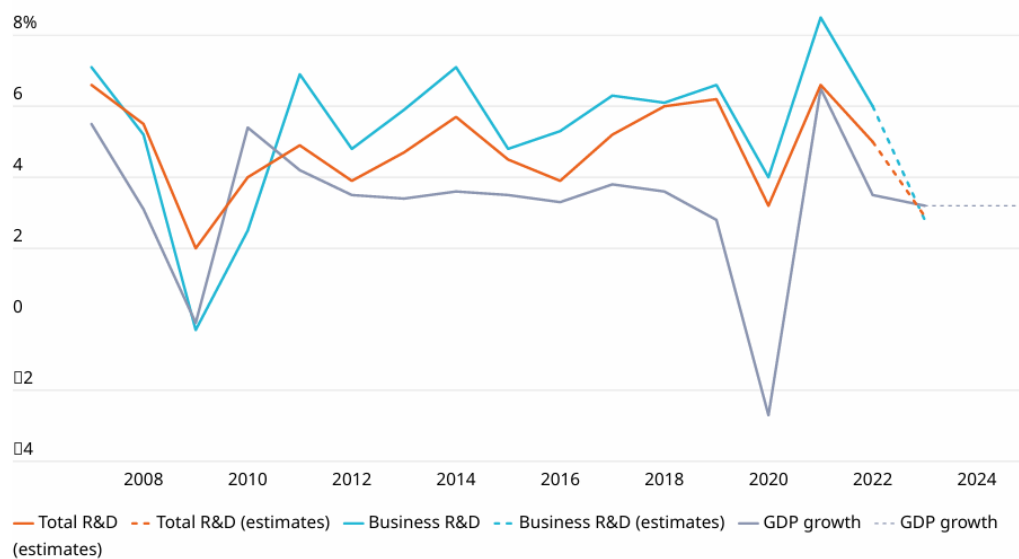


Figure 1. GDP growth and total and business R&D growth rates, 2007–2025 [7]

Many countries and regions provide tax incentives or grants to companies that are active in R&D to stimulate innovation and economic growth. In recent years, there has been an increase in R&D investment, especially in areas such as artificial intelligence, biotechnology, sustainable development, and digitalization .

Research and development (R&D) expenditure is an important indicator of the activity and investment strategy of companies, especially in high-tech industries. These expenditures may include costs for:

Scientific research – funding for laboratories, salaries of researchers and scientists, costs of equipment and materials.

New product development – creating prototypes, testing new technologies and products, as well as patenting costs.

Clinical trials – in the case of medical and pharmaceutical companies, the costs of clinical research into new drugs and treatments.

Improving existing technologies – improving existing products and processes to increase their efficiency.

R&D expenditure to total revenue or gross sales ratios are often used to analyze the R&D expenditures of specific companies. This allows us to assess how actively a company invests in innovation compared to its competitors (Table 1).

Table 1.

R&D growth rates of top global corporate R&D spenders, 2019–2023 [7]

Year	Nominal (billion USD)	Weighted nominal growth (%)	Weighted real growth (%)	Weighted R&D intensity (%)
2019	894	10.5	10.4	5.6
2020	982	12.7	10.7	6.0
2021	1,089	15.2	12.8	5.7
2022	1,174	8.8	7.5	5.8
2023	1,243	8.3	6.1	5.7

Analysis of the table gave us the following conclusions:

1. Nominal ICT spending: Nominal ICT spending has been steadily increasing from 2019 to 2023. It has grown from US\$894 billion in 2019 to US\$1,243 billion in 2023. This shows the growing interest of corporations in innovation activities.

2. Average weighted nominal growth: Average weighted nominal growth reached 15.2% in 2021, reaching its highest level. Although the growth rate has slowed somewhat in recent years, it will still be 8.3% in 2023.

3. Weighted average real growth: The real growth indicator shows a similar trend to nominal growth, but takes into account the impact of inflation. In 2021, growth was 12.8%, and fell to 6.1% in 2023.

4. R&D intensity weighted average: The R&D intensity indicator has been fairly stable, fluctuating between 5.6% and 6.0% from 2019 to 2023. This shows the sustainability of the resources corporations allocate to ICT relative to their revenues.

Based on them we can draw the following conclusions:

- Global corporations continue to invest in R&D, reflecting the importance of innovation.

- Although the growth rate has slowed somewhat since 2021, overall R&D spending continues to grow.

- The persistence of ICT intensity indicates that corporations view R&D as an important part of their business strategy.

The table provides definitions of real growth and R&D intensity. Real growth is the increase in R&D expenditure in US dollars (at the 2015 PPP rate). R&D intensity is defined as the ratio of real ICT expenditure to real income (at the 2015 PPP rate). The data sources are the WIPO (World Intellectual Property Organization) Orbis and the BvD databases .

Looking at the nominal R&D spending of leading companies in different industries from 2019 to 2023, the following key trends emerge: Information and communications technology (ICT) equipment manufacturing: This sector has the highest ICT spending, represented by the green line in the graph, and has grown significantly from 2019 to 2023. Pharmaceuticals and biotechnology and ICT software and services: These sectors have the second highest R&D spending and show an increasing trend from 2019 to 2023. Automobiles: This sector has an average R&D spending and its growth has slowed from 2019 to 2023. Construction and industrial metals, travel, leisure and personal care, and medical equipment and services: These sectors have the lowest R&D spending and have remained virtually unchanged from 2019 to 2023.

The following conclusions can be drawn by industry:

- The R&D equipment manufacturing industry is a leader in IT and communications spending, demonstrating the importance of innovation in this sector.

- Pharmaceuticals and biotechnology, as well as ICT software and services, also receive significant attention from R&D, reflecting the importance of innovation in the healthcare and information technology sectors.

- The automotive industry also continues to invest in ICT, but at a slower pace than other sectors.

- The construction and industrial metallurgy, travel, leisure and personal goods, and medical equipment and services sectors pay less attention to ICT, indicating their low level of investment in innovation activities.

Digital transformation affects all areas of the economy and society, creating new business models, increasing production efficiency and optimizing management processes. In this context, research and development (R&D) plays a decisive role, ensuring the development and implementation of innovative technologies.

R&D helps develop and improve key digital technologies such as artificial intelligence, machine learning, big data, the Internet of Things, blockchain, and cloud computing. These technologies underpin digital transformation, helping companies improve productivity, automate processes, and create new products and services.

Investments in research and development enable organizations to develop unique solutions that give them a strategic advantage in the market. Companies that actively invest in R&D adapt to technological changes faster and take leading positions in their industries.

Digitalization requires a comprehensive approach to modernizing business processes. R&D helps develop innovative data management methods, improve customer interactions, and automate routine tasks, which helps increase efficiency and reduce costs.

R&D stimulates the development of new competencies and professional skills. The introduction of digital technologies requires the training of qualified specialists who are able to work with advanced tools and adapt to rapidly changing conditions.

Many countries view R&D as an important element of digital transformation and develop government programs to support innovation. Subsidies, tax incentives, and research grants help accelerate technological progress and create an innovation ecosystem.

Thus, R&D is a key factor in successful digital transformation, determining the pace and direction of technological development. Their active development allows

companies and states not only to adapt to changes, but also to shape the future of the digital economy.

Conclusion

Research and development (R&D) is the foundation of digital transformation, ensuring the development of innovative technologies, increasing competitiveness and optimizing business processes. In the modern world, digitalization is becoming not just a trend, but a necessary condition for the sustainable development of companies and countries. Investments in R&D allow you to adapt to rapidly changing market conditions, develop advanced solutions and create strategic advantages.

However, the successful implementation of digital technologies requires a comprehensive approach, including not only research funding, but also human capital development, effective government regulation, and active interaction between business, the scientific community, and government agencies. In this regard, it is important to continue improving R&D support mechanisms, stimulate innovative activity, and create conditions for the effective implementation of developments in the economy.

Offers

Increased investment in R&D – expansion of public and private funding for scientific research in the field of digital technologies to accelerate the development of an innovative economy.

Creation of an innovative ecosystem – support for startups , technology centers and research laboratories engaged in the development of digital solutions.

Development of digital competencies – modernization of educational programs and advanced training of specialists in the field of IT, engineering and data analysis.

State support for digital initiatives – provision of grants, tax incentives and subsidies to companies actively implementing R&D results in digital transformation.

Expansion of international cooperation – participation in global scientific and technical projects and exchange of experience with the world's leading technology centers.

The implementation of these initiatives will accelerate digital transformation, increase technological independence and create conditions for sustainable economic growth.

References:

1. Stracke, C., et al. (2020). The Impact of R&D on Digital Transformation: A Comprehensive Review. Journal of Business Research.
2. Smith, A., & Jones, B. (2021). R&D and Organizational Efficiency: The Role of Innovation in Digital Transformation. International Journal of Operations & Production Management.
3. Kim, H., & Park, J. (2022). Fostering an Innovation Culture through R&D in the Context of Digital Transformation. Technology Innovation Management Review.
4. Isametdinovna , K. and Naimovna , A. (2020). R&D Expenditure as A Factor In The Development Of The Economy Of Knowledge. The American Journal of Interdisciplinary Innovations and Research, 2(12), 9-16.
<https://doi.org/10.37547/tajir/Volume02Issue12-02>.
5. The Swedish Economy: A Success Story. Sweden.ru (January 26, 2018).
6. Kvarchia D.A. State regulation of innovations in the USA // Economics and management of innovation technologies. 2018. No. 4 [Electronic resource]. URL: <https://ekonomika.snauka.ru/2018/04/15901>.
7. Global Innovation Index 2024 Unlocking the Promise of Social Entrepreneurship. 17th Edition. WIPO, 2024. – p. 30.