

Priority Factors of Innovation for the Development of Country

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Abstract

The article analyzes the impact of education, investment climate, and ease of doing business in the country on its innovative development. The correlation is set at 0.67. The influence of each of the factors on the level of economic development is analyzed. The greatest interdependence was found between the level of education and the level of innovative development. The analysis shows that the selected factors are critical for the development of innovation in the country and need attention from both the state and the business environment. Improving the quality of education promotes innovation and thus stimulates economic growth. At the same time, economic growth is the basis and important condition for the development of education, including technical. The innovative business environment is sensitive to the complexity of regulations. In addition to incentives, the state must provide accessible and transparent rules for innovative business. Investing in innovation is a crucial factor in transforming the economic system. Innovation and investment are interconnected and cannot exist in isolation. The growing share of both government and business investment in research and development contributes to exponential growth.

Keywords: innovation economy, education, investment, business, digitalization.

1. Introduction

A feature of economic relations in modern conditions is the increasing use of various network and electronic mechanisms for their implementation and optimization. In this regard, the term «digital economy», which in recent years has been actively used in periodicals and scientific publications related to the functioning of the economy in the new environment. Increased interest in the use of digital technologies in various fields of activity is associated with ample opportunities to reduce the costs of commercial enterprises. In addition, the use of such technologies for state and municipal structures has a huge potential to reduce the budget burden, which contributes to the emergence of various strategies, plans and programs for the digital economy. The concept of «digital economy» was first described by scientist Nicolas Negroponte (1995). The digital economy is an economy based on digital technologies. The term defines the advantage of the digital economy, which is based on the intensive development of digital technologies and creative industries over traditional ones.

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Analysis suggests that on average over the past three decades, a US \$1 investment in digital technologies has led to a US \$20 rise in GDP. This return on investment dwarfs the US \$3:US \$1 return for non-technology investments in the same period. This result shows that for every US \$1 investment the average return to GDP is 6.7 times higher for digital investments than for non-digital investments. We find that the digital economy is worth US \$11.5 trillion globally, equivalent to 15.5 percent of global GDP and that has grown two and a half times faster than global GDP over the past 15 years, almost doubling in size since the year 2000.

Access to digital technologies, of course, ensures the growth of personal well-being, but it is difficult to quantify this economic benefit. The ability of information technology to reduce transaction costs expands opportunities for people who have difficulty finding work or accessing resources. Although a small number of jobs are being created directly in the field of digital technologies, new opportunities for entrepreneurship and self-employment are rapidly expanding.

The digitization mechanism operates on two sides. First, the sharp decline in digital prices has given companies and governments an incentive to replace the factors of production used - labor and non-ICT-related capital - ICT capital, as well as to automate many activities. Yes, airlines use online airline ticket booking systems. Supermarkets are replacing cashiers with automatic payment devices. Manufacturers use real-time digital instrumentation and supply chain management systems. Governments are investing in information management systems and offering online services in a variety of areas, from issuing driver's licenses to filing tax returns. Second, digital technologies enhance unsubstituted factors of production and increase their productivity. They help managers more effectively monitor the work of employees, politicians - monitor the work of information service providers, and employees - use technology to increase productivity, which, in turn, increases the return on investment in human capital. By simplifying tasks and increasing the productivity of existing factors of production, digital information and communication technologies can significantly increase the economic efficiency of companies, employees, and governments.

The rapid spread of technology and innovation in the economy means that their benefits are being realized on a large scale, but their indirect impact on economic growth is difficult to assess. The problem is that according to the large statistical evidence of the growing role of ICTs in economic activities, their real impact on the activities of economic entities has not been studied, and digital dividends are an increase in commercial and non-commercial benefits that cannot be obtained traditional technologies. For example, the information and analytical department of a trading company is engaged in information activities, but the question of how to allocate for analytical purposes its share in the provision of services throughout the enterprise remains open. To determine the impact of the efficiency of digitalization of the economy more accurately, it is advisable to develop a system of indicators for the use of information and communication technologies.

The study makes assumptions about the most important factors for innovative economic development. Key factors include the level of education, investment freedom and ease of doing business.

2. Literature review

Innovative theories in dynamic and evolutionary aspects were developed by Schumpeter (1982), Druker (2003), Mensch (1979), Perez (2005) among others. In their research, the authors considered the concept of technological revolutions and their consequences for the economy. The processes of innovation in terms of identifying patterns in these processes are studied. Research has taken place at both the micro and macro levels. The research is based on technological revolutions, the study of their structure and the role they play in the rejuvenation of the whole economy using the accompanying technical and economic paradigm.

Both Mensch (1979) and Perez (1983, 1985), to take just two examples, argued that major technological changes, such as, for instance, the ICT revolution today, or electricity a century ago, require extensive organizational and institutional change to run their course.

Ahmad, Mallick and Schroeder (2012), the innovation process can take different forms depending on the product and external factors. From a historical perspective, Rothwell (1994) clarifies how innovation processes has changed over time, due to changes in the industry.

Hirooka (2006) substantiated the process of clustering of innovations and their synergetic effect, which causes significant complex economic growth and contributes to the intensification of its development.

Most research on innovation concludes that innovation is highly dependent on external sources. In a study by Van de Ven et al. as early as 1999 it is noted: popular folklore notwithstanding, the innovation journey is a collective achievement that requires key roles from numerous entrepreneurs in both the public and private sectors (Van de Ven et al. 1999: 149).

Digital technologies create a virtual copy of the physical world. Manufacturing industries easily integrate physical objects with /into the information network, «allowing real-time adaptation in the future» (Smit et al. 2016).

In contemporary global development digital technologies force business to adapt novelties to survival in the transformed global industrial space against the tough international competition (Lekashvili 2019, Sepashvili 2019). By Using digital technologies, consumers get faster services, sell, and buy products online, save money in online stores, can start their own businesses online, become an entrepreneur without leaving home (Gazzola et al., 2017).

The suing of digital Technologies makes easier access to any product and service and creates good basis for equal treatment (Gazzola et al. 2016).

The COVID-19 pandemic has accelerated digitalization processes. More people have continued, to the extent possible, with their activities through online channels – for example, for working, studying, communicating, selling, and buying, or entertainment. (UNCTAD, 2021). The whole economy is experiencing the benefits of digital technology. When it comes to business, the Internet promotes the inclusion of companies in the global economy by expanding trade, increasing capital productivity, and intensifying competition in the market, which, in turn, promotes innovation. It expands the capabilities of households, increasing human capital and creating new jobs and additional benefits for consumers, opens access to services in the financial and banking sector, public services, increases the capacity of the state.

While many metaphors have been used to explain the nature of data, most notably oil, data are not like anything else, and these metaphors are not useful for policymaking purposes (De La Chapelle and Porciuncula, 2021). Data can be used to make decisions with economic impacts, environmental impacts or effects on health, education, or society in general (Coyle et al., 2020).

The issue of studying the factors of development of the innovative economy remains relevant. The emergence of new markets, new forms of business, new forms of assets only deepen the problems of research. The issue of factors of development of innovative economy and the importance of each of them remains especially relevant.

3. The identification of previously unresolved issues and the formulation of research hypotheses

Rapid rates of technological development and social change have already become an everyday reality. Succeeding in this reality is only possible by investing in new research and innovation infrastructures that reach all people. Although the future of labor, the economy and society are uncertain, to maintain leadership in the discovery of science and technology, it is important to create a special approach to learning. This approach should prepare for future changes in science, technology, and the creative industries. Such demands for change encourage the creation of different concepts of education and science. One of the most common is STEM (science, technology, engineering, and math) education. Experts agree that science, technology, engineering, and mathematics will stimulate innovation in different disciplines, using computing power to accelerate discoveries and finding creative ways to work in different disciplines to solve big problems. Investments in the system can ensure the competitiveness of the economy and promote the development of an innovative economy.

It is envisaged that the quality of education promotes technological innovation, improving the quality of workers, and thus effectively stimulates economic growth. On the other hand, economic growth is the basis and important condition for the development of education. Economic growth can also stimulate the development of higher education with increasing social demand and increasing human capital.

The process of investing in innovative projects is a decisive factor in the reproduction of the world economic system. In the XXI century innovative development of states is accompanied by the intensification of globalization of the world economy. With the help of investment and innovation processes, it is possible to overcome both global economic crises and provide an impetus to the recovery of individual national economies, the progress of corporations and enterprises that finance and implement innovations. Innovation and investment are closely intertwined and cannot exist without each other. To succeed in an innovative project, you must first have a ratio between the initial investment and financial return.

Accessible and transparent rules create an environment where new entrants (especially startups) can start a business, and existing businesses can invest, expand, and create new jobs. The role of public policy in business is a central focus of Doing Business data. Complex regulations hinder the development of innovation and research, as time is spent on bureaucratic procedures rather than operational tasks. Instead, regulation that is effective and transparent promotes business expansion and innovation. It is important to ensure equal competition, which is a critical condition for the development of startups.

The article aims to study the following hypothesis:

Hypothesis 1. A change in the level of education affects the level of innovation in the economy. It is expected that in terms of the quality of education, especially technical education, there is a statistically significant direct linear relationship between innovation and education.

Hypothesis 2. Changing the investment attractiveness of the country affects the change in the level of innovation in the economy. The indicator of investment attractiveness will promote the development of research projects. The market of innovations at the present stage of development is characterized by sustainable development, respectively, is interesting for investors.

Hypothesis 3. Availability and ease of doing business affect the level of innovation in the economy. Innovation development requires flexibility and mobility in doing business, so countries with the lightest regulations are expected to be most conducive to innovation.

4. Research methodology and methods

Regression analysis was chosen as the methodological basis of the research. This analysis helps us to identify the relationship between the independent factor (innovative development) and the dependent factors. The regression model helps level how changes in the independent factor affect the dependent factor. The analysis helps to make forecasts, evaluate results, and predict potential risks.

The level of innovative development of the country was chosen as the resulting indicator. Three macroeconomic indicators were selected as factors: the level of education, the level of investment attraction and the ease of doing business. During the study, data were obtained to determine the degree of influence of each of the factors on the level of innovative development of the country. The study also found a strong link between the factors.

The article focuses on the relationship between innovation, education, investment freedom and ease of doing business, using empirical research into their causation and the impact between them. Education, freedom of investment and ease of doing business are indices that are seen as drivers for technical innovation. The data used in the study were obtained from «Global Innovation Index» provided by WIPO, «Education Index» provided by the UNDP's Human Development Report, «Investment freedom index» provided by the Heritage Foundation, «Doing Business Index» provided by the World Bank.

5. Result

The result of the correlation analysis (Table 1) indicates a high level of correlation of the dependent variable on the selected factors. There is also a strong link directly between the factors themselves. These results confirm the assumptions about the importance of education, investment freedom and ease of starting and running a business for the development of an innovative economy.

Table 1
Correlation matrix

	<i>Global Innovation Index</i>	<i>Education</i>	<i>Investment Freedom</i>	<i>Doing Business</i>
Global Innovation Index	1	0,75105401	0,69490228	0,69857279
Education	0,75105401	1	0,691173387	0,677338934
Investment Freedom	0,69490228	0,691173387	1	0,577949815
Doing Business	0,69857279	0,677338934	0,577949815	1

Table 2 presents the data of regression analysis.

Table 2
Regression analysis

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	-40,9738879	11,74858154	-3,487560409	0,001274881
Education	41,3299064	16,98434843	2,433411361	0,019907089
Investment Freedom	0,21883665	0,106715236	2,050659842	0,047433208
Doing Business	0,46524862	0,207358377	2,243693372	0,030923111
<i>Regression Statistics</i>				
Multiple R	0,81754087			
R Square	0,66837307			
Adjusted R Square	0,6414844			
Standard Error	6,93603784			

Next, the influence of each of the factors on the dependent variable, i.e., on the innovation economy, is analyzed. First, there is a close relationship between the level of innovation development and the level of education (Figure 1). This connection is explained by the importance of science and technology for the modern world.

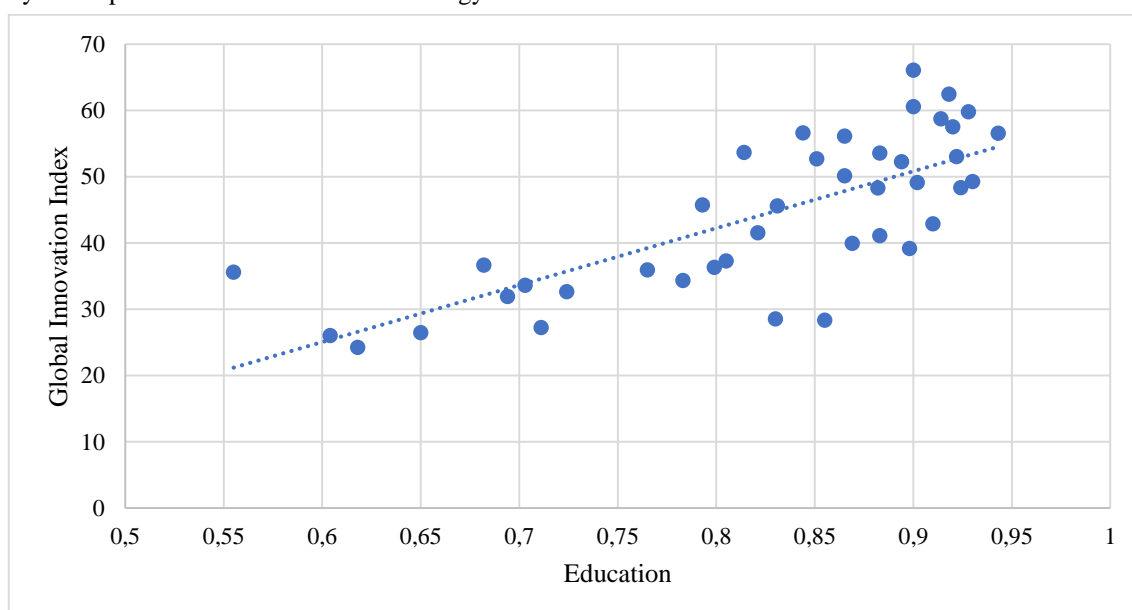


Fig. 1. The correlations between innovation and education

The education system must create the right patterns of behavior and interaction as a basis for building the right institutions. Building a culture of good perception and adherence to institutions is too important for building an efficient economy to ignore. Obviously, the key role in instilling the right institutional culture is given to the education system and the educational model integrated into it. The education system must create the right patterns of behavior and interaction as a basis for building the right institutions. At the same time, an important link is that quick victories will not be achieved. Fulfillment of the conditions will allow to get into the cherished group of leading countries, but it will take more than a decade, and the countdown begins from the moment when the required majority formed the principles of institutional discipline.

For every US\$1 spent on education, as much as US\$10 to US\$15 can be generated in economic growth (UNESCO 2012). If 75% more 15-year-olds in forty-six of the world’s poorest countries were to reach the lowest OECD benchmark for mathematics, economic growth could improve by 2.1% from its baseline and 104 million people could be lifted out of extreme poverty (UNESCO 2012).

The raw material foundation, on which all calculations of socio-economic development have been built for years and decades, has proved to be too shaky a basis for looking to the future in modern conditions. The need for innovation, which gradually began to emerge in certain branches of industrial production, is now felt everywhere. But even the first attempts to reorient industrial policy to the introduction of new technologies were met with low receptivity to innovation of the entire hopelessly outdated and backward production structure. Awareness of this connection - innovation for modernization – allows you to build for many years of economic priorities not only more clearly within the public administration system, but also for business. Moreover, combining the efforts of productive forces to achieve global goals, perhaps for the first time, allows us to abandon the former practice of opposing private and public interests. In the field of support for technological innovation, the principle that in a market economy the selection of technological innovation projects is the prerogative of private business should be strictly adhered to.

Figure 2 graphically shows the correlation between the level of investment freedom (how attractive a country is for investment) and the level of innovation.

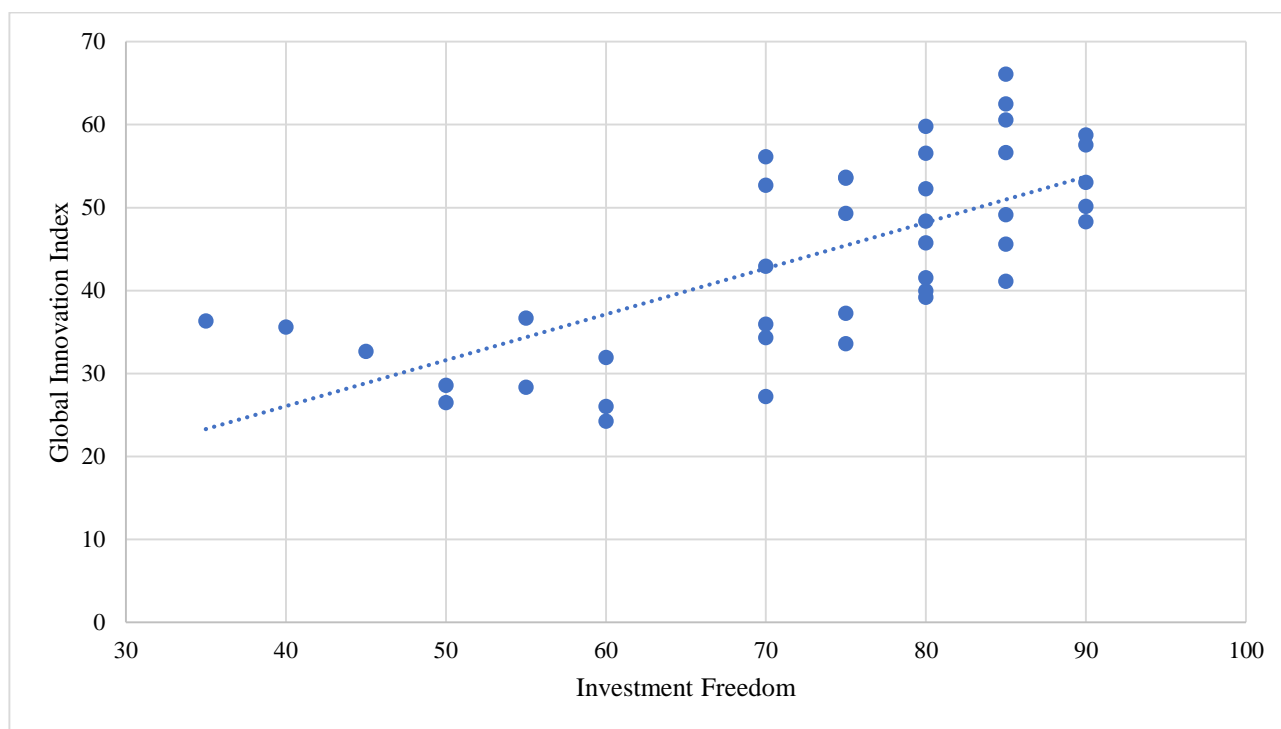


Fig. 2. The correlations between innovation and investment freedom

Investing in innovation remains a difficult issue. These investments are characterized by increased risks, latent cost structure, prevalence in the structure of creative work, which is not subject to regulation, the inability to determine the time interval of the project, and so on. Nevertheless, the innovative development of the economy is growing and spreading to all industries - therefore, all risks pay off. Here we should talk about the development of venture capital. Global venture investment last year totaled \$ 643 billion, compared to \$ 335 billion for 2020 — marking 92 percent growth year over year (Teare G., 2022). Ukraine remains unattractive in the venture capital market. However, the idea arose to attract Western venture funds to invest in so-called startups, such as Internet business. Although in general the attractiveness of the Ukrainian innovation market is low, the assessment of the intellectual component of this sector remains at such a level that allows us to expect the participation of Western capital in the development of Ukrainian innovation.

The Ukrainian investment market continues to grow. In total, over \$ 1 billion was invested in a company of Ukrainian origin in the period 2011–2018. (UVCA, 2018) the trend of investment growth has been observed over the last 10 years. One of the

reasons is that the companies, which were founded five or seven years ago, are now actively developing, and attracting foreign investment. The number of Ukrainian unicorn companies has also increased, especially in the period 2018-2022.

Figure 3 shows the dependence of innovation on the ease of doing business. Innovative business is primarily related to venture capital as a source of capital, and startups as a form of business. The rapid changes taking place in the market of innovations and creative industries require the most accessible and transparent rules. A country with better regulations helps participants in the flexibility and resilience of doing business, which helps transform the country's economy.

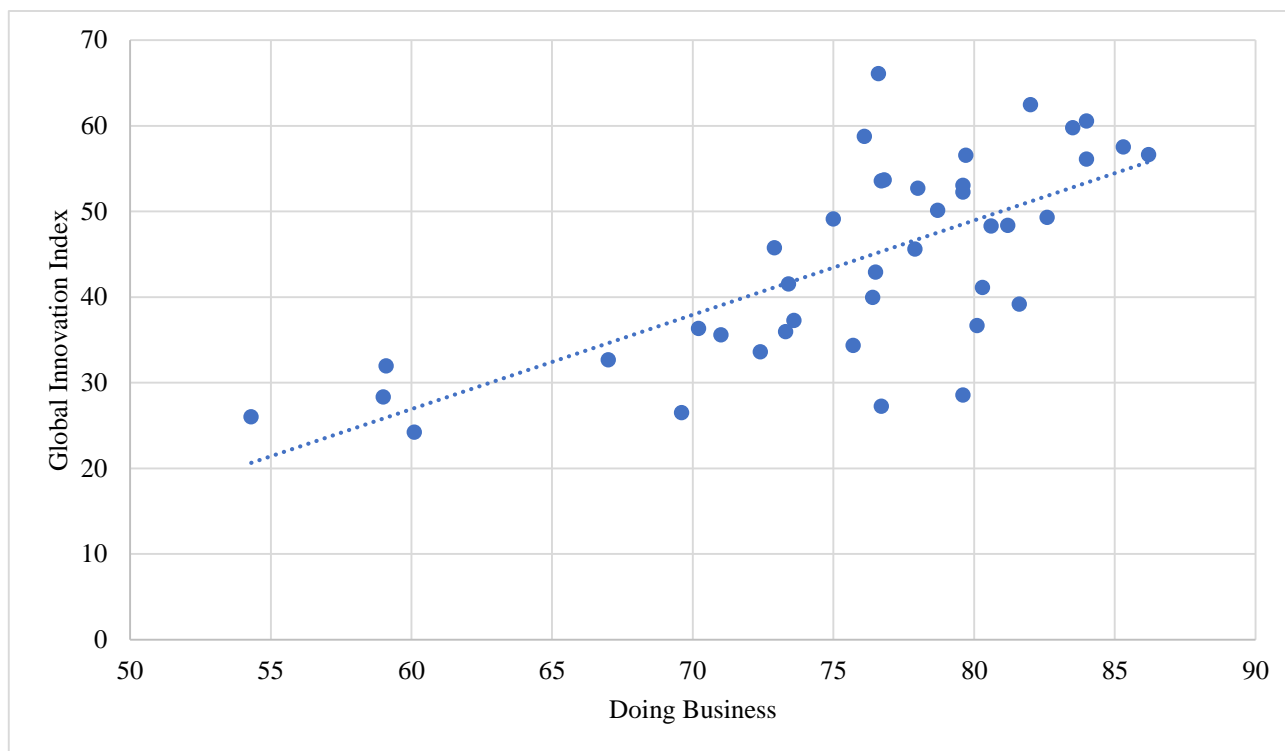


Fig. 3. The correlations between innovation and «Doing Business Index»

The transition to a market economy requires a significant increase in production flexibility and receptivity to innovation. Newly established enterprises in the knowledge-intensive sector, in contrast to traditional ones, focus on the full cycle, which includes the stage of R&D and the development of production of new goods and services. Innovations connect different in nature and management methods of economic activity: science, production, investment, sales. Improving styles and techniques of innovation management, rapid and adequate response to changing market conditions, development of new areas of tools in the work of enterprises and more. enable innovators to use all kinds of reserves for successful innovation. In recent years, Ukraine has taken a major step towards innovative development, mainly by providing systemic incentives for innovation and technological development of economic sectors. Active creation and modernization of technologies, implementation of various technological projects is one of the driving forces of the innovation process. That is why the creation of new, unique advanced production technologies is the most important element of innovative development of the country's economy. And, as forecast values show, the prospects for development in this area are very high. However, many domestic enterprises follow the «conservative» path of development, the essence of which is to maximize the preservation of the existing structure of the enterprise, production technology, even in the transition to the release of a new generation of products. This development option for many years preserves the situation of domestic industry lagging the leading Western countries. The way out of this situation is the complete development of the enterprise considering innovations. That is why the development of industrial design is one of the main stimulating factors of innovative development of Ukraine. It should be borne in mind that the development of the innovation sphere, through which the achievements of scientific and technological progress are promoted, is a particularly relevant area of research, and requires serious attention at all levels of government.

6. Discussion

The digitalization of the economy can be defined as a modern innovative stage of economic development, which is based on the integration of physical and digital resources in the field of production and consumption, in the economy and society. It is characterized by new methods of generating, processing, storing, transmitting information in all spheres of human activity. Digitization of the economy, multiplying the information space and creating information products, reduces information costs. This significantly speeds up and simplifies the search for information, its comparative analysis and exchange and helps to strengthen the cohesion and cooperation of companies, which, in turn, affects the operating methods of businesses, people's search for favorable living conditions, and mutual understanding and interaction between the population of the country and its

government. The basic condition for the expansion of the digital segment of the economy is the growth of the transaction sector, which includes public administration, consulting and information services, finance, wholesale and retail trade, and the provision of various utilities, personal and social services and which in developed countries.

New technologies and digital platforms allow companies and individuals to reduce transaction costs on an ever-increasing scale and to maintain closer contact with businesses and government agencies. The very concept of «digitalization» indicates a new stage in the development of production management and production itself based on «through» the use of modern information and communication technologies, from the Internet of Things to e-government technologies.

In today's advanced economies, private firms undertake the bulk of research and development. The business sector's share of total R&D spending ranges from 60% in Singapore to 78% in South Korea, with the United States closer to the higher end, at 72%. But it is the public sector that provides the essential social, legal, and educational infrastructure that sustains private R&D (Rodric D., 2020).

It should be noted that innovations increase the efficiency and productivity of public services through automation and information-based management. Thus, filling in electronic declarations reduces the cost of ensuring compliance with tax legislation, and computerized service structures on a «one-stop shop» and online portals increase the efficiency of the service. Enabling the public to express their views on specific issues quickly improves the quality of work in many cases. In response, the authorities can report on the measures taken, ensuring feedback. The time to solve problems is reduced if the management mechanism is well thought out and sound. These benefits do not appear automatically and are not guaranteed, but in many cases digital technologies can create significant benefits. To maximize the benefits of digitalization, the state needs to support the market for relevant high-tech products.

In 2016, Ukraine adopted the «Ukraine Digital Agenda – 2020» until 2020. It outlined the conceptual framework for digital development, proposed development initiatives and identified key objectives to be achieved in 2020. Thus, it was expected to improve its position in three rankings based on global development indices, including the Networked Readiness Index, the Global Innovation Index, and the Global Competitiveness Index. However, despite the beginning of the transformation of economic sectors, digitalization of public services, increasing the level of Internet access, the changes were not enough for the real qualitative growth of digitalization of the country. In 2020, the Ukrainian Institute of the Future developed a strategy for the development of the digital economy «Ukraine - 2030E» (Ukrainian Institute for the Future, 2020). The strategy provides for several development scenarios and defines an algorithm of actions to achieve the set goals. The key CRIs by 2030 are:

- 65 % – the share of the digital economy in total GDP of Ukraine in 2030E.
- 99.9 % of Ukrainian households have broadband Internet access (broadband).
- 100 % - coverage of the territory of Ukraine 4G-5G.
- 99 % of all highways and railways and 95% of rural areas are covered by mobile Internet technologies.
- 99.9 % of citizens have digital identification (citizen-card, Mobile ID) and technical capabilities to use trust services, etc. (Ukrainian Institute for the Future, 2020).

It is worth noting that in 2020 Ukraine also launched the Action City project at the national level to create favorable conditions for the development of innovation and technology business. It is noted that the project covers such areas as AgroTech, Fintech and Blockchain, AI and cloud computing technologies, medical neural networks, and biotechnology, IoT, Publishing and trading platforms, aerospace, drones, advertising, marketing and promotion, animation, graphics, animation, e-sports, and business process outsourcing (Project «Diia Citi», 2022).

7. Conclusion

By overcoming information barriers, increasing production capacity, and changing the nature of products, digital technologies can make economic development more inclusive, efficient, and innovative. Particular attention should be paid to the problem of building modern economic theory, recognizing that information is a commodity and that the well-being and standard of living are directly related to specific energy consumption, and social status is replaced by social prestige and authority. The current level of digitalization of the economy allows to organize mechanisms for collecting, processing and delivery to the place of use of basic and effective information with minimal use of labor, material, and financial resources to perform these functions. Possession of relevant information is a unique competitive advantage of economic entities, which allows to increase the accuracy of forecasting their activities and thus ensure financial stability.

The most stable relationship (0.75105401) is observed between innovative development and the level of education. This indicates the special importance that should be attached to the development of education, because, as we see, it is the main driver for the development of innovation. The importance of the other two factors that have been studied should not be underestimated. This is indicated by a somewhat smaller, but still high correlation between innovation development and the level of investment attractiveness (0.69490228) and innovative development and ease of doing business (0.69857279). The digital economy is a huge potential for innovative development, the organization on a new basis of markets for goods, services and labor, financial assets, and payment systems. Digitalization will provide a significant contribution to sustainable economic growth, increase the competitiveness of basic industries and innovative sectors of the economy, quality of life, and will achieve a high position of our country in world rankings.

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