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Yuliia Strilchuk
Candidate of Economy Sciences, Associate Professor of the Department of Banking and Insurance, Kyiv National Economic University named after Vadym Hetman, Kyiv, Ukraine;
e-mail: juliastrilchuk@gmail.com
ORCID: 0000-0001-8368-322X
(Corresponding author)

Iryna Krasnova
D.Sc. in Economics, Professor of the Department of Banking and Insurance, Kyiv National Economic University named after Vadym Hetman, Kyiv, Ukraine;
ORCID: 0000-0002-4507-6629i

Serhiy Khodakevich
Candidate of Economy Sciences, Associate Professor of the Department of Banking and Insurance, Kyiv National Economic University named after Vadym Hetman, Kyiv, Ukraine;
ORCID: 0000-0002-8951-2605

Ievgen Metsger
PhD Student, Kyiv National Economic University named after Vadym Hetman, Kyiv, Ukraine;
ORCID: 0000-0002-6463-2651

Artur Stryzhak
Candidate of Economy Sciences, Doctoral Student, Kyiv National Economic University named after Vadym Hetman, Kyiv, Ukraine;
ORCID: 0009-0006-0633-0651

Andriy Dubas
PhD Student, Kyiv National Economic University named after Vadym Hetman, Kyiv, Ukraine;
ORCID: 0009-0000-0815-036X

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SUSTAINABLE DEVELOPMENT DETERMINANTS IN THE CONTEXT OF DIGITAL TRANSFORMATION

ABSTRACT

Progress towards sustainable development is the priority for countries all over the globe. Understanding the essence of sustainable development is a basis for conducting research and practical actions. The aim of the article is to find out the global determinants of sustainable development in the context of digital transformation. The era of digital technologies creates new approaches to solving available issues and challenges. New normality requires defining global determinants of sustainable development and creating new tools for achieving its goals. The study has provided empirical evidence and proved that ICT is one of the important drivers of sustainable development. The conducted analysis shows that there is a direct impact of ICT development and digitisation on achieving SDG 9 "Industry, Innovations and Infrastructure". The indirect impact of digitalisation on the SDGs is analysed. It is proved that the implementation of digital technologies in business processes and digitalisation of non-IT sectors of the economy will contribute to the comprehensive implementation of a number of SDGs, such as SDGs 3, 4, 8, 9, 11, 12, and will give impetus to the achievement of other goals, which will generally have a synergistic effect. Benchmarking of practices used by well-developed countries enabled the identification of a number of priority areas related to the digitisation of the economy, namely, the development of digital skills among the population for entrepreneurial activities, state support for the digitalisation of business, especially SMEs, promotion of e-commerce, electronic payments. This study makes multiple contributions namely to academic debate on the influence of digitisation on sustainable development, demonstrates the interrelations between SDGs and highlights evidence on the global determinants of sustainable development. Conducted research outlines 4 groups of factors to enhance achieving SDGs in terms of digital transformation: 1) network coverage; 2) the number of Internet users; 3) affordability of access to the Internet; 4) digital literacy.

Keywords: sustainable development, sustainable development goals, sustainable growth, digital economy, digital transformation, digitalisation, innovations

JEL Classification: A130, F63, O44

INTRODUCTION

Sustainable development is on the agenda in most countries of the world and is a global issue. Nowadays achieving the UN Sustainable development goals is a strategic priority. The paradigm of sustainable development involves taking into account economic, ecological and social spheres of development together in their connectivity and synergy. Such a combination will allow overcoming the challenges faced by countries in modern conditions of global turbulence, contribute to the preservation of the environment for future generations, and improve quality of life.

Each country in the world plays an important role in achieving sustainable development goals globally. 'The impacts of the climate crisis, the war in Ukraine, a weak global economy, and the lingering effects of the COVID-19 pandemic have revealed weaknesses and hindered progress towards the goals. While lack of progress is universal, it is the world's poorest and most vulnerable who are experiencing the worst effects of these unprecedented global challenges. [UNO, 2023]. In such a situation, governments should pay attention to the issue of sustainable development and do their best in order

to have higher progress in this sphere. Creating a roadmap and an action plan for achieving sustainable development goals is essential for each economy. Moreover, it is necessary to use all the available resources and possibilities to foster growth and development. The modern paradigm of the digital economy has changed all the spheres of life, including the economy, social and ecological spheres as well. The process of digitalisation is so rapid and has a great number of positive effects on the economic growth of the particular country and on the multinational level. Advantages of the digital technologies are used in well-developed countries and should be spread all over the world. The era of digital technologies creates new approaches to solving available issues and challenges. Therefore, living in the new normality requires defining global imperatives of sustainable development and creating new tools for achieving its goals.

LITERATURE REVIEW

Understanding the essence of sustainable development is a basis for conducting required research and practical actions. A great number of researchers worldwide have defined sustainable development. The most popular and frequently used definition is one from the Report of the World Commission on Environment and Development: Our Common Future which is also called the Brundtland Report. According to the document 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. [UNO, 1987]. UN has described all 17 Sustainable development goals and 169 targets set for each goal (UNO, 2022C). The 2030 Agenda for Sustainable Development was adopted by all United Nations Member States in 2015. This document is based on the 17 SDGs, which are an urgent call for action by all countries in a global partnership (UNO, 2015). In order to transform all these goals into real actions it is important to take into account their interrelations. Kolb et al. (2017) noticed that different SDGs are connected and influence one another, they offered an SDG pyramid model and put SDG 4 at the top as the main one which has its impact on all the other SDGs. Researchers take into consideration not only connectivity but also the complexity of sustainable development goals. Greenland S. J. et al. (2023) have underlined the complexity of SDGs and have examined various sustainability models, mostly founded on the pillars of sustainability.

An active transition to a model of sustainable development involves the creation of an appropriate ecosystem, which requires an adequate regulatory and legal framework, the creation and implementation of a targeted state policy and strategy, and the development of private-public partnerships. According to the Global Sustainable Competitiveness Index (GSCI) (SolAbility Sustainable Intelligence, 2022), none of the countries achieves the maximum possible level of sustainable competitiveness. The Global average Sustainable Competitiveness score in 2022 is 43.1 out of a possible maximum of 100. To compare in 2020, Sweden topped the rating with an index value of 62%. The average value of GSCI was 48 out of 100. It confirms the importance of further work of the global community in the direction of sustainable development and the search for effective tools that will contribute to the faster implementation of tasks to achieve the SDGs. Ukraine joined the process of promoting the achievement of sustainable development by adapting global SDGs to Ukrainian realities and creating a national system of tasks and indicators of sustainable development. Ukraine ranks 38th in the world in terms of success in achieving its goals with an achievement rate of 76.52% (Sachs et al., 2023). So sustainable development is a complex issue that is interesting for researchers and at the same time, its practical implementation requires convergence of business, innovation, and sustainability.

Researchers (Subramaniam et. al., 2023) conclude there is a need for a more robust Sustainable Development Goal measurement and reporting framework that can support companies to align their business strategies with the goals. In recent research, Bose et al. (2024) provide determinants and consequences of SDG disclosure, and demonstrate a connection between higher levels of SDG disclosure and increased firm value. Rosati & Faria (2019) demonstrate the vital role of SDG reporting for business and consider it as one of the factors of companies' contribution to sustainable development. Researchers (Lenort et al., 2023) analyse factors that influence the adoption of the SDGs in company strategies and sustainable reporting. According to the study business contribution to sustainable development depends on the industry and the level of economic development of the country. Kaimuri & Kosimbei (2017) outline determinants of sustainable development from the point of view of a particular country and offer to use quantitative indices such as household consumption per capita, unemployment rate, resource productivity, energy efficiency, real gross domestic product per capita and terms of trade. Such an approach concentrates only on the economic part of sustainable development. Fedulova et al. (2023) provide an analysis of environmental determinants of sustainable development of a particular country including environmental protection; structural restructuring of the economy; resource efficiency and biodiversity; well-being and health of the population. Above mentioned approaches are complementary and demonstrate important factors that influence sustainable development at the state level.

It is important to find out the determinants of sustainable development from a global perspective. Gálová, J. & Mravcová, A. (2021) have described four determinants of sustainable development: globalisation, climate change, poverty versus

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unlimited consumption as well as limited exhausted access to resources. The authors show connections between these determinants and SDGs. It is worth mentioning that the authors have not paid attention to such changes in the global community as digitalisation and its influence on sustainable development. In recent years digital technologies have rapidly changed and spread. That has made a huge impact on the economic, social, and ecological spheres. Information and communication technologies are one of the important drivers of sustainable development. Communication is becoming more and more disaggregated as a result of the growing number of social networks and their users. Thus, Facebook has shown a growth in the number of active users over the past 10 years by 568% and according to data for October 2022 had more than 2.7 billion, WhatsApp - 2 billion, Instagram - more than 1 billion active users, the number of which has increased more than 10 times in the last 7 years (Statista, 2022). The use of social networks and the latest digital technologies greatly simplifies communication and allows stakeholders to easily monitor and disseminate information on compliance with corporate social responsibility, and activities of companies to promote sustainable development. Information and communication technologies make it possible to accelerate the implementation of sustainable development goals and specific targets, which are laid down in the economic growth strategy of well-developed countries. The development of ICT correlates with the speed and efficiency of achieving the SDGs significantly, $R^2 = 0.91$ (Huawei, 2019). There is still a continuing digital divide in the world. Many communities, particularly in less and least-developed countries, continue to be excluded. Recent research provides information that the lack of access to sustainable energy and digital and information services are directly interrelated (UNO, 2022A). It also proves the importance of digitalisation and digital inclusion in fostering sustainability. Using the advantages of ICT in the process of achieving the SDGs will allow to obtain a synergistic effect and to form a new paradigm of inclusive development. Digital transformation has changed the world by influencing all the spheres of life. New technologies are being implemented into the process of production, financial sphere, healthcare, education etc. Thus, new factors that influence sustainable development appeared in new conditions. No comprehensive analysis of sustainable development determinants in terms of digital transformation has been carried out. This study is a novel one because it provides the identification of key factors that influence sustainable development on a global level in the conditions of digitalisation.

AIMS AND OBJECTIVES

The aim of the article is to find out the global determinants of sustainable development in the context of digital transformation. The list of objectives is set in order to achieve the aim of the article:

- to study the current knowledge on sustainable development;
- to analyse the interrelations between the sustainable development and digitalisation;
- to outline leading practices of digital transformation worldwide;
- to identify key factors to enhance achieving SDGs in the digital era.

METHODS

This study has consequently used a mixed-method approach to deepen the understanding of sustainable development drivers in the digital economy paradigm. Qualitative and quantitative data analyses are combined in the study. Secondary data analysis, and statistical analysis methods are used to generate reproducible knowledge, to make conclusions based on quantitative data. Tables and graphs are used to visualise data.

Descriptive research, using analysis and synthesis, induction and deduction methods, has been made to synthesize existing knowledge on sustainable development and its factors in the digital era. Thematic analysis is used to interpret patterns and meanings in the data. The qualitative research using system analysis and generalization has identified key imperatives of sustainable development in modern conditions. Using a case study method has enabled us to compare best practices of implementing innovative technologies and using digital transformation to achieve SDGs.

RESULTS

The conducted analysis has shown that there is a direct impact of ICT development and digitalisation on the speed of achieving SDG 9 'Industry, Innovations and Infrastructure'. A list of tasks is defined within the framework of this goal, most of which can be fulfilled only because of the use of ICT, the development of digital transformation with the transition to a digitalised economy. According to the data of the interactive map compiled by experts on sustainable development (Sachs et al., 2023), only three countries in the world have fulfilled all the tasks and achieved this goal, these are Great

Britain, Japan and Singapore. Most well-developed countries continue working with the challenges on the way to achieving SDG 9. Ukraine is in a group of countries with significant challenges remaining and is characterised by a lack of positive dynamics towards achieving SDG 9. This result is determined on the basis of 11 indicators and their dynamics (Sachs et al., 2023). Ukraine has the worst indicators in terms of the indicator of expenditure on R&D, which does not reach 0.5% of GDP and has a negative trend (Ukrstat, 2020). The drop is also observed in the logistics efficiency index, which reflects the quality of trade and transport infrastructure. Ukraine has a value of 2.2 out of a possible 5 points and a downward trend since 2012. The best changes are observed in the indicators 'Share of the population using the Internet', 'Number of subscriptions to mobile broadband Internet', and 'Articles published in academic journals' which showed a steady upward trend. However, the target values have not been achieved yet and require further governmental work in this direction.

One of the tasks within SDG 9 requires increasing access to information and communication technologies significantly and strives to ensure universal access to the Internet in the least developed countries, demonstrating the relationship between digitalisation and the Sustainable Development Goals. The conducted research confirms significant shifts in the performance of the specified task. Fixed broadband Internet is still out of reach for many people, but mobile cellular signal and mobile broadband coverage have expanded rapidly. In 2019, 97% of the population lived within network coverage of at least the 2G standard and 81.8% - with a network of the 3G standard or higher (UNO, 2020A). There is a rapidly increasing trend in the number of people covered by the 4G mobile network. In the period from 2015 to 2020, the coverage of the 4G network increased by two times and amounted to 85% of the population in 2020 (International Telecommunication Union, 2020B). In order to achieve a number of SDGs, to create an inclusive global information society, it is necessary not only to expand network coverage but also to stimulate the growth of the number of Internet users. A positive trend has been formed in the world and a rapid growth of this indicator is observed namely 3 times over the last 10 years to more than 4 billion people in 2019 [UNO, 2020B]. Latest figures show that an estimated 5.3 billion people of the earth's 8 billion are using the Internet in 2022, or roughly 66 per cent of the world's population. At the same time, three-quarters of the population aged 10 years and over own a mobile phone (International Telecommunication Union, 2022). The best results in terms of the share of the population using the Internet are shown by well-developed countries (Figure 1). African countries have the smallest shifts in the indicated direction.

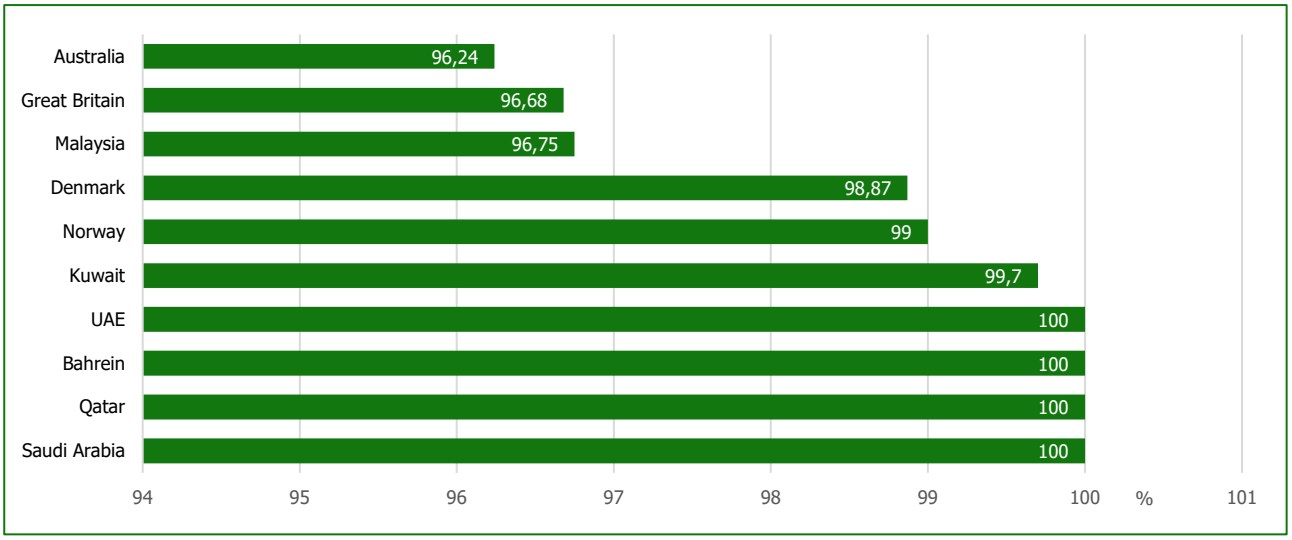

Figure 1. TOP-10 countries by the share of the population using the Internet. *(Source: built on the basis of Sustainable Development Report 2023 [23])*

The long-term target towards which the world is gradually moving is 100%. However, only 4 countries have reached the target value. The first place in the world according to this indicator is occupied by Eastern countries such as Saudi Arabia, Qatar, Bahrein, and the United Arab Emirates, which have a result of 100 %. The TOP-10 countries also include Kuwait, Norway, Denmark, Malaysia, Great Britain and Australia, which reached the value of the studied indicator over 96%. Ukraine has lower indicators compared to other European countries. At the same time, there is a rapid increase in the share of Internet users from 6.5% in 2007 to 62% in 2018 and 79.22% in 2021 (Sachs et al., 2023).

A strong indicator of countries' progress towards achieving SDG 9 is the number of subscriptions to mobile cellular networks with broadband Internet access, regardless of the gadget used for access (per 100 people). The world leader in this indicator is the UAE with a value of 241, the second and third places are occupied by Japan (227) and Poland (206) respectively Figure 2).

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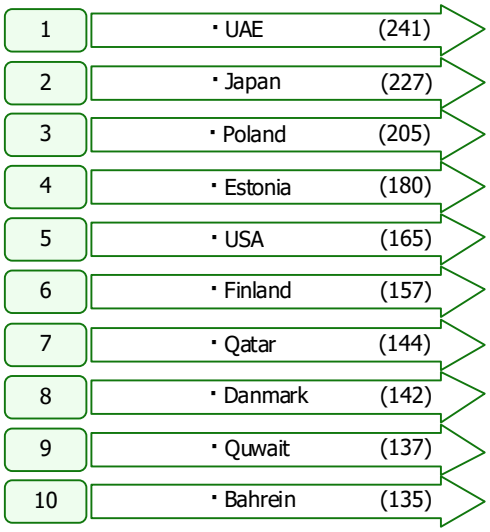

Figure 2. TOP-10 countries by the number of mobile broadband subscriptions per 100 people. *(Source: built on the basis of Sustainable Development Report 2023 [23])*

All leading countries in the top ten have a value of the indicator above 130. High results are also shown by individual countries of the Middle East, such as Saudi Arabia (120), and Israel (124). Ukraine has rather low results (80) compared to other countries in its region, despite the positive dynamics of this indicator. This indicator is twice higher now than in 2020. This shows efficient work being done at the state level regarding the development of ICT, ensuring the availability of the Internet for the population. African countries have the lowest values of the indicator in the world, in most of which it does not reach 25.

High-performing countries effectively take advantage of mobile cellular network expansion, such as facilitating Internet access in remote areas where there is no fixed network, facilitating the development of IoT, expanding Internet usage, etc., all of which contribute to their growth. However, as mentioned before, only 66 % of the world's population are Internet users, and 19% in the least developed countries. SDG target 9.c – to provide universal and affordable access to the Internet in least developed countries by 2020 – has not been met. While virtually all urban areas of the world are covered by a mobile broadband network, gaps persist in rural areas. In the least developed countries, 14 per cent of the rural population have no mobile network coverage at all, while another 12 per cent have only 2G coverage (UNO, 2022D). This is due to the insufficient level of knowledge and skills, as well as high costs. Therefore, the governments of individual countries, and first of all - the least developed ones, and the international community as a whole should pay attention to that part of society that was left behind the opportunity to use the advantages of the Internet to promote faster development.

A number of targets within SDG 9 involve the modernisation of infrastructure and industries, technological capabilities of industrial sectors in all countries, and support for the development of internal technologies, research and innovation, which cannot be accomplished without the use of the latest technologies, implementation of new technical solutions and developments. Therefore, despite the significant achievements of individual countries in the field of ICT and the promotion of digital transformation, there is still a significant asymmetry in the global dimension, the overcoming of which will accelerate the implementation of the tasks of SDG 9 and will be a fundamental factor that will contribute to the expansion of the possibilities of using ICT to achieve other sustainable development goals.

The indirect impact of digitalisation on the Sustainable Development Goals

The relationship between sustainable development goals and digitalisation is characterised by dualism and interdependence. Development of ICT, and modernisation of infrastructure is not only an important component of SDG 9 achievement, but at the same time, they are necessary conditions for achieving a number of other sustainable development goals. The application of existing ICT advantages and the development of new ones is one of the tools that should be actively used by countries to accelerate the achievement of sustainable development goals, which, at first glance, have no connection with digitalisation. Artificial intelligence is already used in many areas of our lives, with high levels of penetration in financial services, e-commerce, healthcare, education, agriculture and manufacturing. Emerging markets can greatly benefit from harnessing the power of AI to address existing challenges in infrastructure and critical sectors (World Bank, 2018), opening up new opportunities to unlock the value of big data for decision-making, which can overall accelerate progress towards

achieving the Sustainable Development Goals (UNO, 2019A). The role of ICT is especially evident in modern conditions of permanent crises and instability. The pandemic hit manufacturing industries hard, caused disruptions in global value chains and product supply, which also has a negative impact on employment levels.

A significant number of digital transformation tools enabled well-developed countries to support their economies during the pandemic. It was possible thanks to the transition to the online mode and transformation of business processes when representatives of certain industries were able to avoid bankruptcy, continue their functioning, and save jobs. For example, in India, digital transformation is driving significant employment growth, with 3 to 4 new jobs created for every job in the business process outsourcing and IT services sectors. According to forecasts of the experts of the World Economic Forum (2023), about 6 million jobs can be created by 2025 due to the digital transformation only in the fields of energy and logistics. Thus, it is possible to outline a significant positive impact of digitalisation on the social sphere, economic growth and therefore on the achievement of SDG 8. The pandemic has shown the level of readiness of the world community and each state in particular for effective functioning in the digital age and became a catalyst for the digital transformation of those countries or industries that were not digitised enough. The period of pandemic during 2020 – 2022 was marked by the accelerated implementation of digital technologies in the fields of healthcare, education, electronic payments, and governance, which in turn contributed to the achievement of the SDGs. So, economies that have been able to modernise their ICT infrastructure and expand the adoption of digital technologies are prepared for the recovery phase in the post-pandemic period better than others.

Digitalisation of healthcare

SDG 3 'Good Health and Well-being' and SDG 4 'Quality Education' can be considered fundamental to the prosperity of society and should be a priority for governments, especially in the least developed countries. The most attention should be paid to these SDGs for the improvement and development of healthcare and education in order to achieve progress in other goals in the future. It has been proven that the improvement of technologies and the expansion of the use of the Internet lead to rapid positive changes in the direction of achieving the specified goals, primarily in the pioneer countries in this field (Huawei, 2019). Digitisation of the healthcare sector should take place in such priority directions for improving the quality of diagnostics, increasing the efficiency of treatment and rehabilitation, as well as the introduction of remote services. So, on the basis of our research, we can offer a range of directions and particular instruments for the digital transformation of healthcare (Figure 3).

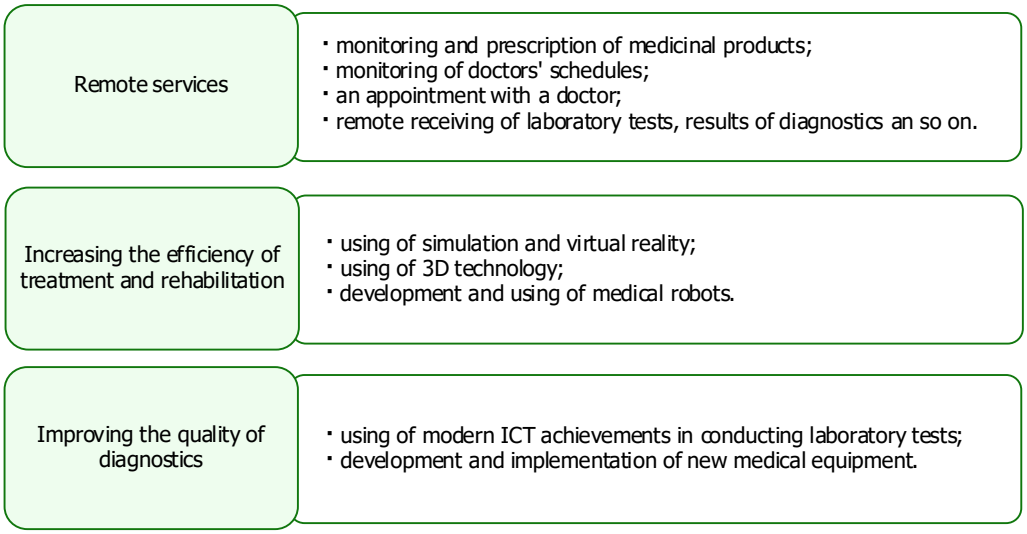

Figure 3. Directions and instruments of digital transformation of healthcare.

Diagnostics. The use of new technologies is necessary to improve the quality and speed of diagnostics in order to prevent the occurrence of certain diseases or to detect them at an initial stage. Thanks to the use of modern technology, the performance of laboratory tests is also accelerated and the accuracy and reliability of the results increases.

Treatment and rehabilitation. It is especially important to use the latest achievements, and technical and technological developments not only in diagnosis but also in treatment. Their implementation in the reality of modern surgery allows for reducing surgical interventions, increasing their efficiency and quality. The use of ICT, virtual reality and simulation is necessary for the development of the latest medical equipment, which allows improving the treatment procedures.

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The expansion of the use of digital technologies in medicine makes it possible to accelerate the pace of development in this field. The use of 3D technology and robotics in the medical field is promising. During the COVID-19 pandemic, a vivid example of the positive impact of ICT and innovation on healthcare was the use of medical robots, which enabled to reduce the doctor's contact with sick patients and time spent on the performance of individual procedures. However, the development and widespread dissemination of such achievements require significant spending on education, science, and research, which still remains a challenge for many countries.

Remote services. In the conditions of social distancing, the use of ICT and digital services became even more relevant, as they allowed reducing the number of contacts between patients and doctors. Thanks to the use of the Internet, it became possible to access the results of tests, monitor, check the availability of drugs and make online orders, find the doctor's schedule and make an appointment, etc. All this allows people to reduce the time spent on these procedures and the number of visits to medical institutions. Moreover, at the same time, the issue of creating an inclusive environment is being solved, because the spread of ICT makes it possible to provide the most remote regions and various population groups with access to remote medical services.

Information and communication technologies play an important role in healthcare, supporting the economy and society during the COVID-19 crisis. The use of digital technologies has helped maintain communication between governments and the public during the outbreak of a pandemic and enabled governments to make rapid policy decisions based on real-time data and analytics. Timely, secure and reliable access and sharing of data was critical during the pandemic to improve the effectiveness of public policy at the national level and to facilitate global collaboration on vaccine development and distribution. Obstacles on the way to achieving SDG 3 from the point of view of digitisation are the insufficient level of digital literacy and the lack of necessary equipment in certain population groups within the same country or even in entire regions, which restrains the expansion of digital services in medicine. This problem is also typical for Ukraine. Due to the low level of income, some groups of the population, including the most socially vulnerable, cannot purchase the necessary gadgets or pay for access to the Internet, which prevents them from using the benefits of ICT in general and in the field of healthcare in particular. On the other hand, certain segments of the population, mainly representatives of the elder generation, do not have the necessary digital skills, therefore the issue of increasing digital literacy and overcoming gaps in the quality of education is urgent.

Digitalisation of education

The favourable impact of digitalization on education is manifested in expanding the population's access to educational services, increasing the level of literacy, improving the educational process and improving the quality of educational services, and development of inclusive education, which contributes to the faster achievement of SDG 4 "Quality education" (Figure 4).

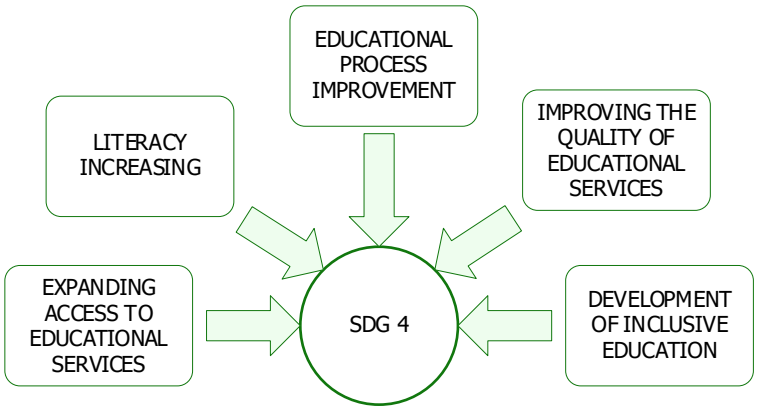

Figure 4. The positive impact of digitalisation on the achievement of SDG 4 "Quality Education".

During the last decade of the 2000s, there was significant progress in increasing access to education and the number of school attendance, especially for girls. Before the coronavirus crisis, the share of children and youth who did not attend primary and secondary school decreased from 26% in 2000 to 17% in 2018. However, some countries still lack access to education. More than 50% of all out-of-school children live in sub-Saharan Africa (UNESCO, 2019). The problem of access to education is solved at the governmental level in various states by implementing the appropriate legal framework and monitoring its implementation, as well as popularising education among the population and ensuring citizens' access to educational services, expanding Internet coverage. Thanks to the digitisation of the population in the most remote regions,

where offline education is not provided, it would be possible to use remote educational services using online learning platforms.

SDG 4 targets include ensuring equal access of all women and men to quality education and increasing the number of people with relevant skills, including technical and vocational, for employment and entrepreneurship. Digital transformation is important and required for achieving these targets. It will expand global access to information and educational services. Within SDG 4, society also faces the target of eliminating gender disparities in education by 2030 and ensuring equal access to education for vulnerable segments of the population, as well as building and modernising educational institutions that take into account the needs of children and provide a safe, non-violent, inclusive and effective learning environment for all. These targets confirm the important role and necessity of the development of inclusive education, which could provide access to learning for everyone, regardless of age, gender, and physical capabilities. According to UNESCO (2020), the formation of an inclusive education system should be a priority for all countries and will facilitate the learning process for all subjects of education, both students and teachers. In low- and middle-income countries, children with disabilities were 19% less likely to reach the minimum reading level (UNO, 2022B). In well-developed countries, this issue is solved by the creation of remote learning programs for children with disabilities, and the development of special platforms where training courses are posted taking into account the special needs of students, which allow studying at home. This approach helps to eliminate existing disparities and requires state support in terms of financing online education and ensuring access of vulnerable sections of the population to the Internet and the necessary software.

In 2020, because of the COVID-19 pandemic, most countries announced temporary school closures, affecting more than 90% of students worldwide. By April 2020, about 1.6 billion children and young people were not in school (UNO, 2022B). The use of ICT and EdTech made it possible to implement remote learning and ensured the continuity of the educational process in a number of countries. One of the examples is Ukraine, where the transition to remote learning was made in all educational institutions due to the high level of Internet coverage. The Ministry of Education and Science of Ukraine launched the educational platform "All-Ukrainian School Online", which contributed to the continuous education of students during the quarantine restrictions. At the same time, the transition to online education made it possible to identify weaknesses in the education system. Pupils and students who were not able to have an Internet connection were left out of the educational process. These are mostly people who live in remote regions where there is no high-quality network coverage. The key directions the government should focus its attention on in order to build a sustainable education system in Ukraine and contribute to the achievement of SDG 4 from the point of view of digitalisation are equipping educational institutions with modern equipment, computer technology, providing schools with access to the Internet, as well as expanding network coverage in those regions where there is currently no fixed connection. Therefore, the priority direction in the field of education for all countries should be equipping educational institutions with technical tools, and providing access to the necessary technologies, and the Internet in order to implement distance learning effectively.

In the conditions of digitisation of the economy, the states face the need to create educational projects, programs, and schools on digital literacy that would enable elder people to acquire the necessary knowledge and skills. The advantages of such training will be the development of an inclusive environment where the elder generation can independently pay bills, make transfers, order delivery of goods, and also receive the necessary services remotely. All this will contribute to the development of the concept of lifelong learning and acceleration of the achievement of SDG 4 (Onopriienko et al., 2023). In addition, the digital literacy of the older population will allow to ensure financial and social inclusion during forced distancing.

Some countries, including Ukraine, already have experience in state support for the formation of adults` digital literacy. For example, in Switzerland, which ranks first among European countries and third in the world according to the Global Connectivity Index (Huawei, 2020), a lifelong learning program covering 50% of the cost of digital advanced training has been introduced as part of the Digital Switzerland concept (Digital Switzerland, 2022).

It is impossible to identify the impact of digital transformation on the achievement of one specific sustainable development goal separated from the others. Thus, the spread and use of digital technologies in education also contribute to the increase in the number of skilled labourers on the labour market, and to ensuring gender equality in society due to the formation of equal access for all to education. Women who are forced to stay at home because of childcare or other circumstances can work remotely. It also enhances gender equality (SDG 5) and contributes to building an inclusive society. However, in low- and middle-income countries, women's access to the Internet and mobile phones is held back by the high cost of ICT. Gender inequality in ICT is exacerbated by the fact that women tend to have less access to ICT and lower levels of digital literacy, as well as the low number of women and girls studying and working in ICT according to the International Telecommunication Union (2020C). Expanding Internet coverage in regions where there are not enough jobs will allow the population to work remotely, reducing the unemployment rate and improving the quality of life. This approach will

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make it possible to increase the level of employment in rural areas and remote regions of Ukraine as well. This shows the positive impact of increasing digital literacy and access to ICT on poverty alleviation and, accordingly, achieving SDG 1 "No Poverty".

In modern conditions development and operational implementation of intelligent technological systems in the cities of key innovator countries is a fundamental trend that helps them become more efficient and sustainable, ensuring high international competitiveness. The concept of "smart cities" is based on the use of various types of technologies that collect large amounts of data to improve city management and ensure high standards of living for the population. A smart city is an innovative city that uses information and communication technologies and other means to improve the quality of life, efficiency of city operations, services and competitiveness, while meeting the needs of current and future generations in terms of economic, social, environmental, and cultural aspects [UNO, 2019B]. The development of smart cities will significantly accelerate the implementation of a number of tasks set within the framework of SDG 11 'Sustainable Cities and Communities. Stimulating the development and implementation of software solutions for smart cities, aimed at improving environmental, social and economic sustainability, will contribute to ensuring high living standards and achieving sustainable development in the long term.

Digitalisation and the economic component of sustainable development

Implementation of digital technologies in the companies` business processes and digitalisation of non-IT sectors of the economy will contribute to the comprehensive implementation of a number of sustainable development goals, such as SDGs 8 "Decent Work and Economic Growth", 9 "Industry, Innovation and Infrastructure", 12 "Responsible Consumption and Production", and also will give impetus to the achievement of other goals, which will generally have a synergistic effect. One of the examples of the transmission mechanism of the impact of digitalisation of the economy on achieving sustainable development goals is represented in Figure 5.

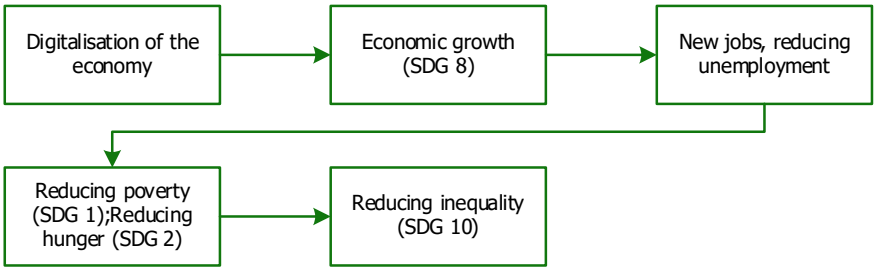

Figure 5. The transmission mechanism of the impact of digitalisation on the SDGs.

Increasing the global competitiveness of the economy requires the modernization of equipment and technologies, and the introduction of innovative solutions that enable reducing costs of production, and increase the efficiency of enterprises. The priority direction in many countries of the world is the support and development of small and medium-sized businesses. It is advisable to use digital platforms that simplify the registration procedure and facilitate business. For example, in Switzerland, the state provides information support for SMEs and ensures data protection at the legislative level. Switzerland possesses basic technologies such as microtechnology and precision engineering, which allow the country to take advantage of digitisation. Digitisation in this country consists of adapting the business model to the progress of information and communication technologies, which optimises the efficiency of the company's activities, its strategy, production and relations with customers, and allows the country to remain competitive in European and international platforms (Swiss Federal Council, 2022). In Austria, the "Once Only Prinzip" project was created (Digital Austria, 2023). It provides the collection of data from an entrepreneur for bureaucratic purposes only once, and then the system of authorities exchanges information. This gives competitive advantages of doing business in the country. In the Netherlands, digital hubs for businesses are created as a part of an overall digitalisation strategy. SMEs are also a priority, students and teachers help and support entrepreneurs in the digitisation process. During 2020, the Ministry of Economy and Climate Policy was engaged in the creation of 5 hubs for SMEs (Nederland Digitaal, 2022).

According to the rating represented in the study of the Business School of the European Centre for Digital Competitiveness (2021), France ranks third among the G7 countries and ninth among the G20 countries in promoting digital transformation. The country implemented the strategy "La French Tech" in 2013, which provides development of 3 key areas: circulation of data and knowledge, protection of rights in the digital environment, access to digital technologies that include digital apps and services, e-governance and e-commerce. A global government-initiated community and platform for entrepreneurship was created, and more than €600 million were invested there. According to the same study, Saudi Arabia ranks

second among the G20 countries. The concept "Saudi Vision 2030" and the strategy "ICT Strategy 2023" envisage the implementation and development of major digital initiatives for key sectors. Both documents are based on the Saudi Arabia National Transformation Plan (Table 1) which provides implementation of a number of ICT programs and tools for this process (Deloitte, Huawei, 2017).

Table 1. Saudi Arabia digitisation tools. *(Source: built on the basis of Digital Riser Report 2021 [6] and National Transformation in the Middle East. A Digital Journey [3])*

	Documents	Key Tools
Saudi Arabia National Transformation Plan	The concept "Saudi Vision 2030" (adopted in 2016)	▪ Implementation of ICT programs regarding: ▪ expansion of access to high-speed Internet; ▪ ICT in the field of human capital; ▪ e-commerce.
	ICT Strategy 2023	▪ road map for creating an innovative digital economy; ▪ increasing the level of technical and digital literacy; ▪ promoting research in ecosystems and start-ups; ▪ launch of co-working platforms; ▪ introduction of a low-cost contactless payment service for the development of e-commerce; ▪ development of smart cities.

The government of Saudi Arabia has developed a roadmap for creating an innovative digital economy with the aim of developing digital capabilities and attracting foreign technical investments. A broad action plan was proposed, which includes increasing the level of technical and digital literacy and promoting research in the start-up ecosystem. In 2016, a governing body for small and medium-sized businesses was established. It ensures the launch of co-working platforms, promotes the formation and development of digital skills necessary for starting a business, and builds the culture of entrepreneurship in the country. The government also announced a project in the field of building smart cities worth USD 500 billion. The aim of the project is the integration of data analytics and artificial intelligence in all aspects of modern life. In order to increase the level of digital transformation and promote e-commerce, the regulator in the monetary sphere, The Saudi Arabian Monetary Authority, introduced a low-cost contactless payment service (Deloitte, Huawei, 2017). It proves the importance of new technologies in the financial sector. Nowadays financial services are provided in brand new ways due to the wide implementation of ICT. Digitalisation made an impulse for the creation of fin-tech companies and their rapid development. These companies as new financial market players facilitate access to financial services for a population that strengthens financial inclusion (Strilchuk, 2023). The digitalisation of the financial sphere leads to the creation of sustainable and inclusive financial ecosystems. Recent research (Kuznyetsova et al., 2022) have proved the importance of financial inclusion for financial stability and economic growth as well. It should be noted that financial inclusion cannot develop without implementing new digital technologies and improving financial services taking into account the needs of excluded groups of people.

So, the conducted study demonstrates the huge impact of digitalisation on society worldwide and on the progress towards sustainable development. The research has enabled the identification of key factors that enhance achieving SDGs. (Figure 6). These factors are considered as determinants of sustainable development in terms of digital transformation.

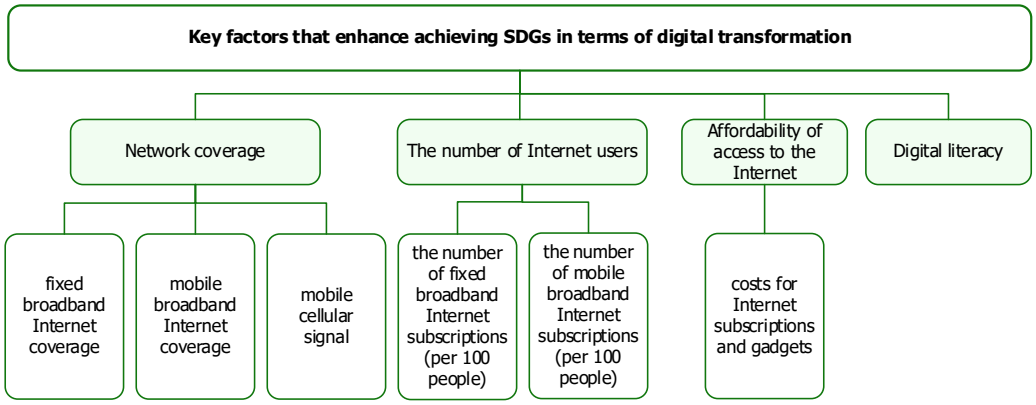

Figure 6. Key factors that enhance achieving SDGs in terms of digital transformation.

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The first group of factors is network coverage. It includes fixed broadband Internet coverage, mobile broadband Internet coverage and mobile cellular signal. These indicators are complementary and should be on the agenda in all the countries. The next identified group of factors is called 'the number of Internet users. It includes such indicators as the number of fixed broadband Internet subscriptions (per 100 people) and the number of mobile broadband Internet subscriptions (per 100 people). Analysis of these factors enables to deepen the understanding of the current situation in the particular country. The higher the indicators are the higher the possibility of sustainable growth and achieving SDGs is. The last but one outlined factor that influences sustainable development progress is the affordability of access to the Internet for the population. It relates to the costs of Internet subscriptions and gadgets. Cheap access to the Internet promotes digital inclusion that boosts access of excluded groups to remote services, jobs and so on. At the same time, a great share of the population cannot afford to buy the required gadgets. Thus, the affordability of the Internet plays a vital role in the digital transformation of any country and influences its path to sustainable development. The last but not least factor affecting the achievement of SDGs is digital literacy. It is crucial for sustainable development because people who do not have digital skills and knowledge are left behind in the modern era of digital transformation. Digital literacy is essential for customers in order to use the benefits of new goods and services as well as for businesses, entrepreneurs that develop innovative products and technologies, and governments. An increase in digital literacy leads to better usage of ICT advantages and in such a way faster achieving sustainable development targets and goals.

DISCUSSION

Digital transformation of the economy plays a vital role in fostering economic growth of a particular country and at the same time, it is important and essential for achieving sustainable development goals related to the economic part of the sustainable development. Benchmarking of practices used by well-developed countries made it possible to identify a number of priority areas related to the digitalisation of the economy, namely, the development of digital skills among the population for entrepreneurial activities, state support for the digitalisation of business, especially SMEs, promotion of e-commerce, electronic payments. At the same time, digitalisation influences social and ecological spheres as well. The development of digital strategies aimed at achieving the SDGs is important for governments.

Alojail & Khan (2023) analyse the impact of digital transformation toward sustainable development. The study demonstrates that aligning digital transformation goals with sustainable development goals increases long-term sustainability outcomes for organisations. However, the authors do not pay attention to the qualitative analyses and the impact of digitalisation on sustainable development at the macro level. Our study provides evidence that digital transformation has an impact not only on the companies` sustainability but also on the sustainable growth of the country and its input into the global progress in achieving sustainable development. At the state level, it is worth focusing attention on the creation of the necessary conditions for the circulation and storage of data and the protection of information in a digitised environment. Experts of the International Telecommunication Union (2020 A) also proved in their research that all these will contribute to such results as simplification of doing business, an increase of foreign investments, growth of the country`s attractiveness for transnational corporations, improvement of export orientation and the increase of competitiveness on the world stage. It demonstrates the positive impact of mentioned factors connected to data circulation on the economy but researchers do not pay attention to other essentials of digitalisation and their influence on ecological and social spheres. The current research demonstrates the impact of digitalisation on the SDGs by identifying its transmission mechanism. It enables to creation wider understanding of connections between different sustainable development goals and shows the influence of digitalisation of the economy on the other non-economic spheres.

The UNO Secretary General (United Nations Economic and Social Council, 2018) mentioned that the technological changes of recent years, especially due to the rapid development of ICT, have the potential to transform the economy and improve the standard of living of many people through technological convergence and recombination. We totally agree with these statements and in addition, it provides a range of factors that stimulate achieving SDGs in the context of digitalisation in order to deepen the understanding of the influence of ICT development on sustainable development. These factors include network coverage, the number of Internet users, digital literacy, and affordability of access to the Internet. The last-mentioned factor is crucial for least-developed countries where citizens in most cases cannot pay for access to the Internet. So, the implementation and expansion of digital technologies have a vital role in the achievement of most SDGs in the context of digital transformation.

CONCLUSIONS

Sustainable development is a strategic priority in most countries of the world. This is an issue of great importance and interest among researchers. The paradigm of sustainable development involves taking into account economic, ecological and social spheres of development together in their connectivity and synergy. The study outlines that sustainable development goals are interrelated and influence one another, no one goal can be achieved separately without others.

SDGs can be achieved in many ways using different tools and methods. This process started several decades ago but it needs a revision and implementation of new approaches due to the changes in a global environment. The modern digital era has its own peculiarities. Digital transformation leads to the creation of brand-new business models, modernisation of production technologies, changing supply chains etc. On the current stage of digital transformation ICT and innovative digital technologies become the main factors that influence SDGs` achievement. The development of the ICT sector leads to the accelerating pace of economic and social development, creating a stable base for economies` growth and at the same time, it has a positive impact on solving environmental and social problems. The creation and implementation of digital development strategies covering all spheres of life is on the agenda in most countries in the world. It will enable the increase of the economic growth rate of the particular country, improve its position in the global market, as well as accelerate the achievement of the sustainable development goals and their targets. The conducted analysis has shown that there is a direct impact of ICT development and digitalisation on the speed of achieving SDG 9 Industry, Innovations and Infrastructure. Moreover, digital technologies have penetrated all spheres of life, not only the economy but also social and ecological ones. So, in terms of digital transformation sustainable development cannot be achieved without using digital technologies and their advantages. Development and implementation of innovative digital technologies foster meeting SDGs and their targets in an indirect way as it helps reduce inequality in different spheres, exclusion, hunger, and unemployment levels as well as promote gender equality, better education, access to information and services, financial inclusion and so on.

In order to use all the advantages of digital technologies and leave no one behind digital transformation should be conducted on a national level. Governments should support this process, and prioritise sectors that are to be digitalised first of all according to their national requirements and interest. Leading practices of digital transformation worldwide have been analysed in the study. On this basis, it is found that leading well-developed countries that are highly competitive such as Switzerland, Austria, Saudi Arabia and others, have long-term strategies for their development. A core part of such a strategy is digital transformation, its priorities and tools. We conclude that the national-based approach leads to faster digital transformation and its higher impact on different sectors of the economy, environment protection and social development level that is favourable for sustainable development. Countries that are not digitalised enough have to improve the process of their digital transformation and in this way contribute to global sustainable development.

Thus, conducted research outlines key factors to enhance achieving SDGs in terms of digital transformation that can be divided into 4 groups: 1)network coverage: fixed broadband Internet coverage, mobile broadband Internet coverage, mobile cellular signal; 2) the number of Internet users: the number of fixed broadband Internet subscriptions, the number of mobile broadband Internet subscriptions; 3) affordability of access to the Internet: affordability of the Internet subscriptions and gadgets for the population, especially in least developed countries; 4) digital literacy. These factors are paramount determinants of sustainable development from a global perspective and can be used as basic indicators for the creation digital transformation plan for sustainable development at the national level.

It is worth mentioning that findings on the determinants of sustainable development are mixed and it proves the necessity and relevance of further research in this area especially in a digital economy paradigm. Future research can be based on this one and be extended by combining micro and macro-level analyses of sustainable development determinants.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

The Authors have contributed equally.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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Стрільчук Ю., Краснова І., Ходакевич С., Мецгер Є., Стрижак А., Дубас А.

ДЕТЕРМІНАНТИ СТАЛОГО РОЗВИТКУ В КОНТЕКСТІ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ

Сьогодні просування до сталого розвитку є пріоритетом для країн по всьому світу. Розуміння сутності сталого розвитку є основою для проведення необхідних досліджень і практичних дій. Метою дослідження є виявлення глобальних детермінант сталого розвитку в контексті цифрової трансформації. Ера цифрових технологій створює нові підходи до розв'язання наявних проблем і викликів. Тому життя в новій нормальності вимагає визначення глобальних детермінант сталого розвитку й створення нових інструментів для досягнення його цілей. Дослідження надало емпіричні докази та довело, що інформаційно-комунікаційні технології є одним із важливих драйверів сталого розвитку. Проведений аналіз показав, що існує прямий вплив розвитку ІКТ й цифровізації на швидкість досягнення ЦСР 9 «Промисловість, інновації та інфраструктура». У дослідженні проведено аналіз опосередкованого впливу диджиталізації на цілі сталого розвитку. Доведено, що впровадження цифрових технологій у бізнес-процеси компаній і цифровізація секторів економіки, не пов'язаних з ІТ, сприятимуть комплексній реалізації низки цілей сталого розвитку, таких як ЦСР 3 «Гарне здоров'я та благополуччя», ЦСР 4 «Якісна освіта», 8 «Гідна праця та економічне зростання», 9 «Промисловість, інновації та інфраструктура», 11 «Сталі міста», 12 «Відповідальне споживання та виробництво», а також дасть поштовх для досягнення інших цілей, що загалом матиме синергетичний ефект. Бенчмаркінг практик розвинутих країн дозволив визначити низку пріоритетних напрямів, пов'язаних із цифровізацією економіки, а саме: розвиток цифрових навичок населення для підприємницької діяльності; державна підтримка цифровізації бізнесу, особливо МСБ; просування електронної комерції, електронних платежів. Дослідження робить внесок у наукову дискусію щодо впливу цифровізації на сталий розвиток, демонструє взаємозв'язок між Цілями сталого розвитку та висвітлює отримані результати щодо глобальних детермінант сталого розвитку. Проведене дослідження окреслює 4 групи факторів для посилення досягнення ЦСР в умовах цифрової трансформації: 1) покриття мережі; 2) кількість користувачів інтернету; 3) доступність інтернету; 4) цифрова грамотність.

Ключові слова: сталий розвиток, цілі сталого розвитку, стале зростання, цифрова економіка, цифрова трансформація, диджиталізація, інновації

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