

THE INFLUENCE OF DIGITALIZATION ON THE CONCEPT OF SUSTAINABLE DEVELOPMENT

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Digitalization has become an essential part of modern business, facilitating the conversion of analog data into digital format for easier storage, sharing, and access. As organizations continue to adopt digital technologies to streamline their operations and improve efficiency, they are also recognizing the importance of sustainability. Sustainability includes reducing environmental impact, minimizing waste and maintaining ethical business practices. This paper explores the intersection of digitalization and sustainability in the business world. Digitalization has had a significant impact on business operations, leading to increased efficiency and productivity at the same time, sustainability has emerged as a critical issue for organizations, with consumers and stakeholders demanding environmentally responsible practices. This paper seeks to examine how businesses can use digitalization to achieve sustainability goals and create a positive impact on the environment and society.

Keywords:
sustainable development, goals of sustainable development, digitalization, modern business, organizations

1 Introduction

The world is passing through an era of digitization where most of our daily activities are highly dependent on innovative digital and computer technologies. These modern technologies have found their application in socio-economic, environmental, sustainable and climate research to improve the productivity and efficiency of the given system (Balogun et al., 2020). The 2030 Agenda for Sustainable Development, adopted by the UN General Assembly in 2015, sets out an ambitious program for the universal achievement of economic, social, environmental and institutional goals, concretized in 17 sustainable development goals (SDG - *Sustainable Development Goals*).

The need for better digital technology infrastructure is often seen as a challenge to social sustainability that can widen the gap between developed and developing regions instead of narrowing it. There is a need to provide infrastructure and equal access to the Internet in order to achieve the goals of reducing inequality and poverty, in line with the need to provide end users with all the benefits of digitalization.

Companies today, recognizing the importance of sustainability, are increasingly adopting digital technologies in order to simplify their operations in order to improve efficiency and effectiveness. Digitization has become an essential part of modern business, facilitating the conversion of analog data into digital format for easier storage, sharing, and access. The digitalization of enterprises has had a profound impact on various aspects of their operations. Digital technologies have enabled companies to collect and analyze data more efficiently, leading to better decision-making and improved overall performance (Petković, 2023).

2 The concept of sustainable development

Until today, sustainable development had various definitions and interpretations that differed significantly. Consensus in defining this term was provided by the World Commission on Environment and Development (WCED), which in 1987 in one of its reports (the Brundtland Report) defined sustainable development as "... development that meets the needs present without jeopardizing the ability of future generations to meet their own needs." With this definition of sustainable

development, the World Commission on Environment and Development highlighted as the leading goal the satisfaction of current needs by the safe use of available resources from the environment so that the needs of future generations can be met by using non-depleted resources. According to Levi Jakšić & Marinković (2012) "Sustainable development is an interdisciplinary scientific and teaching field that has been intensively developing in recent decades and finds its basis in practically all scientific fields - natural, technical, social, mathematical, medical".

In this paper, the emphasis will be on the impact of ubiquitous digitalization on the concept and dimensions of sustainable development.

3 Digital transformation and sustainable development

Industry 4.0 (a term that describes digital transformation in industry) will profoundly change industrial operations. In a recent review of Industry 4.0 and implications for sustainability, Bonilla et al. (2018) identify in the literature "a consensus that the long-term impacts of Industry 4.0 on sustainable development are still unclear". Liao et al. (2021) state that assessing digital transformation requires a multidisciplinary framework that integrates industrial ecology, economics and engineering, with the focus of their work on artificial intelligence in industrial applications. Muller et al. (2018) report the results of a questionnaire distributed among several hundred industry practitioners and find that "Industry 4.0 is expected to transform industrial production as well as society, with the aim of economic, environmental and social achievements". Quantitative and specific research on the interdependence of digital transformation and sustainable development is emerging and growing.

A number of studies, for example, Andrae and Edler (2015) and Jones (2018), express concern about the growing use of electricity for digital services and the increasing share of digital technology in global electricity consumption. Also, the materials contained in ICT and future volumes of waste are concerns that warrant further research into future growth and the impacts and potential of circular economy strategies. Bai et al. (2020) state that there is a lack of sufficient guidance in the scientific and practical literature regarding the sustainability implications of Industry 4.0. At a conceptual level, the link between digital transformation and sustainable development is well established at the level of industrial process clusters. From numerous case studies and surveys, specific potential benefits and negative

impacts of sustainability have been identified. Examples include increased recycling, increased technology transfer around the world and better quality and more durable products, but also increased waste streams, resource extraction and energy use. The immediate benefits of implementing digital transformation lie at the process and process cluster level, but the ultimate (long-term) sustainability gains and constraints, especially those relevant to the Sustainable Development Goals, are found at higher system levels involving policy and transformations throughout the economy and society (Pauliuk et al., 2022).

4 The two-way impact of digitization on sustainable development

The fourth industrial revolution is a unique phase in the history of mankind because the development of technology lays the foundation for the progress of society as a whole. This fact emphasizes the necessity of studying the impact of digital technology on the goals of sustainable development as an imperative for the development of modern society.

4.1 Potential disadvantages of the impact of digitization

Digital technologies have been one of the main vectors of economic growth in recent years and will retain that role in the long term. Developed countries offer a higher level of social and economic development, but a moderate (slower) rate of economic and digital growth (Ju & Hou, 2020). The main social costs of digital economic growth in developed countries are related to the education of personnel through mass training. This cost increases social tensions and competition between sellers in the market. Environmental costs are associated with increased energy consumption because automation increases the energy intensity of production and consumption. However, these costs are being successfully reduced through the use of leading energy-intensive digital technologies, the smart grid, and the transition to alternative energy sources (Zhang et al., 2020). Developing countries are vulnerable to the negative consequences of digital economic growth, which is much higher. They suffer social costs associated with a higher unemployment rate, a decrease in wages and living standards of the population, as well as environmental costs manifested by an increase in the volume of consumption of natural resources and the accumulation of production waste, which leads to the degradation of the environment and the quality of life.

4.2 Examples of digitization in the service of sustainable development

Digital technologies enable companies to increase production capabilities and fully satisfy public demand for goods and services. Digital finance ensures transparency and control of the economy. Digital training is available, encouraging the popularization of lifelong learning. A digital approach to the organization of value added chains enables full-scale monitoring and guarantees product quality and on-time delivery (Wamboye et al., 2020). The benefits of digital technology development are more obvious in developed countries. Social benefits are associated with the creation of highly efficient, highly paid, intensive and creative jobs. Developing countries have social benefits for labor force and social mobility, while the environmental benefits are poorly manifested. Different aspects of digital technology development contribute differently to the Sustainable Development Goals.

The work of Popkov et al. (2022) aims to study the 10 most developed and the first 10 developing countries, which have shown the best results in the implementation of the Sustainable Development Goals and their perspective on the development of digital technology to solve current major challenges. The research provides a description of the cause-and-effect relationships between the development of digital technology and the likelihood of achieving progress in each of the 17 goals. This makes it possible to prove that the development of digital technologies is suitable for solving the great challenges of sustainable development and the most complete characterization of the impact of digital technologies on the implementation of sustainable development goals. Progress in the implementation of sustainable development goals in developed and developing countries should be investigated separately, taking into account their specificities.

The Internet is one of the most critical manifestations of the advancement of digital technology. According to most authors, it is developing intensively in smart cities. Another manifestation of the progress of digital technology is the analysis of big data, which, according to Bertello et al. (2020), depends on the telecommunications infrastructure. Kovaleva and Kanke (2021) prove that the development of intelligent technologies takes place during the transition to the digital economy under the influence of state and corporate management. Thus, the aforementioned publications formed a clear idea of the advancement of digital technology as a socio-

economic category, which is treated as a process of creating and spreading leading technologies, which include artificial intelligence, the Internet, blockchain, ubiquitous computing and robots. Scientists emphasize the potential contribution of the advancement of digital technology to the implementation of the Sustainable Development Goals. Bebbington and Unnerman (2020) propose that the Sustainable Development Goals be integrated into accounting practice to ensure their accurate quantitative and comprehensive monitoring worldwide. Fakhar Manesh et al. (2020) believe that it is necessary to manage knowledge in the conditions of the fourth industrial revolution in order to support sustainable development. Mhlanga (2021) confirms that artificial intelligence in Industry 4.0 has a negative impact and creates challenges for the fight against poverty, innovative development, infrastructure development and the implementation of sustainable development goals in developing economies. Khan et al. (2021) present a systemic reflection of the triple bottom line and the perspective of the circular economy and sustainable business models, proving that Industry 4.0 changes the rules on the implementation of sustainable development goals and makes it difficult to achieve them. Chen et al. (2021) demonstrate the potential negative impact of technological innovations on energy efficiency in the age of Industry 4.0 and determine the moderate character of the gray economy in sustainable development.

Summarizing the results of existing studies, it is possible to conclude that the progress of digital technology could stimulate major challenges of sustainable development. Reducing or preventing the negative consequences of the progress of digital technology is possible with the help of: the spread of smart technologies that save resources and energy; development of distance learning and robotization of education for mass training of qualified digital personnel.

Mirgaderi (2021) recommends the use of an artificial neural network to estimate the index of sustainable development goals. Leading technologies will enable monitoring of progress in the sphere of implementation of sustainable development goals. Advances in digital technology also enable a (potentially) effective response to the COVID-19 pandemic and crisis by: using leading technologies to develop telemedicine and increase the quality and availability of public health services; increasing the quality of life and environmental protection based on smart economic practices.

The work of Popkov et al. (2022) shows that the impact of digital technologies on sustainable development is two-way - it is positive for some of the goals of sustainable development, and harmful for others. The quantitative impact of the development of digital technology on the implementation of sustainable development goals is positive. This enables the use of digital technologies as an advanced tool for the SDGs, although different aspects of digital technology development contribute differently to the implementation of the SDGs. Social development in developed countries has a high correlation with digital knowledge (75.16%) and digital technologies (77.16%); globalization, with digital knowledge (74.15%). In developing countries, digital technologies contribute little to the development of institutions and the implementation of sustainable development goals. The most prominent (although statistically insignificant) connections are observed between social development and digital infrastructure (9.94%) and digital technologies (11.71%) and between economic freedom and digital infrastructure (40.86%).

5 The impact of digitization on individual sustainable development goals

Information and communication technologies can help accelerate progress towards each of the United Nations' 17 Sustainable Development Goals. Efficient and affordable ICT infrastructure and services help countries engage in the digital economy and boost their economic competitiveness and prosperity. Most of the world's 42 least developed countries are making impressive progress towards SDG 9, with significant impact on financial inclusion, poverty reduction and improved health. ICTs provide the means to deliver high-quality goods and services in health, education, finance, commerce, governance, agriculture and other vital areas. According to the latest statistics from the International Telecommunication Union (ITU), less than half of the world's people still do not use the Internet. Disadvantaged populations, especially women and girls, the elderly, persons with disabilities, indigenous populations and the economically disadvantaged, as well as people living in the world's least developed countries, landlocked developing countries and small island developing states, should be included in the emerging digital society to meet all 17 SDGs. Much of the ITU's work is aimed at expanding ICT networks, promoting an enabling environment, encouraging investment in telecommunications/ICT networks and fostering digital inclusion.

The COVID-19 pandemic has increased connectivity, as more people have moved online to continue working, studying and staying in touch with friends and family during quarantine. However, the challenges of the pandemic and the economic slowdown have created additional problems for achieving the Sustainable Development Goals. The international community has pledged to draw lessons from the global challenge of the pandemic. Increased connectivity and ICT can form a major part of building better, countries can use increased connectivity to better engage with their citizens to achieve the SDGs.

- SDG 1

A world without poverty: More than 2 billion people in the world do not have bank accounts, while access to digital financial services has been proven to help lift people out of poverty. The Financial Inclusion Global Initiative (FIGI), launched in 2017 by the ITU, the World Bank and the Committee on Payments and Market Infrastructure, with support from the Bill & Melinda Gates Foundation, is expanding digital financial inclusion in developing countries.

- SDG 2

A world without hunger: By making farming practices more data-driven, ICT solutions can help farmers increase crop yields while reducing energy use. The UN Food and Agriculture Organization (FAO) has been working closely with the ITU since 2017 to foster ICT innovation in agriculture.

- SDG 3

Good health: Direct interaction with patients, health informatics and telemedicine can be improved through better connectivity. The Digital Health for Africa partnership, launched by the ITU and the World Health Organization in 2017, has enabled the development of digital health capacity for more than 15 countries in Africa. Be Healthi, Be Mobile is another ITU-WHO collaboration. Current and upcoming ITU standards for multimedia systems, developed in collaboration with other organizations, will support the widespread use of digital health applications, including telemedicine and remote medical imaging.

- SDG 4

Quality education: The ITU and the International Labor Organization (ILO) are leading the Digital Skills for Decent Jobs Campaign, which aims to equip 5 million young men and women with job-ready digital skills by 2030. The Giga Initiative, founded by ITU and UNICEF, monitors and promotes connectivity in schools.

- SDG 5

Gender equality: According to ITU statistics, 250 million fewer women were online than men in 2017. Globally, 62% of men use the internet compared to 57% of women. Although the digital gender divide has narrowed in all regions of the world and virtually eliminated in the developed world, a large gap still exists in the least developed countries (where 31% of men are online, compared to only 19% of women) and in developing countries with no access to the sea (where 38% of men compared to 27% of women). To close the digital gender gap, ITU members organize the annual International Girls in ICT Day to encourage more women and girls to pursue science, technology, engineering and mathematics. Gender equality initiatives in which ITU is directly engaged include EQUALS, a ground-breaking global network for building the evidence base and improving women's access to technology, building relevant digital and other skills and promoting women's leadership in the technology sector.

- SDG 6

Clean water and sanitary conditions: New digital technologies facilitate smart management of water and sewage. The ITU Smart Sustainable Cities Focus Group monitors key trends in urban smart water management, including ICT for wastewater management.

- SDG 7

Available and renewable energy: The increasing use of technology contributes to the emission of carbon dioxide and other greenhouse gases. The industry is exploring ways to harness greener energy, make appliances more energy efficient and incorporate solar, wind and other renewables into the value chain. At the same time,

cutting-edge technology will be essential to reducing global emissions, building smart grids and cities, electrifying transport and building sustainable economies and societies. The ITU has helped set stricter energy efficiency and emission control standards for ICT and has shown how smart grids can help build more controlled and efficient energy systems and reduce carbon emissions.

- SDG 8

Decent work and economic growth: Technology creates new jobs, enables resilient work and trade, and stimulates broader social and economic development. The ITU Digital Innovation Framework helps countries, cities and other communities and systems accelerate their digital transformation, stimulate innovative ICT-focused entrepreneurship and boost the small and medium-sized enterprise (SME) sector.

- SDG 9

Industry, Innovation and Infrastructure: Much of the ITU's work is directly aimed at improving the scope and quality of the ICT infrastructure of radiocommunication networks and expanding networks to underserved remote and rural areas. ITU standards improve the energy efficiency and performance of ICT networks, in wired and radio communication networks.

- SDG 10

Reduced inequalities: ITU works to reduce inequality within and between countries, communities and populations by expanding access to technologies and knowledge to vulnerable segments of society.

- SDG 11

Sustainable cities and communities: United for Smart Sustainable Cities (U4SSC), launched by the ITU and the United Nations Economic Commission for Europe (UNECE) in 2016, helps cities take key steps to become smart and sustainable. Fifty cities from several countries around the world have joined this project

- SDG 12

Responsible consumption and production: E-waste, including ICT-generated waste, is growing worldwide. ITU has launched a coalition to produce a Global Monitor of e-waste and strengthen cooperation in solving the global challenge of electrical and electronic equipment waste. The ITU also develops global strategies, standards and policies that offer guidance for the sustainable management of e-waste.

- SDG 13

Action for the climate: Digital tools enable increasingly sophisticated climate modeling. ITU facilitates international cooperation on policies and standards to reduce energy consumption for ICT products and services. Key ITU standards promote green data centers and green energy power systems. ITU is conducting a joint project to model cities using digital twin modeling.

- SDG 14

Life under water: ICTs are widely used to monitor the changing marine environment (eg the movement of ice flows and the movement of glaciers). Buoys can be equipped with remote monitoring to monitor changing sea conditions (eg salinity levels of the water above the buoy). Sensor networks and RFID chips can be used to protect endangered animals (eg whales and dolphins) to learn about their migratory patterns and needs.

- SDG 15

Life on land: ICTs can be used to identify, monitor and photograph wildlife populations. Sensor networks and RFID chips can be used to protect endangered animals (eg lions, elephants and tigers) to learn more about their migratory patterns and protection needs.

- SDG 16

Peace, justice and strong institutions: E-government services help improve the relationship between citizens and the state and improve the efficiency of the provision of state services. ITU helps empower citizens through its work on smart sustainable cities and key performance indicators (KPIs) that measure social

inclusion, such as voter participation or the number of government services delivered electronically.

- SDG 17

The power of partnership: Public-private partnerships are key to bringing ICT to all nations, peoples and communities. Partnerships are particularly needed to build the physical infrastructure needed to deliver Internet services to hard-to-reach areas and currently vulnerable populations, as well as to facilitate the investment, inclusion and innovation needed to meet the SDGs across the board.

6 Conclusion

Digitization has played a significant role in facilitating and improving the lives of individuals. From a social vision, the digital network has enabled the citizens of the world to open up to other cultures, to access additional information, to predict natural disasters, etc. The digital revolution, with the increased digitization of content and services and the development of the Internet, has provided undeniably significant benefits. The use of remote sensing is increasing agricultural production, and the early application of various hardware (eg sensors, drones, precision fertilization, etc.) combined with geo-mapping is leading a new agricultural revolution, given the opportunities to increase production yields and improve sustainable agriculture. Smart cities of the future should provide affordable water of the highest quality for all its citizens. Big data and digitization play a key role in meeting these goals. Digitization can improve energy efficiency and provide sustainable alternatives. Healthcare and equal access to health have been revolutionized by digitization. Digital tools play a vital role in promoting well-being and improving quality of life by facilitating access to healthcare. The interconnectedness of the goals of sustainable development is indisputable. Digitization and artificial intelligence support low-carbon energy systems while integrating highly efficient renewable energy that can also monitor and model climate and biodiversity responses over time. Digitization defines the path to a green planet by providing solutions and helping sustainable development. The integration of the Internet and the management of big data have already shown numerous advantages. Particular attention should be paid to the implications of unequal access to data that can lead to digital poverty and therefore increase inequalities instead of

reducing gaps. However, the benefits of integrating digitization into everyday life can drastically help humanity face sustainable challenges.

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