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Probing the Impact of Digital Transformation (DT) on the Fulfillment of Sustainable Development Goals (SDGs) in the EU Countries

استكشاف تأثير التحول الرقمي (DT) على تحقيق أهداف التنمية المستدامة (SDGs) في دول الاتحاد الأوروبي

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Abstract:

This study explores how (DT) contributes to attaining (SDGS) in EU countries. Digital Economy and Society Index (DESI) and total advancement towards achieving all 17 SDGs have been relied upon as data sources. (SPSS, v28) was used for data analysis. The results showed an important impact of (DT) on advancement towards achieving (SDGs) in EU countries, especially regarding (IDT). (IDT) has always been an important indicator of sustainable development, as it is a necessary and key driver in most aspects of human life. The study's results specify the relationship between the variables used. It was found that digital transformation through (IDT) positively affects advancement toward achieving (SDGs). On the other hand, no significant impact was found for connectivity (C), human capital (HC), or digital public services (DPS) on the level of this progress.

Keywords: Digital Transformation (DT), Sustainable Development Goals (SDGs), Connectivity (C), Human Capital (HC), Integration of Digital Technology (IDT), Digital Public Services (DPS).

JEL Classification Codes: Q01, O14, 052.

ملخص:

تهدف هذه الدراسة إلى تحديد مساهمة التحول الرقمي في تجسيد أهداف التنمية المستدامة في دول الاتحاد الأوربي. كمصدر للبيانات، تم الاعتماد على مؤشر المجتمع والاقتصاد الرقمي، ومؤشر التقدم في تحقيق الأهداف التنمية المستدامة. تم استخدام الحزمة الإحصائية للعلوم الاجتماعية (SPSS, v28) لتحليل البيانات. أظهرت النتائج أثرا مهما للتحول الرقمي على مستوى التقدم في تحقيق أهداف التنمية المستدامة في دول الاتحاد الأوربي، سيما فيما يتعلق بدمج التكنولوجيا الرقمية. لطالما كان دمج التكنولوجيا الرقمية مؤشرا هاما على التنمية المستدامة، لأنه محرك ضروري ورئيسي في معظم جوانب عيش الإنسان. تقدم نتائج الدراسة تفاصيل محددة عن العلاقة بين المتغيرات المستخدمة. وُجد أن التحول الرقمي من خلال دمج التكنولوجيا الرقمية له أثر إيجابي على مستوى التقدم في تحقيق أهداف التنمية المستدامة، من جهة أخرى، لم يتم إيجاد أثر معنوي لكل (الاتصالية، رأس المال البشري، الخدمات العامة الرقمية)، على مستوى هذا التقدم.

كلمات مفتاحية: التحول الرقمي (DT)، أهداف التنمية المستدامة (SDGs)، الاتصالية (C)، رأس المال البشري (HC)، تكامل التكنولوجيا الرقمية (IDT)، الخدمات العامة الرقمية (DPS).

تصنيفات JEL: Q01، O14، O52.

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INTRODUCTION

Digitalization refers to utilizing digital information to streamline and enhance existing workflows, aiming to make them more straightforward and effective. This concept involves leveraging digital technologies to facilitate and enhance various processes. Digital transformation, on the other hand, encompasses an approach that incorporates digital technologies into our daily lives by converting anything that can be converted into a digital format.

Digital transformation is a complex and far-reaching phenomenon that impacts various aspects of human activity, including technology, economy, politics, and society. It is often called the Fourth Industrial Revolution due to its wide-ranging effects. While digital transformation has gained popularity as a trend, effectively and positively adopting technology to transform businesses, organizations, or society presents greater challenges than ever. To assess Europe's digital performance, the European Commission has introduced the Digital Economy and Society Index (DESI), a comprehensive measure that combines indicators related to connectivity, human capital, integration of digital technology, and digital public services. This index tracks the progress of EU member states across these four key dimensions.

In the context of sustainable development, the 2030 Agenda, launched by the United Nations in 2015, includes seventeen Sustainable Development Goals (SDGs) to create more sustainable societies. The core idea and most important principle of sustainable development is incorporating social, economic, and environmental considerations into all decision-making processes (Zemri & Khetib, 2022). The post-COVID-19 repercussions have made the SDGs more important than ever due to the prevention of socially and environmentally equitable sustainable development due to the increasingly exacerbated inequality between industrialized and developing countries.

Progress toward achieving the EU's Sustainable Development Goals (SDGs) has gained momentum since their adoption. However, there was a setback in this progress during 2020 due to the COVID-19 pandemic. Conversely, the EU has dedicated substantial resources to facilitate digital transformation, with approximately €127 billion designated for reforms and associated digital investments in Recovery and Resilience Facility (RRFs). Although most member states have made strides in digital transformation, there is still a lag in the adoption of crucial digital technologies by businesses.

Study Questions

To explore the relationship between digital transformation and advancement toward achieving the SDGs in the EU, the study questions can be formulated as follows:

- Does connectivity (C) statistically impact the advancement toward achieving the SDGs in EU countries?
- Is there a statistically significant relationship between human capital (HC) and advancement toward achieving the SDGs in EU countries?
- Does the integration of digital technology (IDT) statistically impact the advancement toward achieving the SDGs in EU countries?
- Do digital public services (DPS) statistically impact the advancement toward achieving the SDGs in EU countries?

- Does digital transformation (DT) through its indicators statistically impact the advancement towards achieving the SDGs in the EU countries?

Study hypotheses

To answer the study questions, we propose the following hypotheses:

- (H_{01}): There is no statistically significant impact of connectivity (C) on advancement towards achieving (SDGs) in the EU countries.
- (H_{02}): Human capital (HC) has no statistically significant impact on advancement towards achieving the (SDGs) in the EU countries.
- (H_{03}): Integration of digital technology (IDT) has no statistically significant impact on advancement towards achieving the (SDGs) in the EU countries.
- (H_{04}): Digital public services (DPS) have no statistically significant impact on advancement towards achieving the (SDGs) in the EU countries.
- (H_{05}): Digital transformation (DT) through its indicators has no statistically significant impact on advancement towards achieving the (SDGs) in the EU countries.

Previous studies

Maroufkhani et al. (2022) stated that digital transformation significantly benefits various industries' sustainable development and economic growth. In their study, Mondejar et al. (2021) explored the potential of intelligent systems connected to the Internet of Things to create unique opportunities. They highlighted the importance of addressing the challenges associated with the United Nations Sustainable Development Goals (SDGs) and ensuring a just and sustainable society. Similarly, Onyango and Ondiek (2021) emphasized the need for effective policies to enhance the digitization of the SDGs within public organizations. Their findings underscored the significance of leveraging digitalization to build a sustainable society and integrate the SDGs into the public sector. This will positively impact the degree to which the digital technologies of the SDGs are institutionalized in public organizations and their environments. Maheshchandra and Shivnani (2019) discuss how applying new media technology helps universities shift towards a paperless approach to sustainable development. Dovleac (2015) illustrated the role of innovation and new technologies in helping companies achieve sustainability.

Stephenson and colleagues (2021) noted that adopting new technologies could help achieve the SDGs, called "SusTech solutions." SusTech is defined as using new technologies that help achieve (SDGs) (SDGs), either directly or indirectly. It may directly mean that the technology has been adopted to achieve a specific goal (such as reducing carbon use), while indirectly, it has been adopted for business efficiency. Still, it also provides additional benefits (such as reducing carbon use). The word "solutions" has been added to indicate that these new technologies help governments and businesses achieve their goals.

Gupta and Rhyner (2022) stated that digitalization is widely recognized as a transformative force for sustainable development. Aligning the progress made by digitalization with the globally recognized (SDGs) (SDGs) is critical to achieving inclusive, sustainable development in the digital age. However, research on preventing or enabling the effects of digitization is only found in limited cases in the literature that studies and classifies the impact of digitization on sustainable development. In the study by Del Giudice and colleagues

(2022), they tried to investigate whether digitization and new technologies can help create sustainable business models as set out in the UN 2030 Agenda (SDGs) (SDGs), adopted by all UN Member States in 2015.

The Berntsen (2022) study investigated how companies in the Norwegian construction industry could use digitalization to pursue their business interests while supporting the UN's (SDGs). Perez-Martinez et al. (2022) cautioned that while adopting digital technologies is linked to progress toward most development goals, Sustainability is outlined in the UN Agenda 2030. However, there are many cases (22%) where this technological development is associated with poor achievement in areas related to climate change, natural environmental conservation, waste generation, and depletion of natural resources.

All the studies that have been reviewed show that there is no doubt a role for digital orientation in achieving (SDGs). From this standpoint, this study came to clarify the concepts related to digitization and (SDGs) and then work to diagnose part of the reality of digital transformation and the level of advancement towards achieving the (SDGs) In the EU as a practical model for this study and later work on testing the impact of digital transformation on advancement towards achieving (SDGs) in the EU countries.

The added value of our study

The added value of our study compared to the previous studies lies in several aspects:

- Comprehensive analysis of the relationship between digital transformation and achieving Sustainable Development Goals (SDGs) specifically in the EU context
- Focuses on EU Digital Transformation Initiatives and how the European Commission is driving alignment with SDGs
- Tracks SDG progress in the EU by acknowledging monitoring and measurement frameworks
- Provides specific findings for the EU context - positive impact of digital technology integration on SDGs, while other digital transformation indicators do not significantly influence progress.

2- Background of the study

2-1- Digitalization and digital transformation

With the development of ICT, the trend began to generate ideas to use technology in new ways and not only to do things faster, here the idea of digital transformation began to take shape with new technologies, new things, and new ways of doing them, becoming empowered and urgent. Often, digital transformation is referred to as digitalization.

With the advent of Industry 4.0, digitalization emerged as a widespread phenomenon. To grasp the concept fully, it is essential to differentiate between digitization and digitalization. Digitization refers to utilizing digital technologies and information to enhance business operations, creating a digital business environment known as digital transformation (Alieva & Powell, 2022).

Digitalization has emerged as the foremost technological trend revolutionizing society, business, and managerial practices. The significance of the increasing demand for businesses to adopt digital technologies and adjust their models to this emerging reality cannot be understated. However, while digital transformation brings numerous advantages, it necessitates investments and associated costs (Reis et al., 2019). The process of digitization unlocks unprecedented possibilities in processing information, including text, graphics, audio, and video, thereby enabling transformative and informational outcomes that were previously

unimaginable (Maxwell & McCain, 1997). As Hagberg et al. (2016) stated, digitalization is recognized as a highly impactful transformation observed in modern society, influencing multiple facets of business and everyday life. Moreover, it catalyzes the creation of novel forms of value, such as improved accessibility, availability, and transparency.

Clerck (2017) outlines that digitization entails leveraging digital technologies and data to generate revenue, improve business operations, replace or transform processes, and establish a digital business environment where information is primarily digital. Devereux and Vella (2018) view digitization as the widespread adoption of versatile technology. For example, digitizing products and services reduce the distance between people and objects, emphasizes network effects, enables tailored data utilization to meet customers' needs (whether individuals or businesses), and presents substantial opportunities for innovation, investment, and the creation of new ventures and job prospects. Therefore, digitization becomes a crucial driver of sustainable growth. Digital transformation signifies increasing information and communication technology (ICT) integration within the economy. This integration encompasses diverse technologies, concepts, and digital trends such as artificial intelligence, the Internet of Things, and the Fourth Industrial Revolution (Gebre-Mariam & Bygstad, 2019). Successful implementation of ICT systems and the accompanying organizational changes involved in digital transformation require converting social and technical structures, previously reliant on non-digital manual methods, into structures mediated by digital tools (Srai & Lorentz, 2019).

From an economic perspective, digital transformation connects organizations to digital platforms and invests in digital platforms as a competitive priority, including integrating technology into everyday business practices. In doing so, organizations typically hope to reduce certain costs and strengthen the corporate system. Digital transformation in service is not just an innovative solution for companies to maximize their profits and maintain competitiveness; it may be a solution to achieve society's broad (SDGs), such as sustainable consumption and production patterns (Meskic et al., 2022). Digital transformation is a new reality, where digital technologies must be seen as a factor in creating added value for organizations in a dynamic and uncertain business environment. However, ICTs without qualified human resources and supporting infrastructure are considered an investment loss (Todorovic & Parc, 2022).

2-2- Sustainable Development Goals (SDGs)

In 2015, the United Nations General Assembly adopted the 2030 Global Agenda for Sustainable Development to frame an integrated approach that balances sustainable development's economic, social, and environmental dimensions. They include seventeen distinct (SDGs) (SDGs), which were decided by the global community to demonstrate the scale and ambition of this new global agenda and to serve as a transformative and highly ambitious vision for the future (Mustajoki et al., 2022). We summarise the seventeen SDGs as follows (Blumerset al., 2022):

- **Eradicate poverty in all its forms everywhere**: This goal envisions shared prosperity, a basic standard of living, and social protection benefits for people everywhere, including the poorest and most vulnerable.

- **Ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture**: The primary focus for accomplishing this goal is to encourage production systems that are environmentally friendly and can be maintained for a long time and enhance investments in improvements in the infrastructure and research and development related to agriculture in rural areas.
- **Ensure healthy lives and promote well-being for all at all ages**: This goal aims to guarantee well-being and foster good health across all age groups by mitigating behavioural and environmental risk factors that threaten health.
- **Ensure quality, equitable, and inclusive education, and promote lifelong learning opportunities for all**: This goal aims to eliminate gender and income disparities in access to education.
- **Achieving gender equality and empowering all women and girls**: This goal highlights the importance of ensuring women's full participation and equal chances to hold leadership positions in various political and economic decision-making levels.
- **Ensure availability and sustainable management of water and sanitation for all**: Through it, it aims to improve water quality and use efficiency and promote sustainable freshwater extraction and supply.
- **Guarantee universal availability of contemporary, dependable, sustainable, and cost-effective energy for everyone:** This objective aims to ensure the widespread availability of modern energy services, enhance energy efficiency, and advocate for renewable energy sources.
- **Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all**: This objective promotes complete employment and decent work opportunities, eliminating forced labour, human trafficking, child labour, nurturing labour rights, and ensuring secure and protected working conditions.
- **Developing robust infrastructure, advancing inclusive and sustainable manufacturing, and nurturing innovation:** This objective highlights the importance of developing resilient and sustainable infrastructure and fostering inclusive industrialization. It also recognizes the significance of research and innovation in finding lasting solutions to social, economic, and environmental challenges.
- **Diminishing disparities both within and among countries:** This objective focuses on tackling inequalities that exist at the national and international levels.
- **Making cities and human settlements inclusive, safe, resilient, and sustainable**: This goal aims to regenerate and plan cities and other human settlements to provide opportunities for all, with access to basic services, energy, transport, and green public spaces, while reducing resource use and adverse environmental impact.
- **Ensuring sustainable consumption and production patterns**: This goal envisions sustainable production and consumption based on advanced technological capacity, resource efficiency, and global waste reduction.
- **Take urgent action to address climate change and its impacts**: This goal seeks to enhance countries' resilience and resilience to climate-related natural hazards and resulting disasters, focusing on supporting LDCs.

- **Conservation and sustainable use of oceans, seas, and marine resources for sustainable development**: The aim of this goal is to safeguard and guarantee the sustainable utilization of the oceans, which entails minimizing the impacts of marine pollution and ocean acidification, ceasing overfishing, and conserving marine and coastal areas along with their ecosystems.
- **Protect**, **restore, and promote the sustainable use of terrestrial ecosystems and sustainable forest management, combat desertification, stop and reverse land degradation, and prevent biodiversity loss:** This objective aims to protect, restore, and promote the conservation and sustainable use of terrestrial ecosystems, freshwater systems, and mountainous areas. This encompasses efforts to responsibly manage forests, prevent deforestation, combat desertification, restore degraded land and soil, halt biodiversity loss, and safeguard endangered species.
- **Foster peaceful and inclusive societies to attain sustainable development, ensure justice for all, and establish efficient, responsible, and inclusive institutions at every level:** This goal advocates for societies to prioritize peace, inclusiveness, respect for human rights, the protection of vulnerable groups, adherence to the rule of law, and good governance. They also envision transparent, effective, and accountable institutions.
- **Strengthening the means of implementation and revitalizing the global partnership for sustainable development:** This goal emphasizes the need for worldwide collaboration towards sustainable development and underscores the significance of trade for developing nations and the equitable regulations governing international trade.

3- Methodolgy

3-1- Study variables

The study was conducted at a macro level, as it targets the EU countries where the statistics are available for the two variables of the study, represented in digital transformation expressed as (the Digital Economy and Society Index) as an independent variable and (SDGs) expressed as (the degree of overall advancement towards achieving all seventeen (SDGs)) as a dependent variable. The study model can be illustrated according to the following mathematical formula:

$$SDG_S = B_0 + B_1\ DESI + \varepsilon i$$

Whereas:

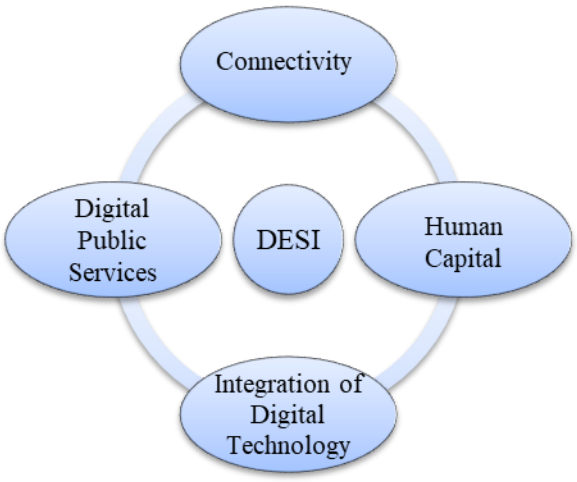
- DESI: Digital Economy and Society Index expressing digital transformation.
- SDG_S: The degree of overall progress toward achieving all seventeen (SDGs).
- εi: random error.

3-2- Source and nature of study data

The Digital Economy and Society Index (DESI), developed by the European Commission, is a comprehensive composite index condenses various indicators associated with Europe's digital performance. This index serves to monitor and evaluate the progress of EU member states across four primary dimensions, which encompass over 30 indicators in total:

- Connectivity: This dimension encompasses broadband internet availability, speed, and affordability indicators.
- Human Capital: It focuses on the digital skills the population and workforce possess, emphasizing their ability to navigate and utilize digital technologies effectively.
- Integration of Digital Technology: This dimension evaluates how companies incorporate essential digital technologies into their operations. Examples include e-invoicing, cloud services, e-commerce, and similar advancements.
- Digital Public Services: This dimension examines how digital technologies are employed in public services such as e-government and e-health. (European Commission, 2016).

Figure 1: DESI



Source: (European Commission, 2022)

DESI was first calculated in 2015 (mostly contains data from 2014). In this study, the data of the latest indicator (DESI 2022), including data for 2021, was relied upon.

Since 2014, the European Commission has been closely monitoring the digital advancements of its member states through the publication of the Digital Economy and Society Index (DESI) reports. These annual reports provide valuable insights and include soft profiles that assist member states in identifying priority areas for action. The DESI 2022 reports primarily rely on data from 2021 to track the progress made by EU member states in the digital realm. Despite making strides in digitization efforts during the COVID-19 pandemic, member states continue to face challenges in addressing gaps related to digital skills, promoting digital transformation among small and medium enterprises (SMEs), and implementing advanced 5G networks (European Commission, 2022).

In September 2015, global leaders endorsed the 2030 Agenda for Sustainable Development, which encompasses the Sustainable Development Goals (SDGs). To assist countries in assessing the progress and contours of these goals, the Bertelsmann Foundation Stiftung and the Sustainable Development Solutions Network (SDSN) published the initial SDG Index in July 2016 (Guillaume, 2018). The most recent data from this study pertains to the overall progress toward achieving all seventeen SDGs and is based on statistics from 2021.

3-3- Study population

The study encompasses a wide range of EU countries, including Finland, Denmark, the Netherlands, Sweden, Ireland, Malta, Spain, Luxembourg, Estonia, Austria, Slovenia, France, Germany, Lithuania, Portugal, Belgium, Latvia, Italy, Czechia, Cyprus, Croatia, Hungary, Slovakia, Poland, Greece, Bulgaria, and Romania.

3-4- Method of analyzing study data

To achieve the exploratory purpose of the study, linear regression analysis was used to detect the potential impact relationship between the independent variable (DESI) and the dependent variable (SDGs) through the SPSS V28 program. Where it was used:

- Simple linear regression analysis to measure the impact of DESI dimensions separately at the SDGs level.
- Performing progressive multiple regression analysis involves selecting only the regression model that includes the dimensions of (DESI) which have a statistically significant impact on (SDGs).

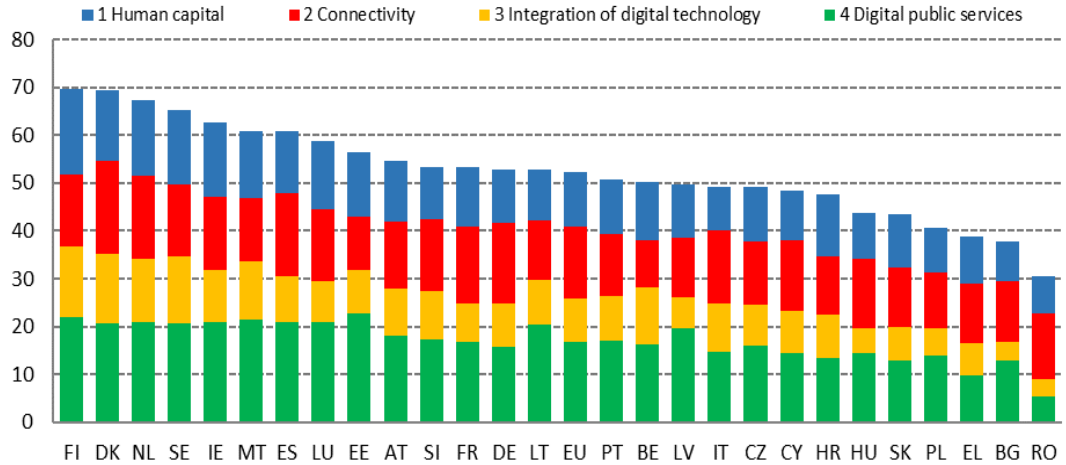
4- Results and discussion

4-1- The actual state of digital transformation within the EU

The EU has harnessed significant resources to support digital transformation, with around €127 billion earmarked for reforms and related digital investments in its (RRF), an unparalleled chance to accelerate digitalization. Member States have allocated an average of 26% of RRF allocations for digital transformation, with the 26% threshold being mandatory. Member countries that have chosen to invest more than 30% of their RRF allocations in the digital space are Austria, Germany, Luxembourg, Ireland, and Lithuania (European Commission, 2022).

The figure illustrates the EU member states' rankings according to the 2022 DESI report. The EU countries with the most sophisticated digital economies are Finland, Denmark, the Netherlands, and Sweden, while Ireland, Malta, and Spain follow closely behind. On the other end of the spectrum, Romania, Bulgaria, and Greece registered the lowest DESI rankings.

Figure 2: Digital Economy and Society Index 2022



Source: (European Commission, 2022)

The report for this year (2022) indicates that while most member countries are making headway in digital transformation, there is still a low level of corporate adoption regarding crucial digital technologies. Increasing efforts to fully implement the necessary communication infrastructure for highly innovative services and applications is crucial. Member States should also focus on making significant advancements in developing digital skills, as it is another essential area requiring attention.

The European Commission says digital technologies significantly influence our lifestyle and business practices. Member states must possess the capacity to harness the advantages of an evolving digital society while effectively addressing the associated challenges. For instance:

- The UNHCR supported Flanders Investment and Trade, a Belgian company, in creating a structured framework for deploying artificial intelligence (AI). This framework facilitates enterprise analysis and the design and planning of AI implementation. The support improved FIT's ability to design and plan the development of AI applications and critical data assets and improved AI awareness and internal capabilities in FIT. Based on the project's results, FIT began developing its new IT strategy, prepared digitization plans, conducted a management review of the personnel plan, and took steps to improve data management.
- To strengthen Lithuania's innovation capacity, the Lithuanian authorities have initiated an innovation reform. The reform is a response to the ineffective system of investments in science, technology, and innovation that fails to promote research and development adequately. To enhance efficiency and maximize the benefits of science, technology, and innovation activities, the UNHCR aids in fostering collaboration between public entities and private institutions.
- UNHCR supported the implementation of the digital strategy in Italy. After the reform of the administration, human resources services were provided centrally. Italy's digital strategy has enabled a large-scale digital transformation of the human resources system for public sector employees. As a result, the directorate's customer base increased from 2 million employees in 100 public institutions to 3.3 million employees in 10,000 institutions.
- In line with UNHCR's priority for the eHealth Consortium, it supported Croatia in developing the Strategic Development Plan for eHealth 2020. This support consisted of assisting national authorities to strengthen their capacity to develop an e-health strategy by adopting the WHO National eHealth Strategy Toolkit.
- The Commission has invited the Federal Ministry of Finance to modernize and digitize Austria's tax filing system. By developing a new IT system for the authorities, the project will allow automated self-assessment of tax returns, thereby reducing the number of checks needed by tax officials.

4-2- Level of advancement towards achieving the EU SDGs

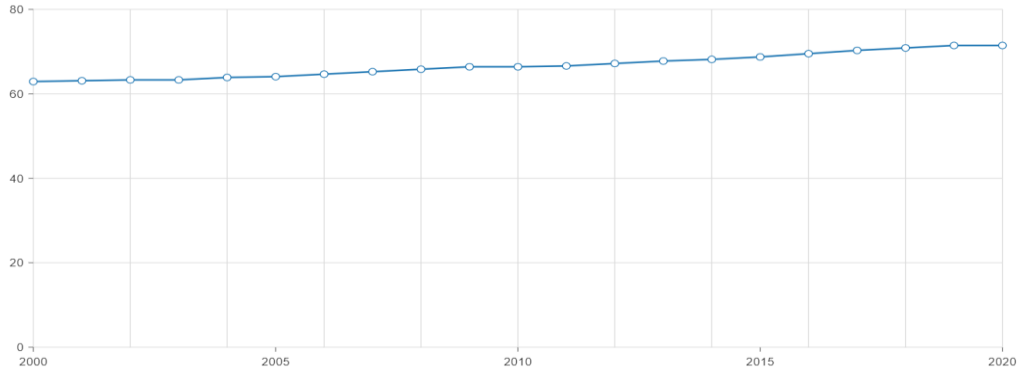
The EU has consistently prioritized the Sustainable Development Goals (SDGs) and incorporated them into different facets of policy-making, projects, and sector-specific policies. The endorsement of the 2030 Agenda for Sustainable Development and its seventeen Sustainable Development Goals (SDGs) by the United Nations in 2015 has revitalized global efforts towards sustainable development. The EU and its Member States are dedicated to this crucial global agreement and actively contribute to advancing the SDGs.

The set of indicators for the EU Sustainable Development Goals (SDGs) has been developed to align with the 2030 Agenda. As outlined in the seventeen SDGs, it encompasses sustainability's social, economic, environmental, and institutional aspects. Each SDG is represented by six essential indicators that have been thoughtfully chosen to capture the wide-ranging objectives and ambitions of the SDGs. Additionally, thirty-one multi-purpose indicators are used to monitor multiple targets. This approach helps to highlight the interlinkages between different objectives and strengthens the narrative of monitoring reports. Currently, sixty-seven of the EU's SDG indicators are aligned with the United Nations Sustainable Development in the EU 2022 report.

The COVID-19 pandemic has posed significant challenges to sustainable development in Europe and worldwide. For the first time since the inception of the SDGs in 2015, the average score of the SDG Global Index experienced a decrease in 2020. This decline was driven by high poverty and unemployment rates. Nevertheless, the decline in the average SDG score among EU countries was relatively modest compared to other parts of the world. This could be attributed to effective economic and social policy implementation and the widespread adoption of automatic stabilizations on a significant scale (Lafortune et al., 2021).

While the progress made by EU countries towards achieving the SDGs has not yet reached complete alignment, there has been an overall upward trend. From 2000 to 2020, the average index score for the EU increased by 8.5%, rising from 62.9% to 71.4%. The average annual growth rate of the SDG index score between 2015 and 2019 was 0.9%, surpassing the average annual growth rate observed from 2010 to 2015 (0.6%). These figures suggest accelerating SDG progress since their adoption in 2015, although it does not necessarily imply that EU countries have been fully on track to attain the goals (Lafortune et al., 2021).

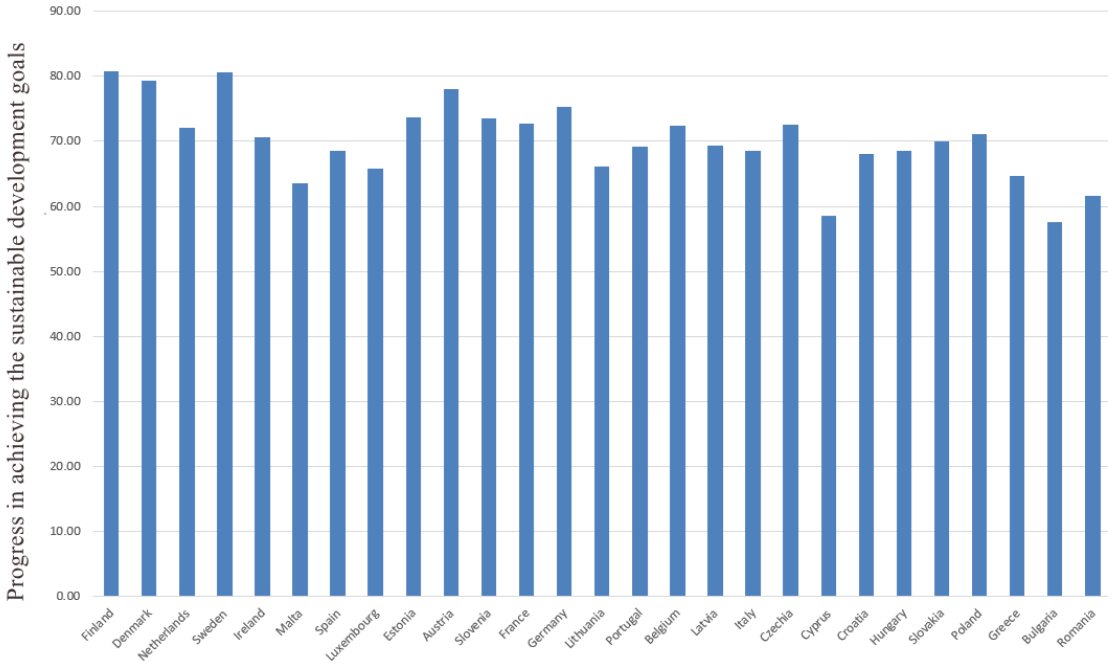
Figure 3: SDG index scores in the EU countries during the period (2000-2020)



Source: (Lafortune et al., 2021)

As depicted in the figure provided, there are disparities in the performance of European countries concerning the SDGs. It is noteworthy that, as a general trend, the Nordic countries exhibit the highest level of performance.

Figure 4: Percentage of advancement towards achieving the (SDGs) in the EU countries during 2021



Source: Prepared by the researcher using the outcomes obtained from the statistical analysis (Sustainable Development in the EU, 2022)

4-3- Results of simple regression analysis of the impact of connectivity on advancement towards achieving the SDGs in the EU countries

In the DESI report, the connectivity aspect examines both the supply and demand aspects of fixed and mobile broadband.

According to the table provided, the outcomes of the simple regression analysis do not indicate a statistically significant impact for connectivity on advancement towards achieving (SDGs) in the EU countries, and the lack of significance of this impact confirms the calculated T value, which amounted to (1.653), which is not statistically significant.

Table (1): Results of simple regression analysis of the impact of (C) on advancement towards achieving the (SDGs)

	(R)	(R^2)	Unstandardized Coefficients		Standardized Coefficients	T	Sig*
			B	Standard error	Beta		
(Constant)	0.314	0.09	57.781	7.535	-	7.668	0.000
Connectivity			0.872	0.528	0.314	1.635	0.111
Dependent variable: Advancement towards achieving the SDGs							

*The impact is statistically significant at ($\alpha \leq 0.05$)

Source: Prepared by the researcher using the outcomes obtained from the statistical analysis

In light of these findings, we confirm the acceptance of (H_{01}), which asserts that connectivity has no statistically significant impact on progress in achieving the SDGs in the EU countries.

4-4- Results of a simple regression analysis of the impact of (HC) on advancement towards achieving the SDGs in the EU countries

The digital skills dimension, or human capital, is a tool that provides useful information about citizens' online behaviour, people's skills, and competencies in various digital fields.

According to the table provided, the outcomes of the simple regression analysis indicate that there is a statistically significant impact of human capital on advancement towards achieving (SDGs) in the EU countries, and the impact significance is confirmed by the calculated T value, which amounted to (3.932), which is statistically significant.

Table (2): Results of simple regression analysis of the impact of (HC) on advancement towards achieving the (SDGs)

	(R)	(R^2)	Unstandardized Coefficients		Standardized Coefficients	T	Sig*
			B	Standard error	Beta		
(Constant)	0.618	0.382	52.409	4.592	-	11.414	0.000
Human Capital			1.463	0.372	0.618	3.932	0.000
Dependent variable: Advancement towards achieving the SDGs							

*The impact is statistically significant at ($\alpha \leq 0.05$)

Source: Prepared by the researcher using the outcomes obtained from the statistical analysis

The correlation coefficient is denoted by R (0.618), while the coefficient of determination is represented by R^2 (0.382). Therefore, we conclude that human capital explained (38.2%) the progress changes in achieving (SDGs). Drawing from these findings, we reject (H_{02}) and validate the alternative hypothesis that human capital exerts a statistically significant influence on progress towards attaining the Sustainable Development Goals (SDGs) in EU countries.

According to the findings, we refuse (H_{02}) and support the alternative hypothesis that human capital has a statistically significant impact on advancement towards achieving the Sustainable Development Goals (SDGs) in the EU countries.

4-5- Results of a simple regression analysis of the impact of the (IDT) on advancement towards achieving the (SDGs) in the EU countries

The assessment of digital technology reintegration measures the extent to which businesses and e-commerce have adopted digitization. It specifically focuses on adopting digital technologies by companies, ranging from basic usage to advanced implementation. This encompasses electronic information sharing, utilizing social media platforms, and adopting advanced technologies like big data analytics, cloud services, and artificial intelligence (AI).

According to the table provided, the outcomes of the simple regression analysis indicate a statistically significant impact of the integration of digital technology on

advancement towards achieving (SDGs) in the EU countries and the significance of this impact is confirmed by the calculated T value, which amounted to (4.233), which is statistically significant.

Table (3): Results of simple regression analysis of the impact of the (IDT) on advancement towards achieving the (SDGs)

	(R)	(R^2)	Unstandardized Coefficients		Standardized Coefficients	T	Sig*
			B	Standard error	Beta		
(Constant)	0.646	0.417	57.911	3.015	-	19.206	0.000
Integration of Digital Technology			1.316	0.311	0.646	4.233	0.000
Dependent variable: Advancement towards achieving the SDGs							

*The impact is statistically significant at ($\alpha \leq 0.05$)

Source: Prepared by the researcher using the outcomes obtained from the statistical analysis

The correlation coefficient is denoted by R (0.646), while the coefficient of determination is represented by R^2 (0.417). Therefore, we conclude that integration of digital technology explains the ratio of (41.7%) of changes in advancement towards achieving the (SDGs). Based on these results, we refuse (H_{03}) and confirm the alternative hypothesis that there is a statistically significant impact of integration of digital technology on advancement towards achieving (SDGs) in the EU.

According to the findings, we refuse (H_{03}) and support the alternative hypothesis that integration of digital technology has a statistically significant impact on the progress made in achieving the Sustainable Development Goals (SDGs) in the EU countries.

4-6- Results of a simple regression analysis of the impact of (DPS) on advancement towards achieving the (SDGs) in the EU countries

This dimension aims to digitalize public services and prominently enhance the delivery or effectiveness of e-government solutions within recovery and resilience plans. The Commission closely monitors the digital public service indicators of the EU to ensure that both citizens and governments fully benefit from the potential offered by this technology.

According to the table provided, the outcomes of the simple regression analysis indicate a statistically significant impact of digital public services on advancement towards achieving (SDGs) in the EU countries. The significance of this impact is confirmed by the calculated T value, which amounted to (2.820), which is statistically significant.

Table (4): Results of simple regression analysis of the impact of (DPS) on advancement towards achieving the (SDGs)

	(R)	(R^2)	Unstandardized Coefficients		Standardized Coefficients	T	Sig*
			B	Standard error	Beta		
(Constant)	0.491	0.241	58.038	4.381	-	13.258	0.000
Digital Public Services			0.705	0.250	0.491	2.820	0.009
Dependent variable: Advancement towards achieving the SDGs							

*The impact is statistically significant at ($\alpha \leq 0.05$)

Source: Prepared by the researcher using the outcomes obtained from the statistical analysis

The correlation coefficient is denoted R (0.491), while the coefficient of determination is represented by R^2 (0.241). Therefore, we conclude that digital public services explain the ratio of (24.1%) of changes in advancement towards achieving the (SDGs).

According to the findings, we refuse (H_{03}) and support the alternative hypothesis that digital public services have a statistically significant impact on advancement towards achieving the Sustainable Development Goals (SDGs) in the EU countries.

4-7- Results of the multiple progressive regression analysis of the impact of (DT) on advancement towards achieving the (SDGs) in the EU countries

According to the table provided, the outcomes of the multiple progressive regression analysis indicate a statistically significant impact of integration of digital technology on advancement towards achieving (SDGs) in the EU countries and the significance of this impact is confirmed by the calculated T value, which amounted to (4.233), which is statistically significant.

Table (5): Results of multiple regression analysis of the impact of (DT) dimensions on advancement towards achieving the (SDGs)

	(R)	(R^2)	Unstandardized Coefficients		Standardized Coefficients	T	Sig*
			B	Standard error	Beta		
(Constant)	0.646	0.417	57.911	3.015	-	12.206	0.000
Integration of Digital Technology			1.316	0.311	0.646	4.233	0.009
Dependent variable: Advancement towards achieving the SDGs							

*The impact is statistically significant at ($\alpha \leq 0.05$)

Source: Prepared by the researcher using the outcomes obtained from the statistical analysis

The correlation coefficient is denoted by R (0.646), while the coefficient of determination is represented by R^2 (0.417). Therefore, we conclude that digital transformation through the integration of digital technology explains the ratio (41.7%) of changes in advancement towards achieving the (SDGs). On the other hand, the results of the multiple progressive regression analysis (as shown in the table below) did not show a significant

impact on (connectivity, human capital, and digital public services), On advancement towards achieving (SDGs) in the EU countries.

Table (6): Variables excluded from the model of the impact of (DT) on advancement towards achieving the (SDGs)

	T	Sig*
Digital Public Services	0.363	0.074
Connectivity	0.310	0.063
Human Capital	0.953	0.191

*The impact is statistically significant at ($\alpha \leq 0.05$)

Source: Prepared by the researcher using the outcomes obtained from the statistical analysis

Based on these results, we refuse the (H_{05}) a and confirm the alternative hypothesis that states that there is a statistically significant impact of digital transformation through its combined indicators on advancement towards achieving the (SDGs) in the EU countries, given that there is a significant impact of at least one indicator. (Integration of digital technology).

Based on this reason, the estimated regression equation for the model of this study can be written according to the following formula:

$$SDG_S = 57.911 + 1.316\ DESI + ei$$

(57.911) represents the value of the (constant), which is the level of achieving (SDGs) unrelated to digital transformation, while (1.316) represents the regression coefficient.

The EU's revised Industrial Strategy 2021 sought to facilitate the concurrent transition to a sustainable and technologically advanced economy. The primary goal was to ensure that European industry takes the lead in attaining the EU's objectives for an environmentally friendly, socially inclusive, and robust future.

The EU's National Recovery and Resilience Plans are structured around six main thematic pillars identified in the Recovery and Resilience Facility regulation. These pillars include the green transition, digital transformation, economic cohesion, productivity and competitiveness, social and regional cohesion, health, and overall resilience of the economy, society, and institutions, along with policies targeted towards the next generation. It is mandatory for all recovery and resilience plans to prioritize reforms and investments that facilitate the transition towards a greener and more digital-focused economy, allocating at least 37% of the funds for climate action and 20% for digital expenditure.

Over the next decade, there are expected to be advancements in quantum computing technologies that will facilitate innovation in complex research fields like climate change and sustainable energy. The advancement of EU cohesion policy, encompassing the European Regional Development Fund, the European Social Fund, the Cohesion Fund, and the Just Transition Fund, strongly corresponds to the Union's political focal points, specifically the green and digital transformation, while being in line with the Sustainable Development Goals (SDGs).

Conclusion

Digital transformation can be understood as a societal phenomenon and a means of business development to shift from existing business models to new ones. On this basis, digital transformation represents a paradigm shift that affects economic and social development. The core of the 2030 Agenda for Sustainable Development, adopted by the United Nations in 2015, is seventeen (SDGs) (SDGs), and most are expected to be achieved by 2030. Although the SDGs are not the first effort to set global goals, they are still the most comprehensive and detailed attempt by the United Nations to advance sustainable development.

The study's findings demonstrated the European Commission's dedication to assisting the EU in its digital transformation. This is accomplished by equipping individuals, companies, and departments with a new wave of technologies that foster an open and democratic society, a thriving and sustainable economy, and aid in the fight against climate change while achieving green progress. Through its technical support tool, the European Commission has aided EU nations in implementing reforms that unleash the potential for digital advancement. Moreover, it has facilitated the adoption of innovative solutions for businesses and citizens and enhanced the accessibility and effectiveness of public services.

The study's findings also highlighted the European Commission's dedication to tracking the Sustainable Development Goals (SDGs) advancement within the EU. The EU's dedication to developing the set of indicators for Sustainable Development Goals (SDGs) is apparent, which aligns with the SDGs and serves as a framework for monitoring progress in the EU framework. The SDGs analysis in the EU noted that the average SDG score in the EU countries decreased slightly from its level in 2019. However, this vulnerability was less than observed in the rest of the world, probably due to the size and effectiveness of automatic stabilization factors and ad hoc economic and social policies.

The study's results diagnosed the relationship between the two variables of the study (digital transformation and achieving (SDGs)). It was found that digital transformation has a positive impact - through the integration of digital technology - on advancement towards achieving (SDGs); on the other hand, there was no impact on the rest of the indicators of digital transformation on the level of this progress.

Bibliography List

Alieva, J., & Powell, D. J. (2022). The significance of employee behaviours and soft management practices to avoid digital waste during a digital transformation. International Journal of Lean Six Sigma. https://doi.org/10.1108/ijlss-07-2021-0127

Berntsen, L. D. (2022). Digitalization and Sustainability in the Norwegian Construction Industry (Master's thesis, UIS).

Blumers, M. (ed.). (2022). Sustainable Development in the European Union. Monitoring Report on Progress Towards the SDGs in an EU Context. [Eurostat Statistical books 2022 edition]. Luxembourg: Publications Office of the European Union.

Clerck, J. (2017). Digitalization, Digital Transformation: The Differences. i-SCOOP

Del Giudice, M., Di Vaio, A., Hassan, R., & Palladino, R. (2022). Digitalization and new technologies for sustainable business models at the ship–port interface: A bibliometric analysis. Maritime Policy & Management, 49(3), 410-446.

Devereux, M., Vella, J. (2018). Debate: implications of digitalization for international corporate tax reform. Intertax 46(6), 550–559.

Dovleac, L. (2015). Innovation and new technologies - pillars for a business sustainable development. Bulletin of the Transilvania University of Brasov. Economic Sciences. Series V, 8(2), 385-390.

European Commission. (2022). The Digital Economy and Society Index (DESI). https://digital-strategy.ec.europa.eu/en/policies/desi

European Commission. Whoa, who Reform Support. https://reform-support.ec.europa.eu/what-we-do/digital-transition_en

Gebre-Mariam, M., Bygstad, B. (2019). Digitalization mechanisms of health management information systems in developing countries. Inf. Organ. 29(1), 1-22.

Guillaume, L., et al. (2018). SDG Index and Dashboards Detailed Methodological paper. https://github.com/sdsna/2018GlobalIndex/raw/master/2018GlobalIndexMethodology.pdf

Gupta, S., & Rhyner, J. (2022). Mindful application of digitalization for sustainable development: The Digit inability Assessment Framework. Sustainability, 14(5), 3114.

Hagberg, J., Sundstrom, M., Egels-Zandén, N. (2016). The digitalization of retailing: an exploratory framework. Int. J. Retail Distrib. Manag. 44(7), 694–712

Lafortune G, Cortés Puch M, Mosnier A, Fuller G, Diaz M, Riccaboni A, Kloke-Lesch A, Zachariadis T, Carli E, Oger A. (2021). Europe Sustainable Development Report 2021: Transforming the European Union to achieve the Sustainable Development Goals. SDSN, SDSN Europe and IEEP, France: Paris.

Maheshchandra, B. J., & Shivnani, T. (2019). A step towards sustainable development in higher education in India by implementing new media technologies: A paperless approach. [Sustainable development in higher education] World Journal of Science, Technology and Sustainable Development, 16(2), 94-100. https://doi.org/10.1108/WJSTSD-08-2018-0056

Maroufkhani, P., Desouza, K. C., Perrons, R. K., & Iranmanesh, M. (2022). Digital transformation in the resource and energy sectors: A systematic review. Resources Policy, 76, 102622. https://doi.org/10.1016/j.resourpol.2022.102622

Maxwell, L., McCain, T. 157 (1997). Gateway or gatekeeper: the implications of copyright and digitalization on education. Commun. Educ. 46(3), 141–141

Meskic, Z., Albakjaji, M., Jevremovic, N., Omerovic, E., & Adams, J. (2022). Digitalization and Innovation in Achieving SDGs – Impacts on Legislation and Practice. IOP Conference Series.Earth and Environmental Science, 1026(1), 012061. https://doi.org/10.1088/1755-1315/1026/1/012061

Mondejar, M. E., Avtar, R., Diaz, H. L. B., Dubey, R. K., Esteban, J., Gómez-Morales, A., Hallam, B., Mbungu, N. T., Okolo, C. C., Prasad, K. A., She, Q., & Garcia-Segura, S. (2021). Digitalization to achieve sustainable development goals: Steps towards a Smart Green Planet. Science of The Total Environment, 794, 148539. https://doi.org/10.1016/j.scitotenv.2021.148539

Mustajoki, J., Borchardt, S., Büttner, L., Köhler, B., Lepenies, R., Lyytimäki, J., Mille, R., Pedersen, A. B., Reis, S., & Richard, D. (2022). Ambitiousness of Sustainable Development Goal (SDG) targets: classification and implications for policy making. Discover Sustainability, 3(1). https://doi.org/10.1007/s43621-022-

00104-8

Onyango, G., Ondiek, J.O. (2021). Digitalization and Integration of Sustainable Development Goals (SDGs) in Public Organizations in Kenya. Public Organiz Rev 21, 511–526. https://doi.org/10.1007/s11115-020-00504-2

Perez-Martinez, J., Hernandez-Gil, F., San Miguel, G., Ruiz, D., & Arredondo, M. T. Analysing Associations between Digitalization and the Accomplishment of the Sustainable Development Goals. Available at SSRN 4122952.

Reis, J., Amorim, M., Melão, N., Cohen, Y., & Rodrigues, M. (2019). Digitalization: A literature review and research agenda. In International Joint conference on industrial engineering and operations management (pp. 443-456). Springer.

Srai, J., Lorentz, H. (2019). Developing design principles for the digitalization of purchasing and supply management. J. Purch. Supply Manag. 25(1), 78–98.

Stephenson, M., Lejarraga, I., Matus, K., Mulugetta, Y., Yarime, M., & Zhan, J. (2021). SusTech solutions: enabling new technologies to drive sustainable development. G20 Insights: TF4-Digital Transformation.

Sustainable development in the European Union – 2022. (2022). In Publications Office of the European Union.

Todorovic, M., & Parc, D. (2022). Success factors, tools and controllers' tasks in conditions of intensive digitalization. Ekonomski Horizonti, 24(2), 167-183. https://doi.org/10.5937/ekonhor2202177T

ZEMRI, B. E., & KHETIB, S. M. (2022). Work Productivity and Opportunities for Sustainable Economic Development in Algeria, Journal of Economic Integration, 10 (4), 341-355. https://www.asjp.cerist.dz/en/article/215471