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THE IMPACT OF INNOVATION SUPPORT ON THE SUSTAINABLE DEVELOPMENT OF ENTERPRISES

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ABSTRACT

Today, the problems of devaluation of the environment, depletion of natural resources, and social and economic crises are increasingly deepening. The issue of sustainable development at the enterprise level is becoming a necessity, not just a regulatory requirement. The critical role in this process is played by innovative support capable of reforming the existing approaches to the problems mentioned above. The study aims to determine the relationship and mutual influence between the indicators of innovation support and sustainable development of enterprises and to form recommendations based on the results using the methods of correlation analysis, multivariate regression, and case study. The study revealed a close correlation between the indicators of innovation support, which are represented in the study by the Global Innovation Index with its sub-indices, and such Sustainable Development Goals (SDGs) indicators as the "Logistics Performance Index: Quality of trade and transport-related infrastructure" and "Electronic waste (kg/capita)". It has been determined that the first indicator is most strongly influenced by institutions and infrastructure, and the second is influenced by institutions, human capital and research, infrastructure, and market structure. The recommendations formed because of the analysis include using electronic systems and resource cycles. The results obtained can be of practical importance and used by both enterprise management and government agencies to optimise the enterprise's logistics system and waste management.

Keywords: innovation, innovation support, innovative technologies, sustainable development, sustainable development goals, ecology, logistics, waste

JEL Classification: O1, O3, Q01, Q53, Q57

INTRODUCTION

Today, the global environment is characterised by growing problems and crises of various origins. Environmental issues and climate change are particularly acute, escalating conflicts, crisis trends in the economy, etc. In response to these phenomena and trends, the concept of sustainable development has been developed, which contains several goals to address the existing problems. The Sustainable Development Goals (SDGs) are intended for global development by balancing social, economic, and environmental components (Breuer et al., 2019; Bennich et al., 2020; Mio et al., 2020). The SDGs were adopted in 2015 by UN member states, several multinational enterprises, and international non-governmental organisations. The SDGs form a "hybrid governance" platform where stakeholders can work in a coordinated manner to achieve common goals in environmental, social, and economic issues. This platform is the leading global framework for sustainable development until 2030. However, researchers note that progress towards achieving the SDGs has been plodding in the period up to 2020 by multinational companies and governments (Van Tulder et al., 2021; Danilova et al., 2021). The SDGs are addressed to society as a whole, but scholars and leading practitioners emphasise the particular importance of business (Mio et al., 2020; Kuzior et al., 2022; Kuznyetsova et al., 2022).

Innovative support for the process of achieving the SDGs by enterprises (Cordova & Celone, 2019; Sinha et al., 2020; Liu et al., 2022), in particular, the closely related SDG 9 (Denoncourt, 2020; Kynčlová et al., 2020) and SDG 12 (Endl et al., 2021; Herrero et

al, 2021), is a crucial success factor, as practical innovations can transform approaches to resource management, improve social policy and the overall performance of enterprises (Awan et al., 2019; Udriyah et al., 2019; Latysheva et al., 2020; Ch'ng et al., 2021). Process and product innovation, as defined by Awan (2021), is the ability of an organisation to formulate and implement a creative approach to solve organisational problems. Through innovation, an enterprise can increase profits, reduce environmental impact, use resources more efficiently, etc.

The impact of innovations on the sustainable development of enterprises seems obvious and significant (Zhu et al., 2019; Christa & Kristinae, 2021; Hameed et al., 2021), but the study of the relationship between innovation and sustainable development of enterprises should include the identification of specific areas of such a relationship, its strength, as well as the strength of influence between individual indicators and other parameters. The study of these relationships and mutual dependence is complicated because both innovation and sustainable development are multifaceted concepts that contain many constituent elements. Therefore, it can be argued that the horizon for scientific research in this area is virtually unlimited. Within the framework of one work, it is worth focusing on an in-depth study of specific areas.

LITERATURE REVIEW

In the modern scientific literature, the use of innovations for the sustainable development of enterprises is widespread and relevant. Silvestre & Ţîrcă (2019) claim that innovation is the primary driver of sustainable development and dwell on the diversity of innovations for sustainable development, classifying them according to specific criteria. This approach will help companies identify opportunities for implementing innovations for sustainable development and assess potential benefits. The following works reveal the essence of innovations that enterprises for sustainable development can execute within the framework of specific technologies. A particularly relevant area today is using artificial intelligence (AI) for these purposes. Di Vaio et al. (2020) note the connection between AI and the dynamics of sustainable development and try to determine whether the AI industry is contributing to achieving sustainable resource management in line with the SDGs. The study also reveals the role of AI in building sustainable business models. Among other things, the development of sustainability-oriented business models based on the use of innovation is one of the most relevant tools for enterprises to achieve sustainable development. Shakeel et al. (2020) devote their study to identifying standard features between a business model, an innovative business model, a sustainable business model, and an innovative sustainable business model. Based on their analysis, the authors propose components of an innovative business model for sustainable development.

Matinaro et al. (2019) note that caring for the environment is a responsibility of businesses, but while many large enterprises have joined the World Business Council for Sustainable Development (WBCSD), small and medium-sized enterprises (SMEs) have different attitudes towards sustainability and the environment. The lack of attention of some SMEs to environmental issues is an acute problem, as SMEs are the engine of economic growth, and their number significantly exceeds the number of large enterprises. Accordingly, the researchers focus on the study of sustainable development and innovation in SMEs, as well as on proposals for developing a business model for SMEs designed to improve the environmental friendliness and sustainability of their activities. It is worth noting that the implementation of sustainability in SMEs' practices does not always depend solely on the decision of the enterprise's management: the study by Álvarez Jaramillo et al. (2019) identified 175 barriers to sustainable development of SMEs. Most often, these barriers are related to a lack of resources, experience, or high upfront costs of implementing sustainable development measures. According to Prashar (2020), both a critical barrier and a key driver for sustainability in SMEs is the government. Noting the importance of the problem of negative environmental impact by SMEs, the author accumulates information on sustainability strategies and models described in studies on SMEs operating in various economic sectors, which increases the practical value of this study. The paper describes using essential management tools to integrate sustainability into SME business strategy. Shafi (2021) focuses on the challenges craft microfirms face during their operations. He describes how microfirms can overcome their inherent limitations (e.g., limited resources) and achieve sustainable development, in which innovation potential plays a key role.

Shao et al. (2020) think that the impact of environmental regulation on enterprise innovation is closely related to the competitiveness of the enterprise itself and the sustainable development of the region. It is not limited to the creation of technologies but lies in their adoption and use. Luo et al. (2023) note that the environmental policies of countries worldwide are increasingly focusing on green innovations, and the development of the digital economy can play a crucial role in improving ecological innovation. Yin et al. (2022) propose changes in public policy regarding introducing innovations in rural areas. The problem's relevance lies in the significant imbalance in innovation development between rural and urban regions, with agriculture being the basis for stability and prosperity in many developing countries. Innovations in rural

areas and at enterprises located there will contribute to achieving balanced and sustainable development in rural regions (Sumets et al., 2022).

Existing research lacks quantification of the linkage and mutual influence between innovation provision and sustainability aspects. Identifying this linkage and impact allows for more informed and effective decision-making on innovation for sustainability.

AIMS AND OBJECTIVES

The study aims to determine the relationship and mutual influence between the indicators of innovation support and sustainable development of enterprises and to form recommendations based on the results. To achieve this goal, it is essential to solve the following tasks:

- to identify the relationship between global sustainable development indicators and global innovation indicators;
- to assess the impact of innovation support on specific sustainable development indicators of enterprises;
- to formulate approaches and recommendations for applying innovative support for the sustainability of enterprises in Ukraine.

METHODS

The research procedure

The research procedure involves three related stages. The first stage consists of identifying the relationship between global sustainability indicators and global innovation indicators. These indicators include the Global Innovation Index (GII) and its sub-indices, on the one hand, and the constituent elements of Sustainable Development Goal (SDG) 9 and SDG 12, on the other.

The second stage is to identify and determine the impact of innovation support indicators on sustainable development indicators (only those indicators between which the results of the previous study stage identified the closest relationship).

The third stage involves the development of recommendations and proposals for enterprises and the government of Ukraine on the application of innovation support for sustainability. As in the second stage, the third stage involves identifying innovative approaches and relevant, innovative technologies only in the areas of sustainable development that are most closely related to the indicators of innovation support.

Sample

The sample for the study consists, first of all, of global indicators that demonstrate the connection between innovative provision at the country level (macro level). At the same time, the topic of the work includes the micro-level category - sustainable development of enterprises. This is due to the fact that enterprises are the main participants in the innovation process, and their actions and strategies significantly affect the macro-level of the economy and the sustainable development of the country. The role of enterprises in achieving SDG 9 and SDG 12 is decisive because these indicators are directly related to enterprises' activities in the field of sustainable development. The conducted analysis based on global indicators made it possible to identify key interrelationships and dependencies affecting the activities of enterprises, on the basis of which a number of recommendations were formed at the enterprise level using successful examples of global companies.

The sample of indicators for the study includes the GII with sub-indices ("Institutions", "Human capital and research", "Infrastructure", "Market sophistication", "Business sophistication", "Knowledge and technology outputs", and "Creative outputs") as an essential integral indicator that characterises various indicators of innovation. The sample also includes indicators that are part of SDG 9, "Industry, Innovation and Infrastructure", and SDG 12 ", Responsible Consumption and Production", as the SDGs most closely related to the activities and development of enterprises. The components of SDG 9 are: "Population using the internet (%)", "Mobile broadband subscriptions (per 100 population)", "Logistics Performance Index: Quality of trade and transport-related infrastructure", "The Times Higher Education Universities Ranking: Average score of top 3 universities", "Articles published in academic journals (per 1.000 population)", "Expenditure on research and development (% of GDP)". The components of SDG 12 are "Municipal solid waste (kg/capita/day)", "Electronic waste (kg/capita)", "Production-based SO2 emissions (kg/capita)", "SO2 emissions embodied in imports (kg/capita)", "Production-based nitrogen emissions (kg/capita)", "Nitrogen emissions embodied in imports (kg/capita)", "Exports of plastic waste (kg/capita)".

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The sample of countries for the study consists of 132 countries for which the GII ranking has been determined. Ukraine was singled out separately, given the country's European integration intentions, which necessitates improving the country's indicators in sustainable development and innovation.

Methods

To identify the interrelationships between the studied indicators, the correlation analysis method was applied to the indicators of innovation support, on the one hand, and the indicators of sustainable development included in SDG 9 and SDG 12, on the other. The method of multivariate regression allowed us to identify and determine the impact of innovation support indicators on sustainable development indicators, which, according to the results of the correlation analysis, are closely related. The recommendations were formed using general scientific methods such as analysis and synthesis and contain elements of the case study method to present positive examples of enterprises.

RESULTS

Identifying the relationship between global sustainable development indicators and global innovation indicators

A correlation analysis was conducted to determine whether there is a link between innovation and sustainable development in general. The analysis examined the strength of the correlation between the Global Innovation Index (GII) and its sub-indices on the one hand and the SDG 9 component indicators on the other (Table 1).

Table 1. Results of the correlation analysis for the GII and its sub-indices and SDG 9 component indicators for 2022. Note: the paper uses GII values that show the ranking of countries, and thus, the lower the numerical value of the index, the higher the country is in the ranking. This explains the fact that all the values in the correlation table are negative, but in fact, the relationship between the indicators is positive - an increase in the values accompanies an increase in the GII. *(Source: calculated by the author according to Sachs et al. (2022), WIPO (2022))*

	Population using the internet (%)	Mobile broadband subscriptions (per 100 population)	Logistics Performance Index: Quality of trade and transport-related infrastructure (worst 1–5 best)	The Times Higher Education Universities Ranking: Average score of top 3 universities (worst 0–100 best)	Articles published in academic journals (per 1,000 population)	Expenditure on research and development (% of GDP)
Overall GII	-0.808877	-0.684992	-0.838358	-0.787370	-0.770694	-0.756735
Institutions	-0.677822	-0.661677	-0.744919	-0.634809	-0.732302	-0.621647
Human capital and research	-0.828785	-0.721243	-0.804869	-0.744118	-0.762332	-0.734572
Infrastructure	-0.844409	-0.731554	-0.850059	-0.702038	-0.784681	-0.697521
Market sophistication	-0.654050	-0.590004	-0.727967	-0.661215	-0.621036	-0.639765
Business sophistication	-0.734947	-0.631562	-0.800550	-0.751966	-0.751675	-0.732626
Knowledge and technology outputs	-0.725659	-0.591556	-0.768397	-0.747509	-0.724763	-0.744471
Creative outputs	-0.683246	-0.547219	-0.751590	-0.746251	-0.699576	-0.677011

As seen from Table 1, many pairs of indicators are characterised by a high correlation strength (according to the Chadock scale). For example, a significant correlation strength is characteristic of the indicator "Population using the Internet" and the overall GII and most sub-indices. A strong relationship is also observed between the Mobile broadband subscriptions (per 100 population) indicator and two GII sub-indices – "Human capital and research" and "Infrastructure". All the other sustainable development indicators (according to SDG 9) presented in Table 1 are significantly related to the GII, with a high correlation strength between them and most of the GII sub-indices. All GII sub-indices and the GII composite index itself have a high degree of correlation with the indicator "Logistics Performance Index: Quality of trade and transport-related infrastructure".

The analysis suggests that the achievement of SDG 9 is strongly linked to innovation in institutions, human capital, market performance, business performance, knowledge and technology, and creative outputs. Table 2 shows the results of a correlation analysis using a similar approach but with SDG 12 as the second set of indicators.

Table 2. Correlation analysis results for the GII and its sub-indices and SDG 12 component for 2022. *(Source: calculated by the author according to Sachs et al. (2022), WIPO (2022))*

	Municipal solid waste (kg/capita/day)	Electronic waste (kg/capita)	Production-based SO2 emissions (kg/capita)	SO2 emissions embodied in imports (kg/capita)	Production-based nitrogen emissions (kg/capita)	Nitrogen emissions embodied in imports (kg/capita)	Exports of plastic waste (kg/capita)
Overall GII	-0.098279	-0.849540	-0.299349	-0.647752	-0.122643	-0.626156	-0.411211
Institutions	-0.102573	-0.764741	-0.232064	-0.715982	-0.099432	-0.626792	-0.401481
Human capital and research	-0.181676	-0.875668	-0.333241	-0.679669	-0.142988	-0.618593	-0.405769
Infrastructure	-0.142065	-0.907690	-0.374692	-0.741488	-0.106493	-0.633481	-0.413051
Market sophistication	-0.018849	-0.680244	-0.275242	-0.533412	-0.008505	-0.512079	-0.261882
Business sophistication	-0.063343	-0.802869	-0.223114	-0.621912	-0.179603	-0.606611	-0.428858
Knowledge and technology outputs	-0.045358	-0.773030	-0.240436	-0.557026	-0.108632	-0.547478	-0.402136
Creative outputs	-0.100128	-0.745888	-0.221012	-0.532031	-0.130196	-0.562430	-0.347942

Table 2 shows that the high strength of the relationship with the GII and its sub-indices is typical in this case only for two indicators – "Electronic waste (kg/capita)" and "SO2 emissions embodied in imports (kg/capita)". Accordingly, innovation development has a powerful impact on the volume of e-waste and SO2 emissions embedded in imports.

The conducted correlation analysis provides grounds to assert that innovation support is significantly related to the sustainable development of enterprises. However, such an analysis does not provide exhaustive information on the impact of innovation provision on such development, which necessitates an additional stage of analysis based on the multivariate regression method.

Assessing the impact of innovation support on specific sustainable development indicators of enterprises

To assess the impact of innovation provision on specific sustainable development indicators of enterprises, a multivariate regression method was used. The dependent variables are the indicators of sustainable development, the connection of which with innovation provision turned out to be the strongest for all the studied parameters – "Logistics Performance Index: Quality of trade and transport-related infrastructure" (for SDG 9) and "Electronic waste (kg/capita)" (for SDG 12). The results of the analysis are presented in Tables 3 and 4.

Table 3. Results of the multivariate regression analysis for the dependent variable "Logistics Performance Index: Quality of trade and transport-related infrastructure" for 2022. *(Source: calculated by the author according to Sachs et al. (2022), WIPO (2022))*

	Beta	Standard error Beta	B	Standard error B	t(123)	p-value.
Free member			0.011428	0.042392	0.26957	0.787940
Institutions	-0.200391	0.069603	-0.201322	0.069926	-2.87905	0.004706
Human capital and research	-0.128661	0.102508	-0.129144	0.102894	-1.25513	0.211812
Infrastructure	-0.352031	0.111243	-0.354109	0.111900	-3.16451	0.001958
Market sophistication	-0.115596	0.076622	-0.116434	0.077178	-1.50864	0.133955
Business sophistication	-0.098512	0.101148	-0.098540	0.101177	-0.97394	0.332000
Knowledge and technology outputs	0.025883	0.115079	0.025787	0.114651	0.22492	0.822416
Creative outputs	-0.102089	0.098593	-0.102725	0.099208	-1.03546	0.302488

Based on the results of the multivariate regression analysis for the dependent variable "Logistics Performance Index: Quality of trade and transport-related infrastructure", the following conclusions can be drawn. The coefficient of determination R2 is 0.7775, which indicates that about 78% of the variation in the dependent variable can be explained by the variation in the independent variables used in the model. This suggests that the model has a high explanatory power for the quality of trade and transport infrastructure. The F-value of F (7.123) = 61.390 is large and indicates that the regression model is statistically significant. The model contains statistically substantial coefficients for such variables as "Institutions"

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and "Infrastructure". This indicates that institutional factors and developed infrastructure have a significant impact on the quality of trade and transport infrastructure in the context under consideration. On the other hand, the coefficients for the other variables – "Human capital and research", "Market sophistication", "Business sophistication", "Knowledge and technology outputs", and "Creative outputs" – are not statistically significant at the 0.05 level of significance. This may indicate that these variables may have a less decisive impact on the quality of trade and transport infrastructure than other factors. The results underline the need for adequate institutional support and infrastructure development to ensure high-quality trade and transport infrastructure for firms.

Table 4. Results of multivariate regression analysis for the dependent variable "Electronic waste (kg/capita)" for 2022. *(Source: calculated by the author according to Sachs et al. (2022, WIPO (2022))*

	Beta	Standard error Beta	B	Standard error B	t (123)	p-value.
Free member			0.003620	0.034068	0.10625	0.915560
Institutions	-0.133160	0.056002	-0.132957	0.055916	-2.37778	0.018984
Human capital and research	-0.462279	0.082947	-0.460839	0.082689	-5.57319	0.000000
Infrastructure	-0.594311	0.089882	-0.597991	0.090438	-6.61214	0.000000
Market sophistication	0.130355	0.061714	0.130559	0.061810	2.11226	0.036720
Business sophistication	0.016466	0.081573	0.016511	0.081795	0.20186	0.840368
Knowledge and technology outputs	0.181613	0.094151	0.179773	0.093197	1.92897	0.056077
Creative outputs	-0.084210	0.079808	-0.084917	0.080479	-1.05515	0.293459

The R2 value, in this case, is also high. It equals 0.85860991, which indicates that the independent variables taken into account largely explain the variation in the dependent variable "Electronic waste (kg/capita)". The value of the F-statistic confirms the significance of the model – F (7.121) = 104.97, which demonstrates the statistical significance of the model. The beta coefficients show how the dependent variable changes when the independent variable changes if other independent variables are held constant. According to the results, the indicators "Institutions", "Human capital and research", and "Infrastructure" harm "Electronic waste (kg/capita)". "Market sophistication" has a positive impact. "Business sophistication", "Knowledge and technology outputs", and "Creative outputs" were found to be statistically insignificant, as the respective p-values were more significant than 0.05. In general, the analysis shows that institutions, human capital and research, infrastructure, and market development impact the amount of e-waste per capita. At the same time, business sophistication, knowledge outputs, technological outputs, and creative outputs do not have a statistically significant impact.

Thus, as a result of the assessment using the correlation analysis method, the sustainable development indicators for SDG 9 and SDG 12, which are most closely related to innovation support, were identified. The multivariate regression analysis was used to determine the impact of innovation support on these indicators. Summarizing the obtained results, it can be noted that Institutions and Infrastructure have the greatest influence on the Logistics Performance Index: Quality of trade and transport-related infrastructure, and on Electronic waste (kg/capita) - Institutions, Human capital and research, Infrastructure and Market sophistication. From this, we can conclude that most of the innovation support indicators that affect the selected sustainable development indicators are heavily dependent on government actions and decisions. Infrastructure, institutions, the market, accessibility, and quality of education (covered by the "Human capital and research" indicator, as each of the GII sub-indices, in turn, consists of several elements) are in the sphere of government regulation. However, the participation of enterprises in achieving sustainable development is no less critical, and further proposals will address both the public and private sectors. Cooperation between these actors is crucial to achieving a tangible result in terms of sustainability.

Developing approaches and recommendations for the use of innovative support for sustainability in Ukraine

The preliminary analysis revealed that innovation provision has a particularly significant impact on such indicators of sustainable development as logistics and e-waste. Figure 1 shows the values of these indicators for Ukraine and the European Union (EU), as well as the position of countries in the overall GII (the higher the value, the lower the position).

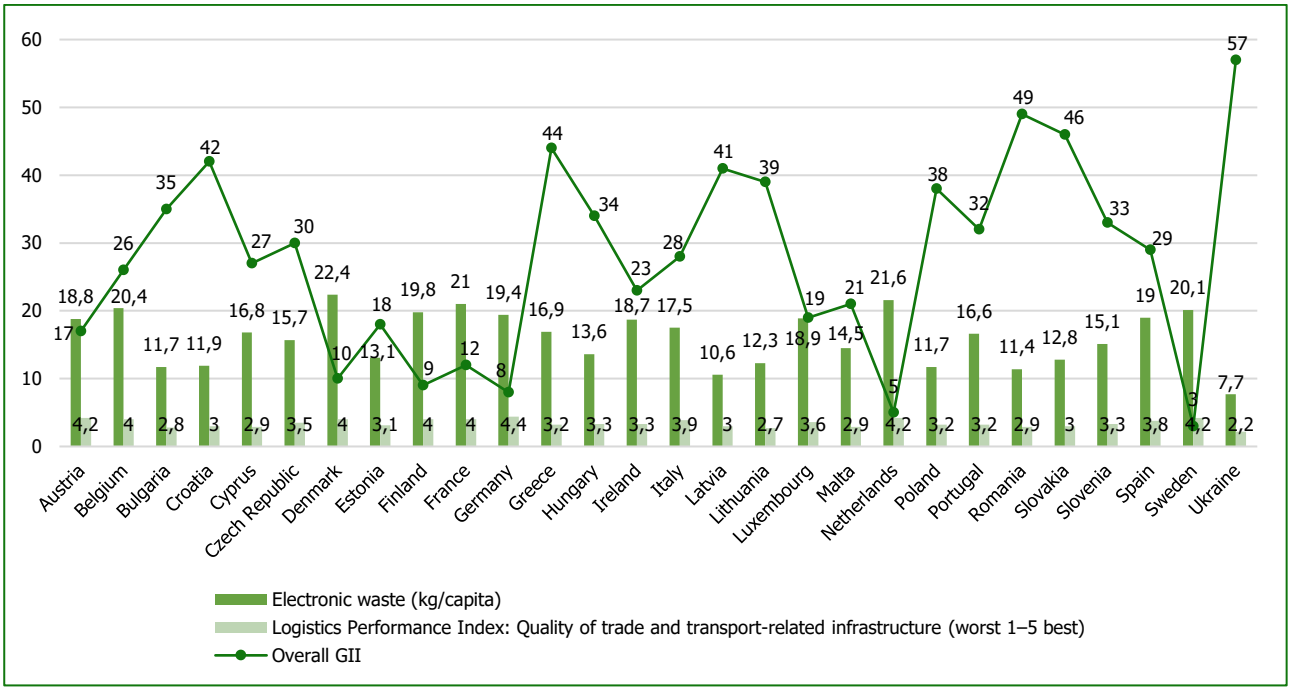

Figure 1. Comparison of critical indicators for Ukraine and EU countries for 2022. *(Source: built by the author according to Sachs et al. (2022), WIPO (2022))*

As can be seen from Figure 1, Ukraine has the lowest GII score among EU countries, as well as the lowest values for the "Logistics Performance Index: Quality of trade and transport-related infrastructure" and "Electronic waste (kg/capita)". Considering the above dependencies and influences, it is worth formulating recommendations for Ukraine on applying innovation support to improve its position in the defined sustainable development indicators. It should also be noted that low values of the indicator "Electronic waste (kg/capita)" may indicate not only effective waste management but also a low amount of such waste in general, which may indicate an insufficient level of development of the information and communication sphere. The recommendations are presented in Table 5, which aggregates possible approaches to applying innovative support for sustainability (in the context of the studied indicators) and innovative technologies that can be used to implement approaches and individual positive examples of enterprises.

Table 5. Recommendation and examples for Ukraine on the use of innovation for sustainability.

Sustainability indicator under study	Approaches to the implementation of innovative support	Innovative technologies that can be applied	Examples of companies
"Logistics Performance Index: Quality of trade and transport-related infrastructure"	Implementation of electronic transport monitoring and management systems	GPS cargo monitoring systems	"Amazon - implementation of a cargo tracking system"
	Modernisation of warehouse processes using electronic systems	Automated warehouse systems using cloud technologies	"DHL - modernised warehouse processes"
	Approaches based on the resource cycle	Use of secondary building materials	"Siemens - uses recycled materials for construction"
"Electronic waste (kg/capita)"	Approaches based on the resource cycle	Use of precious metal recovery technologies	"Apple - uses particular metal recovery technologies"
		Use of plastic recycling technologies to produce packaging	"Coca-Cola - uses recycled plastic for packaging"
		Use of electronic waste to create energy-efficient devices	"Tesla - uses electronic waste to make solar panels"

Table 5 provides a limited list of possible areas for using innovation for sustainability, but successful foreign practices have confirmed the effectiveness of these measures. In Ukraine, such practices are less common, which necessitates further development of the issue of innovation for sustainability in the country, given Ukraine's European integration intentions and the objective need to address logistical problems and the growing volume of waste.

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DISCUSSION

The relevant issues covered in this paper are addressed from different angles in the scientific literature. Matinaro et al. (2019) identify critical factors for a sustainable business model for SMEs. Such factors or principles form a practical framework for developing a business model for enterprises in any industry, as they are presented in the context of the three sustainable development indicators. However, in the author's opinion, the approach could be improved by emphasising innovative technologies, which are an integral part of sustainable development. For example, the study by Di Vaio et al. (2020) on sustainable business models, as well as the work of the authors, focuses on SDG 12 and explores the role of artificial intelligence in achieving the SDGs. The study by Shakeel et al. (2020) focuses on forming an innovative model of sustainable business, which includes approaches to applying innovation to achieve sustainability.

Most other studies also consider innovation an inextricable link with sustainable development. Silvestre & Ţîrcă (2019) pay considerable attention to the classification of innovations, dividing them into social innovations, sustainable innovations, traditional innovations, and green innovations. The authors' study reveals not only management practices and new technologies in the context of innovations for sustainability but also notes new policy approaches for sustainable development. At the same time, the author's research and the work of Silvestre and Ţîrcă (2019) have in common the combination of the research of both macro- and micro-categories, which proves the soundness of the author's approach regarding the fact that sustainability and innovation (including at enterprises) should be considered taking into account the global environment because the successful development of sustainability and innovation requires appropriate macro-environmental conditions. In addition, the advantage of the author's research is highlighting practical examples of technology companies use - including approaches based on resource cycles.

In this context, it is worth noting the work of Prashar (2020), who describes existing tools for sustainable management, noting among them the Life Cycle Assessment (LCA) approach. LCA allows assessing the environmental impact of different alternative resource management strategies. In contrast, resource circularity-based approaches can point to ways to optimise resource use and support sustainable production and consumption. Therefore, it can be said that Prashar's work and the author's research are complementary in studying approaches to sustainability. LCA can be added to the list of recommendations and examples for Ukraine compiled by the author. A pervasive list of other approaches is given by Álvarez Jaramillo et al. (2019), who note the following sustainability tools:

- Material flow cost accounting;
- Nonspecific instruments;
- Agile methodology;
- Heat recovery;
- Green manufacturing,
- Product Service System with lean thinking approaches;
- Cleaner production;
- Energy efficiency;
- Information and communication technology;
- Life cycle techniques;
- Sustainability-balanced scorecard;
- Green logistics.

Providing such a wide range of possible tools for sustainable development is an undoubted advantage of the work. The researchers categorised these tools according to the barriers to the sustainable development of SMEs.

Yin et al. (2022) compare innovations for sustainable development in rural and urban areas and consider logistics problems to be more typical for rural areas, while problems related to pollution and waste are attributed to urban areas. The author's work, which focuses on logistics and waste management, did not specify which areas are more affected by these problems, but this aspect should be considered in further research. In addition, the researchers' work focuses on the role of the state and regulation in balancing sustainability in different territories. In this context, it is worth noting the work of Shao et al. (2020), who provide a mechanism for the impact of environmental regulation on the innovation system of enterprises. As the authors found, environmental regulation affects both internal and external aspects of the enterprise. What this paper and the author's study have in common is determining the impact of regulation on sustainability. Still, the author also emphasises the need for cooperation between the state and the private sector regarding innovation support for sustainable development. Moreover, some researchers emphasise the importance of interaction not only in the state-enterprise format

but also between the enterprise and customers and the enterprise and suppliers. The development of such types of interaction, as noted in Shafi (2021), has a positive impact on innovation capacity. Luo et al. (2023) investigate the impact of the development of the digital economy on the level of environmental innovation, finding that such an impact can be realised through indirect means (increasing the degree of economic openness, increasing market potential, etc.). The researchers' conclusions are confirmed by the quantitative calculations presented in the author's article, given the close relationship between specific indicators of sustainable development and innovation.

Confirmation of the relationship between these indicators based on quantitative calculations is the key value of the author's work. The results obtained make a significant contribution to existing empirical studies because they reveal specific directions of sustainable development of enterprises that are most influenced by innovative provision. This makes it easier to choose and determine the priority of actions and measures aimed at achieving sustainability of enterprises through the introduction of innovations.

CONCLUSIONS

The concept of sustainable development is a response by countries, multinational enterprises and international organisations to the growing social, economic and environmental challenges. Enterprises are essential participants in the process of achieving the SDGs, as they can make a significant contribution to the process by reducing harmful emissions, producing more environmentally friendly packaging for goods, recycling waste, improving logistics efficiency and environmental friendliness of transportation, etc. Innovation support for enterprises is of utmost importance in implementing these areas.

Based on the results of the study, it can be noted that the innovation support presented in the work through the GII and its sub-indices is most closely related to such elements of SDG 9 and SDG 12 as "Logistics Performance Index: Quality of trade and transport-related infrastructure" and "Electronic waste (kg/capita)". It has also been found that institutions and infrastructure most strongly influence the first element, and the second one is influenced by institutions, human capital and research, infrastructure and market structure. Based on the analysis results, recommendations for Ukraine to achieve the abovementioned sustainable development indicators through introducing innovations and proper innovation support are developed. The recommendations include the formation of innovative directions and the identification of appropriate innovative technologies, positive examples of individual enterprises, and highlighting approaches using various electronic systems, as well as approaches based on resource circularity.

Further research could reveal the impact of innovation on other sustainable development indicators, as well as focus on specific industries and types of enterprises. This will help to formulate practical approaches to achieving sustainability through innovation, as it will consider specific industry characteristics.

ADDITIONAL INFORMATION

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ВПЛИВ ІННОВАЦІЙНОГО ЗАБЕЗПЕЧЕННЯ НА СТАЛИЙ РОЗВИТОК ПІДПРИЄМСТВ

На сьогодні проблеми знецінення екології, вичерпання природних ресурсів, соціальні та економічні кризи дедалі поглиблюються, а отже, питання забезпечення сталого розвитку, зокрема на рівні підприємств, постає як необхідність, а не лише регулятивна вимога. Ключову роль у цьому процесі відіграє інноваційне забезпечення, здатне реформувати існуючі підходи до зауважених проблем. Метою роботи є визначення взаємозв'язку та взаємного впливу між показниками інноваційного забезпечення й сталого розвитку підприємств із формуванням рекомендацій згідно з отриманими результатами. У ході дослідження було використано методи кореляційного аналізу, багатовимірної регресії, кейс-стаді. У результаті проведеного дослідження було виявлено тісний кореляційний зв'язок між показниками інноваційного забезпечення, які в дослідженні представляє глобальний індекс інновацій із його субіндексами, та такими вимірами сталого розвитку, як «Індекс ефективності логістики: якість торгівлі та транспортної інфраструктури» й «Електронні відходи (кг на душу населення)». Визначено, що на перший вимір найбільш сильний вплив здійснюється з боку інституцій та інфраструктури, а на другий – з боку інституцій, людського капіталу та досліджень, інфраструктури та структури ринку. Сформовані в результаті проведеного аналізу рекомендації містять підходи, що передбачають використання електронних систем, а також підходів, заснованих на кругообігові ресурсів. Отримані результати можуть мати практичне значення та бути використані й керівництвом підприємств, і урядовими органами з метою оптимізації логістичної системи підприємства та управління відходами.

Ключові слова: інновації, інноваційне забезпечення, інноваційні технології, сталий розвиток, цілі сталого розвитку, екологія, логістика, відходи

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