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RESILIENT SYNERGY: CRAFTING INTEGRATED SMART BUSINESS MODELS FOR EU-UKRAINIAN RECOVERY

ABSTRACT

The aim of this article is to investigate the potential of integrated smart business models in fostering economic recovery, with a specific focus on the European Union (EU) and Ukraine. The research seeks to understand the impact of smart business models, driven by technology, entrepreneurship, and sustainable practices, on the resilience and growth of these regions, especially considering the challenges posed by the ongoing war in Ukraine. The research utilizes a comprehensive index of smart business models based on the entropy method. Modelling and forecasting were conducted using three scenarios involving Markov chains. The study allows us to understand which components of smart business models have the greatest impact on the recovery of the EU and Ukraine and how they can improve their metrics to stimulate innovation and digital transformation. The research identified a group of indicators related to sustainability and social responsibility as the most significant for the application of smart business models. It highlights how these innovative models, driven by cutting-edge technologies and sustainable practices, offer a path to economic rejuvenation and long-term stability. The article emphasizes the need for collaborative efforts between the EU and Ukraine, aligning policies and fostering cooperation. Ultimately, it advocates for innovation, collaboration, and resilience as the means to overcome adversity and forge a prosperous future for both regions.

Keywords: innovation, integrated development, scenario, smart business model, sustainable synergy

JEL Classification: F23, M1, M2

INTRODUCTION

In recent years, the European Union and Ukraine have been confronted with a daunting challenge that has tested their economic and political resilience to the core - the ongoing backdrop of war. The conflict in Ukraine, exacerbated by external aggression, has inflicted profound socio-economic consequences, leaving both regions in urgent need of effective recovery strategies (Hrynevych et al., 2023). As the world witnessed the devastating impact of armed conflict, it became evident that innovative and adaptive approaches were required to revitalize economies, promote sustainable growth, and foster long-term stability (Mariotti, 2022). In this pursuit, the concept of "smart business models" has emerged as a beacon of hope, offering a path towards rejuvenation and prosperity. Smart business models integrate cutting-edge technologies, data-driven insights, and sustainable practices, empowering enterprises to remain agile in the face of adversity and leverage collective strength to address complex challenges (Niemandt, 2022). As both the EU and Ukraine navigate through uncertain times, a joint effort to develop and implement such integrated smart business models holds immense potential for their recovery and transformation.

The European Union and Ukraine share a complex history, marked by diplomatic ties, economic cooperation, and aspirations for further integration. In 2014, however, this relationship took a dramatic turn as Russia's annexation of Crimea and subsequent military intervention in Eastern Ukraine plunged the region into a protracted armed conflict (Vorbrugg & Bluwstein, 2022). The war not only caused substantial loss of life but also

resulted in widespread destruction of infrastructure, disruption of industries, and a significant refugee crisis. The conflict impacted the EU as well, with member states grappling with geopolitical tensions, energy security concerns, and economic implications due to sanctions and trade restrictions (Khan et al., 2023b). Despite these challenges, the EU has remained steadfast in its commitment to supporting Ukraine's sovereignty, territorial integrity, and democratization process.

Confronted with the aftermath of war, both the EU and Ukraine recognize the urgency to rebuild their economies and societies. Traditional approaches to recovery may no longer suffice, as the landscape has fundamentally changed due to the conflict's protracted nature and the disruptive influence of technology on various industries (Cui et al., 2023). In this context, smart business models offer a compelling alternative, advocating for digital transformation, sustainable practices, and cross-sector collaborations. By leveraging advancements in technology such as artificial intelligence, the Internet of Things, blockchain, and big data analytics, enterprises can adapt and thrive in the face of challenges posed by conflict (Ameen et al., 2022; Pakhnenko & Kuan, 2023). The development of integrated smart business models necessitates close cooperation between the EU and Ukraine. Embracing integration not only allows for the seamless flow of goods, services, and investments but also fosters a spirit of collaboration, where collective strengths are harnessed to address shared challenges. This partnership will require the alignment of policies, regulatory frameworks, and incentives to facilitate the exchange of ideas and resources.

The aim of this article is to investigate the potential of integrated smart business models in fostering economic recovery, with a specific focus on the European Union (EU) and Ukraine. The research seeks to understand the impact of smart business models, driven by technology, entrepreneurship, and sustainable practices, on the resilience and growth of these regions, especially considering the challenges posed by the ongoing war. To achieve this aim, the following tasks were set:

- identify and evaluate key components of smart business models, including digital transformation, innovation, customer satisfaction and sustainability;
- formulate a comprehensive index using the entropy method to assess the effectiveness of smart business models among a sample of companies in the EU and Ukraine;
- employ scenario analysis and Markov chains to forecast changes in GDP, considering three scenarios ("Innovation Revival," "Tech-Driven Renaissance," and "Sustainable Synergy");
- determine key indicators related to sustainability and social responsibility that have the most impact on the application of smart business models;
- offer practical recommendations for companies and governments in the EU and Ukraine based on research findings, and guiding strategies for the development and application of smart business models.

By adopting a forward-thinking approach, this research aims to shed light on the transformative power of innovative business models and their capacity to steer the region toward a brighter, more sustainable future. Throughout this study, we will analyze the challenges and opportunities that arise in the context of post-conflict economies. The insights gained from this exploration will offer valuable perspectives to policymakers, businesses, and stakeholders involved in the reconstruction process. Additionally, the article will highlight successful case studies of integrated smart business models already deployed in other regions, offering valuable lessons and best practices that can be adapted to the EU-Ukrainian context. As the EU and Ukraine strive to recover against the backdrop of war, the adoption of integrated smart business models emerges as a transformative force that can drive economic revival, sustainable growth, and strengthened cooperation. By embracing innovation, collaboration, and resilience, both regions can rise above their challenges and build a prosperous and resilient future together. This article aims to shed light on the possibilities and opportunities that lie ahead and inspire stakeholders to forge a collective path towards recovery and progress.

LITERATURE REVIEW

The first aspect that highlights the issue in science encompasses the stability of business models. The contemporary business environment is rapidly changing due to technological progress, social shifts, and global trends. Business models must be flexible and adaptable to new realities, requiring constant reinvention and innovation (Hofmann & Jaeger-Erben, 2020; Keiningham et al., 2020). Distinguishing sustainable business models from traditional ones lies in their ability to effectively utilize modern technologies, such as artificial intelligence, the Internet of Things, and blockchain. These tools can enhance operational efficiency, open new markets, and provide competitive advantages (Dhar Dwivedi et al., 2021; Sulastri et al., 2023). Changes can lead to risks such as market position loss, unsuccessful branding campaigns, or financial difficulties. Sustainable business models must anticipate potential risks, implement reserve mechanisms, and crisis planning

(Khan et al., 2023a). Modern consumers are increasingly focused on the social and environmental responsibility of businesses. Sustainable business models should consider these aspects, developing products and services that contribute to sustainable development and a positive societal impact (Di Vaio et al., 2020; Soegoto et al., 2023). An important aspect of business model sustainability is their financial suitability. They must ensure a stable revenue stream, balanced expenses, and the ability to withstand financial challenges (Rashid & Ratten, 2021).

The second aspect that sheds light on the issue in science is related to the integration and synergy between business models, industries, and countries in the context of post-pandemic recovery and the full-scale Russian invasion of Ukraine. This issue arises from the increasing complexity and interdependence of the modern business environment, as well as the need to enhance collaborative approaches for achieving sustainable development (Radziwon et al., 2022). Contemporary challenges and opportunities require interaction between different business sectors and countries to maximize benefits and resources. However, the absence of adequate integration strategies can lead to inefficiency of efforts and even conflicts of interest. Synergy occurs when different components of a shared system interact in a way that the combined result exceeds the sum of individual parts. In business, this can mean that the collaborative actions of different parties can lead to greater benefits than individual efforts. Integrating business models and strategies requires effective coordination across different sectors and parties based on the "five-helix" model (Megits et al., 2022). Insufficient mechanisms for interaction can slow down the implementation of joint projects. Integrated business models can contribute to more efficient resource utilization, such as technological expertise, infrastructure, financial resources, and more (Han et al., 2020).

The third aspect highlighting the problem in science is associated with the partnership between the EU and Ukraine in the context of developing integrated business models, which is particularly important and complex in modern conditions. This problem arises from several factors, including economic, political, trade, and cultural demands and constraints (Behie et al., 2023; Pidorycheva & Omelyanenko, 2022). The partnership between the EU and Ukraine holds international significance, impacting the political sphere and geopolitical relations. The absence of clear political frameworks can complicate cooperation and lead to delays in implementing joint business models (Lyulyov et al., 2021). Trade restrictions and barriers can hinder market access, and limit export and import opportunities, affecting the partners' ability to realize common business models (Baldynyuk & Tomashuk, 2021; Redziuk, 2021). Differences in legal norms and regulations between the EU and Ukraine can become a hurdle for the implementation of shared business models. The need for standard and procedural harmonization can be a challenging task (Genschel, 2022). Disparities in development levels and economic opportunities can influence the dynamics of cooperation between the EU and Ukraine. Effective integration of business models requires a balance between the interests and benefits of both partners. Developing integrated business models necessitates considering cultural aspects and the specificities of each country. Shared values and understanding can impact partnership effectiveness (Kharazishvili et al., 2020; Shpak et al., 2020).

This study addresses a crucial issue related to the development and application of smart business models for the economic recovery and development of countries, particularly Ukraine and other nations with lower development levels. It fills a gap in science by identifying key components of smart business models that have the most impact on the economy, revealing opportunities to enhance countries' performance in innovation and digital transformation. This research provides valuable information for decision-making in the planning and development of smart business models. Both companies and governments can utilize the results and recommendations provided in the article to shape development strategies, invest in digital technologies, and scientific projects, and improve the quality of goods and services.

AIMS AND OBJECTIVES

The aim of this article is to investigate the potential of integrated smart business models in fostering economic recovery, with a specific focus on the European Union (EU) and Ukraine. The research seeks to understand the impact of smart business models, driven by technology, entrepreneurship, and sustainable practices, on the resilience and growth of these regions, especially considering the challenges posed by ongoing war. To achieve this aim, the following tasks were set:

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- determine key indicators related to sustainability and social responsibility that have the most impact on the application of smart business models;

- offer practical recommendations for companies and governments in the EU and Ukraine based on research findings, guiding strategies for the development and application of smart business models.

METHODS

In the first stage of the research, a sample of companies implementing a smart business model in their operations was formed. A sample of 336 companies from the EU and Ukraine was selected for conducting research on smart business models. The formation of the sample began with identifying criteria that align with smart business models. Next, the database of enterprises was analyzed, encompassing information on over 800 potential candidates from various industries and regions.

Subsequently, a random sampling method was employed to select 500 companies, but positive responses for participation in the research were received from 348 companies. During the process of obtaining the necessary information for participation, 12 companies were disqualified. After finalizing the sample, essential data were gathered for each enterprise. This data included information on their smart initiatives, digital technologies, innovations, customer satisfaction, sustainability, and social responsibility. This data collection enabled an analysis of the effectiveness of smart business models and the identification of common trends among the selected companies.

To calculate the comprehensive assessment index of smart business models for enterprises, the entropy method was utilized (Dong et al., 2020):

$$\begin{cases} x'_i = \frac{x_i - \min\{x_1, \dots, x_n\}}{\max\{x_1, \dots, x_n\} - \min\{x_1, \dots, x_n\}} \\ p_i = \frac{1 + x'_i}{\sum_{i=1}^n (1 + x'_i)} \\ e_j = -k \sum_{i=1}^n p_i \times \ln(p_i), k = \frac{1}{\ln(n)} \end{cases} \quad (1)$$

where x'_i represents the standardized value of x_i , and negative standardized x_i only requires changing the x'_i denominator to $(\max\{x_1, \dots, x_n\} - \min\{x_1, \dots, x_n\})$, p_i is the weight of index, e_j - is the entropy of index j , and n is the sample size. Thus, we can obtain the weights of different samples w_j as follows:

$$w_j = d_j / \sum_{j=1}^m d_j, d_j = 1 - e_j \quad (2)$$

In formula (2) d_j represents the utility value of indicator j . Then, we can derive the aggregated Smart Business Model (SBM_i) index:

$$SBM_i = \sum_{j=1}^m w_j \times x'_i \quad (3)$$

The research employed a regression model with geographic weighting. A traditional econometric model can only reflect the statistical relationship between variables as a whole, but it cannot capture the regional effects between variables. In contrast, a spatial econometric model can compensate for the limitations of traditional econometric models and fully represent differences in spatial geographic impact between variables. It can especially reveal all coefficients of variables related to smart cities in the sample (Thanos et al., 2016). Therefore, for analyzing spatial differences in the impact of various factors on the resilience of smart business models, a Geographically Weighted Regression (GWR) model was utilized.

$$y_j = \beta_0(m_i, n_i) + \sum_{i=1}^k \beta_j(m_i, n_i) x_{ij} + \mu_{ij} \quad (4)$$

where y_j represents the indices of smart business models resilience, x_{ij} represents driving factors; (m_i, n_i) represents the spatial location of sample i , μ_{ij} - represents the random error; β is the regression coefficient calculated as follows:

$$\beta(m_i, n_i) = (X^T W_{ij} X^{-1}) X^T W_{ij} Y \quad (5)$$

where W_{ij} represents the weight of spatial distance between different sample points, determined by the Gaussian function:

$$w_{ij} = \exp[-(c_{ij}/b)^2] \quad (6)$$

where c_{ij} - is the Euclidean distance between sample point i and sample point j ; b - is the bandwidth determining the weight of distance between any two smart business models and is determined through cross-validation (CV):

$$CV = \min \sum_{i=1}^n [y_i - \hat{y}_i(b)]^2 \quad (7)$$

where $\hat{y}_i(b)$ is the fitted value for y .

To assess the effectiveness of the enterprise's smart business model, a system of 12 key indicators has been developed (Table 1), divided into 4 groups. These groups will reflect various aspects of the enterprise's functioning in the context of the smart approach. It is important to note that specific indicators and formulas can be adapted to the specific conditions and goals of the enterprise.

Table 1. Indicators for diagnosing the effectiveness of an enterprise's smart business model.

Group of Indicators	Indicator Name	Calculation Formula	Unit of Measurement
Digital Transformation	Employee Digital Literacy Ratio	$(\text{Number of digitally literate employees} / \text{Total employees}) * 100$	Percentage
	Proportion of Automated Processes	$(\text{Number of automated processes} / \text{Total processes}) * 100$	Percentage
	Integration of Digital Solutions	$(\text{Number of integrated digital systems} / \text{Total systems}) * 100$	Percentage
Innovation and Creativity	Number of Implemented Innovations	Number of new or improved products/services implemented during the period	Count
	Research and Development (R&D) Expenditure	Total R&D expenditure during the period	Monetary amount
	Average Time for Idea Implementation	$(\text{Total time taken to implement new ideas} / \text{Number of implemented ideas})$	Time (e.g., days)
Customer Satisfaction	Net Promoter Score (NPS)	$((\text{Number of promoters} - \text{Number of detractors}) / \text{Total surveyed customers}) * 100$	Percentage
	Proportion of Repeat Orders	$(\text{Number of repeat orders} / \text{Total orders}) * 100$	Percentage
	Customer Response Time	Average time taken to respond to customer inquiries	Time (e.g., hours)
Sustainability and Social Responsibility	Waste Utilization Ratio	$(\text{Volume of waste utilized} / \text{Total waste generated}) * 100$	Percentage
	Investments in Sustainable Development (ESG)	Total investments in environmental, social, and governance (ESG) projects	Monetary amount
	Energy Saving Ratio	$(\text{Energy saved during the period} / \text{Total energy consumption during the period}) * 100$	Percentage

This research attempts to develop a universal set of indicators for companies from different industries. It is important to note the limitation of the study, as formulas and key indicators may vary based on specific industries, goals, and business strategies. It is crucial to select indicators that best reflect the success of the smart business models of the examined enterprises and help achieve the set objectives.

To forecast changes in the GDP of the studied countries considering the development of smart business models, a scenario approach was applied. This approach is based on the European Economic Forecast (European Commission, 2023). Markov Chains were used to determine the probabilities of three proposed scenarios. The "Innovation Revival" scenario assumes the joint approach of the EU and Ukraine, fostering innovation through the implementation of smart business models. Integrating smart technologies and efficient business methods enhances productivity and competitiveness across various industries. According to the "Technological Revival" scenario, a technological renaissance occurs due to the priority given by the EU and Ukraine to integrating smart business models into their economic recovery strategies. Both regions harness the potential of artificial intelligence, blockchain, the Internet of Things (IoT), and data analytics to create dynamic and adaptive business ecosystems. The "Sustainable Synergy" scenario emphasizes the joint efforts of the EU and Ukraine in prioritizing sustainability and environmental responsibility while implementing smart business models.

RESULTS

Analyzing the results of evaluating the effectiveness of smart business models based on four component indicators (DT - Digital Transformation; IC - Innovation and Creativity; CF - Customer Satisfaction; SSR - Sustainability and Social Responsibility), several important points can be highlighted, visualized in Figure 1.

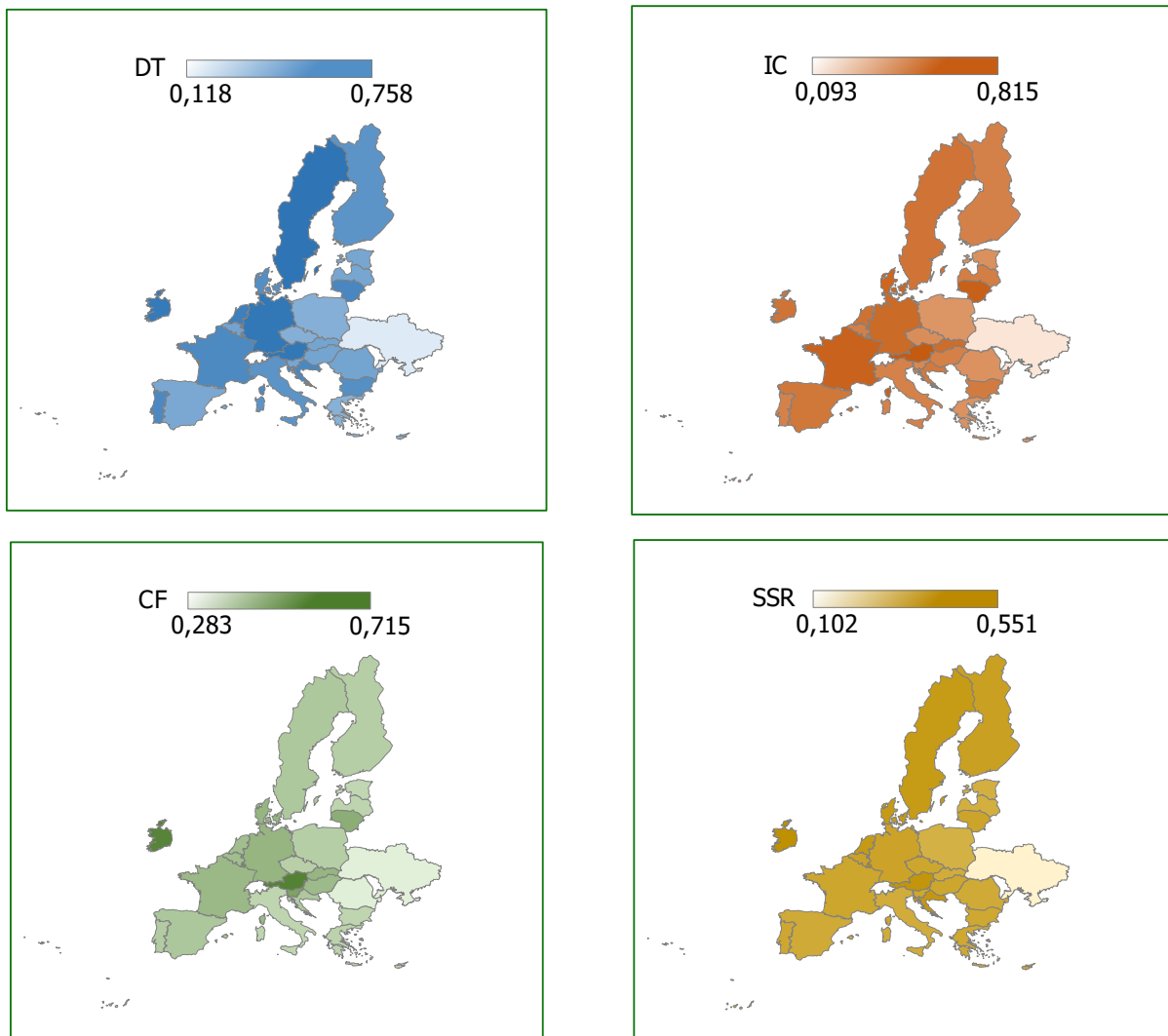


Figure 1. Component indicators of smart business model efficiency of the studied companies in the EU and Ukraine.

Austria, the Netherlands, and Sweden demonstrate a high level of digital transformation. They actively invest in digital technologies and participate in digital development. These countries also have high indicators of innovation and creativity. This could indicate a strong and diverse research base, support for innovative ideas, and a culture of innovation. Ukraine has the lowest DT indicator, which could suggest insufficient efforts in developing digital infrastructure. Ukraine also has a low IC indicator, indicating limited opportunities for innovation and creativity in the economy.

Some countries, including Ireland and Luxembourg, have high customer satisfaction indicators. This could signify good quality of services and products, as well as a high level of customer service. Countries with low indicators, such as Ukraine and Poland, might face challenges in customer service and product quality.

Regarding sustainability and social responsibility, certain countries like Sweden and Austria appear more successful. This might point to their commitment to sustainable development, environmental care, and corporate social responsibility. Some other countries, like Ukraine, have low SSR indicators, implying the need to strengthen efforts in sustainability and social responsibility.

A comprehensive indicator that integrates components from the previous stage of research allows for determining the overall outcome of the effectiveness of smart business models of the studied companies in the EU and Ukraine (Figure 2).

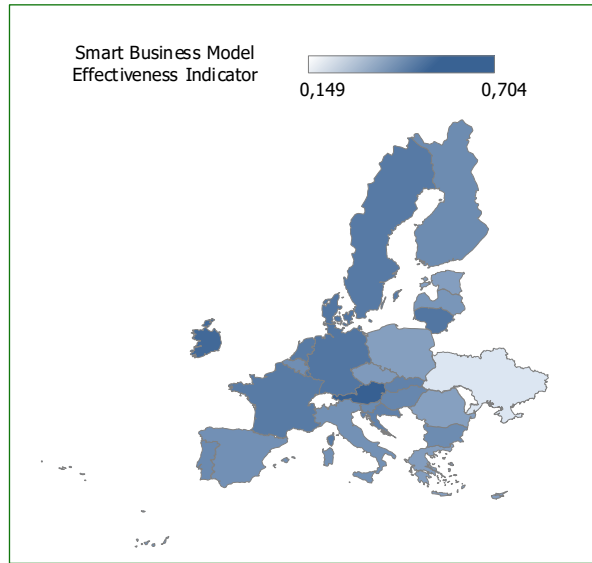


Figure 2. Comprehensive indicator of smart business models efficiency of the studied companies in the EU and Ukraine.

Countries with low CF (Customer Feedback) scores, such as Ukraine and Poland, are advised to pay more attention to the quality of goods and services, as well as enhance customer service to increase customer satisfaction and strengthen competitiveness. Countries with high scores in each of the components should continue their efforts in developing and supporting effective smart business models, as this can contribute to sustainable economic development and societal well-being. The results of the factor analysis of component indicators for the efficiency of smart business models and the GDP of the studied companies are presented in Table 2.

Table 2. Indicators of factor analysis of component indicators for the efficiency of smart business models of the studied companies and GDP.

Factor	Coefficients	Standard Error	t-Stat	P-value	Lower 95%	Upper 95%
Intercept	0.4443	0.0380	11.7048	0.0000	0.3691	0.5194
Employee Digital Literacy Ratio	-0.0060	0.0006	-10.3292	0.0027	-0.0072	-0.0049
Proportion of Automated Processes	0.0019	0.0002	8.3932	0.0009	0.0015	0.0024
Integration of Digital Solutions	0.0006	0.0000	20.9840	0.0006	0.0005	0.0006
Number of Implemented Innovations	0.0017	0.0001	13.8303	0.0000	0.0015	0.0020
Research and Development Expenditure	-0.0021	0.0002	-10.5919	0.0004	-0.0025	-0.0017
Average Time for Idea Implementation	-0.0002	0.0004	-0.5280	0.0485	-0.0011	0.0007
Net Promoter Score	0.0028	0.0002	12.9865	0.0062	0.0024	0.0032
Proportion of Repeat Orders	0.0124	0.0014	8.9677	0.0001	0.0096	0.0151
Customer Response Time	0.0028	0.0004	7.1457	0.0028	0.0020	0.0036
Waste Utilization Ratio	0.0064	0.0006	10.5108	0.0043	0.0052	0.0076
Investments in Sustainable Development	0.0035	0.0003	10.2234	0.0000	0.0028	0.0041
Energy Saving Ratio	0.0071	0.0006	12.8891	0.0021	0.0060	0.0082

The highest impact is observed with the Proportion of Repeat Orders. Companies with a higher share of repeat orders may more successfully apply smart business models to retain customers. Overall, the analysis of the coefficients of factor analysis indicators allows identifying the group of Sustainability and Social Responsibility indicators as the most significant in their entirety. Companies that invest in sustainable development may be more effective in applying smart business models and more attractive to investors.

To form a forecast for changes in GDP in the context of the development of smart business models until 2028, it is necessary to consider alternative scenarios. It is important to note that these scenarios can intertwine and complement

each other in the long term. In this regard, an analysis of Markov chains has been implemented in the formed DSGE model, which allows for the consideration of transition probabilities for the three investigated scenarios (Figure 3).

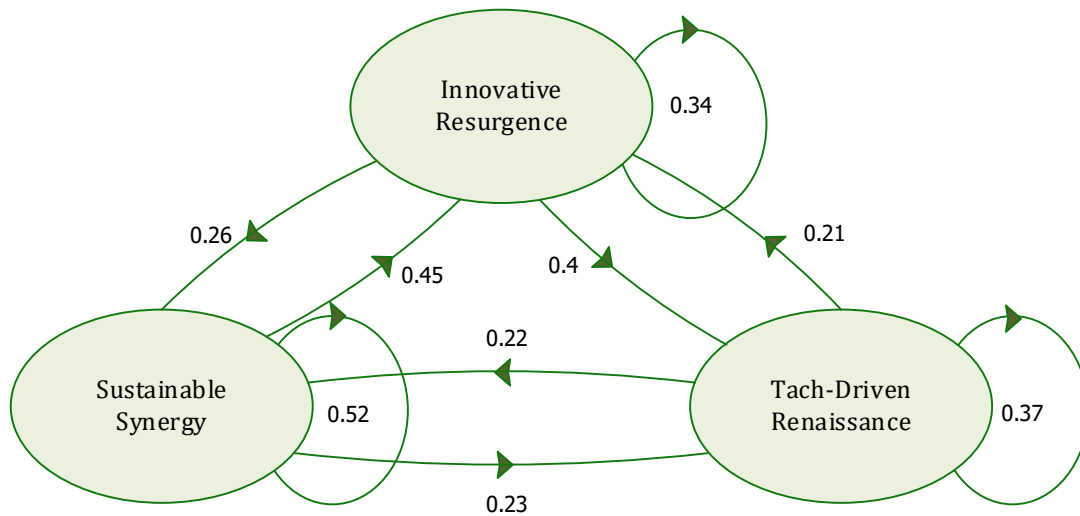


Figure 3. Markov chain model for forecasting the efficiency of smart business models considering three scenarios of EU and Ukraine recovery.

Based on the obtained results of Markov chain analysis by scenarios, the corresponding forecasts of GDP growth were formed, which are presented in Figure 4. At the same time, it is possible to identify the risk limit of deviations from the forecast indicators on the basis of confidence intervals in the lower and upper 95% (Table 3). In all three scenarios, the introduction and integration of smart business models contribute to the recovery and growth of the EU and Ukrainian economies. The degree of impact on GDP depends on the level of technological innovation, sustainability orientation and efficiency of implementation of each scenario. Smart business models serve as a catalyst, enabling businesses to overcome challenges, seize opportunities and create a sustainable and prosperous future for the regions.

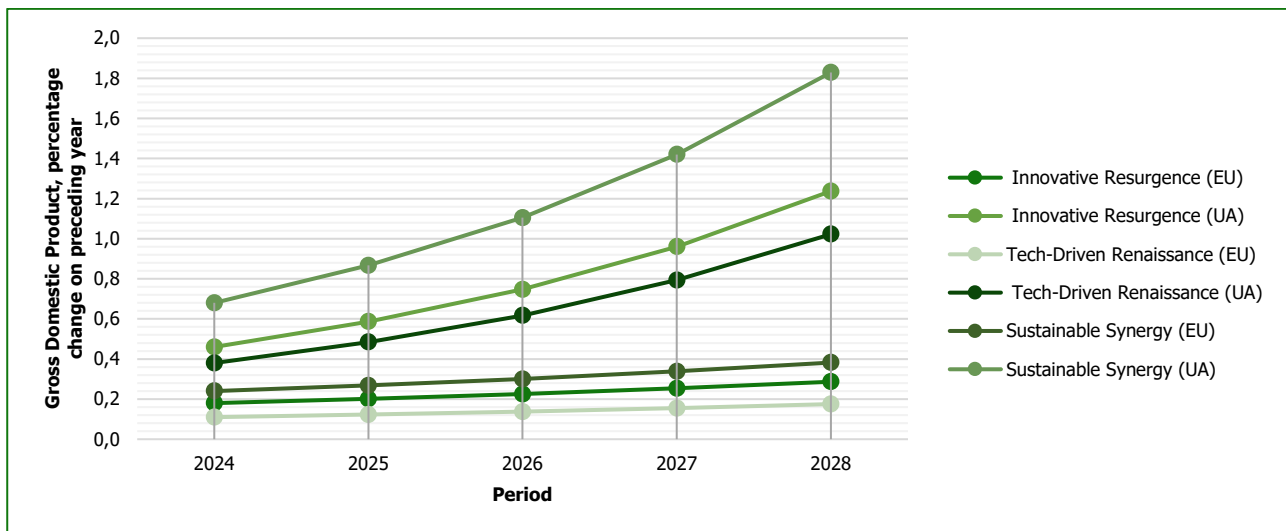


Figure 4. GDP growth forecast under alternative scenarios for the EU and Ukraine.

The "Tech-Driven Renaissance" and "Sustainable Synergy" scenarios for both countries suggest higher GDP growth compared to the "Innovative Resurgence" scenario. This may indicate the importance of technological development and sustainability for faster economic growth. Both countries (EU and Ukraine) could benefit from innovative and sustainable measures, which would contribute to GDP growth. In all scenarios, the GDP growth forecast for Ukraine is higher than for the EU, which may indicate a higher potential for economic growth in Ukraine, possibly due to a lower base and more room for development (Table 3).

Table 3. Projected GDP growth indicators based on the development of smart business models of companies.

Scenario	Period	GDP growth in the EU, %	Lo 95	Hi 95	GDP growth in Ukraine, %	Lo 95	Hi 95
Innovative Resurgence	2024	0.1800	0.1640	0.1960	0.4600	0.4191	0.5009
	2025	0.2013	0.1474	0.2158	0.5864	0.3768	0.5515
	2026	0.2250	0.1311	0.2397	0.7472	0.3350	0.6127
	2027	0.2537	0.1154	0.2684	0.9605	0.2950	0.6858
	2028	0.2866	0.1008	0.3024	1.2372	0.2576	0.7727
Tech-Driven Renaissance	2024	0.1100	0.1002	0.1198	0.3800	0.3462	0.4138
	2025	0.1230	0.0901	0.1319	0.4844	0.3112	0.4556
	2026	0.1375	0.0801	0.1465	0.6173	0.2767	0.5061
	2027	0.1550	0.0705	0.1640	0.7935	0.2437	0.5665
	2028	0.1752	0.0616	0.1848	1.0221	0.2128	0.6383
Sustainable Synergy	2024	0.2400	0.2186	0.2614	0.6800	0.6195	0.7405
	2025	0.2684	0.1966	0.2877	0.8668	0.5569	0.8153
	2026	0.3000	0.1748	0.3197	1.1046	0.4952	0.9057
	2027	0.3383	0.1539	0.3578	1.4199	0.4361	1.0138
	2028	0.3822	0.1344	0.4032	1.8290	0.3808	1.1423

In general, the scenarios related to innovation, technological development and sustainability show a higher GDP growth forecast, suggesting the importance of such factors in driving economic growth in both countries. Thus, of the presented scenarios, the "Sustainable Synergy" scenario can be considered the most effective for the EU and Ukraine, as it implies the highest GDP growth forecast for both countries. However, it should be noted that the realisation of smart business models and different development strategies may strongly depend on various factors, including political stability, investment in infrastructure, scientific and technological innovation and other socio-economic factors.

DISCUSSION

The study aligns with several previous studies emphasizing the importance of smart business models for economic development (Vorbrugg & Bluwstein, 2022). The recognition of digitalization (Behie et al., 2023), innovation (Hofmann & Jaeger-Erben, 2020), and sustainability (Di Vaio et al., 2020; Smerichevska et al., 2023) as core elements driving economic growth echoes findings in the literature. The emphasis on investing in digital technologies and R&D projects mirrors recommendations from prior research (Khan et al., 2023a). However, our study adds value by employing Markov chains and scenario analysis to predict GDP changes within the context of smart business model development (Hrynevych et al., 2023; Bai et al., 2023). This methodology provides a unique perspective on potential economic outcomes, enabling more informed decision-making for both companies and governments.

Despite its contributions, our study has limitations. First, it primarily focuses on GDP changes and does not extensively explore the relationship between smart business models and other macroeconomic indicators such as unemployment, inflation, or investment. Future research should delve deeper into these connections to provide a more comprehensive view of the economic landscape.

Second, the study predominantly concentrates on Ukraine, and while it offers valuable insights for similar underdeveloped countries, the applicability of the findings to more developed nations may require further examination.

Third, the research relies on data availability and quality, which can vary across countries and regions. This could potentially introduce biases or limitations in the analysis.

In summary, our study reinforces the existing body of research on the significance of smart business models for economic growth. It introduces innovative predictive methods and offers practical recommendations for fostering digitalization, innovation, and sustainability in economies like Ukraine. While acknowledging its limitations, our research provides valuable insights for policymakers and businesses to drive sustainable economic growth and prosperity. Further investigations into

the broader economic impact of smart business models and their relationship with other indicators should be a focus of future research efforts.

CONCLUSIONS

The study sheds light on the relevance of smart business models for the economic development of countries, especially for Ukraine and other underdeveloped countries. It provides insight into which components of smart business models have the greatest impact on the economy and how countries can improve their performance to foster innovation and digital transformation. The study provides valuable information for decision-making in planning and developing smart business models. Companies and governments can use the findings and recommendations to shape development strategies, invest in digital technologies, and research projects and improve the quality of goods and services. To stimulate digital transformation and innovation in the Ukrainian economy, it is recommended to improve digitalisation and innovation indicators by investing in digital technologies and R&D projects. It is also worth stimulating the creative thinking of employees, which favours the development of new ideas and innovations. For countries with low quality of goods and services indicators, such as Ukraine and Poland, it is recommended to pay more attention to improving the quality of goods and services as well as customer service. The study identified a group of indicators related to sustainability and social responsibility as the most relevant for the application of smart business models. Investments in sustainability can make companies more attractive to investors and contribute to their performance.

The use of Markov chains and alternative scenarios allows predicting changes in GDP in the context of the development of smart business models. The "Tech-Driven Renaissance" and "Sustainable Synergy" scenarios assume higher GDP growth for the EU and Ukraine compared to the "Innovative Resurgence" scenario. The "Sustainable Synergy" scenario shows the highest projected GDP growth for both countries.

Future research can delve deeper into analysing the relationship between smart business models and other macroeconomic indicators such as unemployment rate, inflation and investment. The practical contribution of the study is that it provides valuable information to companies and governments on how to effectively apply smart business models to stimulate economic growth and development. The findings and recommendations of this study can inform strategic decisions and policies to promote digitalisation, innovation and sustainability in the economy. Companies can use these results to optimise their operations and increase competitiveness, and governments can use them to create a supportive environment and infrastructure for the development of smart business models. Thus, the study has practical relevance for achieving sustainable economic growth and prosperity in the EU and Ukraine.

ADDITIONAL INFORMATION

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СТІЙКА СИНЕРГІЯ: СТВОРЕННЯ ІНТЕГРОВаниХ СМАРТБІЗНЕС-МОДЕЛЕЙ ДЛЯ ВІДНОВЛЕННЯ УКРАЇНИ ТА ЄС

Досліджується потенціал інтегрованих смартбізнес-моделей у сприянні відновленню Європейського Союзу та України, які дуже постраждали від конфлікту, що триває. Дослідження заглиблюється в перетин технологій, підприємництва та сталих практик, а також спільних стратегій, які можуть підвищити економічну стійкість. Автори використовують комплексний індекс розумних бізнес-моделей, заснований на ентропійному методі. Моделювання та прогнозування було проведено за трьома сценаріями з використанням ланцюгів Маркова. Дослідження дозволяє зрозуміти, які компоненти смартбізнес-моделей мають найбільший вплив на відновлення ЄС та України і як вони можуть покращити свої показники для стимулювання інновацій та цифрової трансформації. Дослідження визначило групу показників, пов'язаних зі стійкістю та соціальною відповідальністю, як найбільш значущих для застосування смартбізнес-моделей. Автори підкреслюють, що ці інноваційні моделі, засновані на передових технологіях і сталих практиках, пропонують шлях до економічного оновлення та довгострокової стабільності. Також автори наголошують на необхідності спільних зусиль між ЄС та Україною, на узгодженні політик та сприянні співпраці. Зрештою, вони виступають за інновації, співпрацю й сталість як засоби подолання негативних явищ та побудови майбутнього процвітання.

Ключові слова: інновації; інтегрований розвиток, сценарій, смартбізнес-модель, стійка синергія

JEL Класифікація: F23, M1, M2