



# Sustainable business models in the digital transformation of higher education: Evidence from Ukraine

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**Abstract.** This article provides an in-depth analysis of the integration of sustainable business models (SBMs) into Ukraine’s digital educational framework. Based on a unique empirical study of teachers, graduate students and undergraduates, it evaluates their awareness of, perception of, and readiness for the implementation of SBMs. The findings reveal several barriers to progress, most notably low digital engagement and limited familiarity with modern tools. Statistical analysis emphasises the urgent need to enhance digital competencies throughout the educational community. In response, the authors propose a practical model for integrating sustainability principles with modern technologies, such as AI and blockchain, into the curriculum. The study categorises key challenges into three groups: technological (poor infrastructure); educational (outdated curricula); and organisational (lack of coordination). Respondents ranked technological issues as the most pressing. The research offers practical guidance for policymakers, advocating interdisciplinary courses and closer collaboration with the IT sector. Ultimately, the study stresses that digital transformation in education requires not only technical upgrades, but also a shift in mindset among all stakeholders.

**Keywords:** Digital literacy; Educational innovation; Circular economy; AI in education.

## 1. Introduction

Digital transformation has emerged as a significant catalyst for the evolution of business models towards sustainable development. In recent years, there has been a discernible trend in the scientific literature towards conceptualising digital tools as drivers of innovation in business modelling, thereby facilitating enhanced economic, environmental and social efficiency. Mäkitie et al. (2023) demonstrate that digital innovations have the capacity to function as a potent catalyst for sustainability

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transformations, thereby enabling the augmentation of ecosystem approaches and the incorporation of diverse stakeholders into the change process. Consequently, Müller et al. (2018) have analysed the factors that influence the adoption of Industry 4.0 technologies, emphasising that digitalisation is not inherently sustainable in itself, but creates a potential basis for achieving sustainability goals if managed strategically.

Recent studies have emphasised the necessity to reconsider business models in the context of digitalisation and the mounting pressure to ensure environmental and social responsibility of companies. The present study explores the interconnection between sustainable development and digital transformation in contemporary scholarship, a nexus that is becoming increasingly evident.

## **2. Literature review**

A considerable amount of attention has been dedicated to the development of a theoretical framework for sustainable business models. Evans et al. (2017), Nitsenko (2011; 2013; 2014). present a unified perspective on innovation in business models for sustainable development, emphasising the importance of creating value not only for the consumer, but also for society and the environment. This assertion is corroborated by the research of Lüdeke-Freund et al. (2018), who have proposed a taxonomy of 45 patterns of sustainability-oriented business models. This structuring enables businesses to adapt their models to digital challenges while maintaining environmental responsibility.

Concurrently, digital transformation is becoming the focus of increased scrutiny. Martínez-Peláez et al. (2024) propose a comprehensive digital transformation framework for SMEs, which focuses on combining digital strategies with sustainability criteria. The integration of the dynamic capabilities approach in Hajiheydari et al. (2023) provides a more nuanced understanding of how organisations can innovate their business models through digital technologies. As demonstrated by Isensee et al. (2023), entrepreneurial resilience is closely linked to digital practices and innovative mechanisms for responding to external challenges.

Research has also demonstrated a gradual convergence of the technological and social dimensions of digital transformation. For instance, Elia et al. (2020) propose a methodology for evaluating digital transformation, utilising sustainable development indicators as a framework. Conversely, Antikainen (2018) conceptualises digitalisation as a catalyst for the advancement of the circular economy. Grabowska and Saniuk (2022) analyse empirical data on the transformation of business models in Poland as part of the fourth industrial revolution, focusing on the key conditions for implementing changes.

The present study draws upon the research conducted by Judijanto (2025), which analysed the impact of digital transformation on the structure of business models from the perspective of scientific literature. This finding is consistent with the research conducted by Scuotto et al. (2021), who examined the micro-foundations of small business growth in the context of digital transformation, and Li (2020), who

analysed the transformation of business models in the creative industries in terms of growth and digital trends.

The pertinence of the subject matter is further substantiated by research in the domain of higher education. In particular, Noguera-Méndez et al. (2024) consider the challenges of integrating sustainable development into economic education, which directly resonates with the context of the study within the Jean Monnet educational course. This enables the expansion of academic understanding of the potential of digital transformation to function as a catalyst for business innovation, in addition to its role as an educational paradigm that fosters a novel mode of thinking among the younger generation.

It is also important to acknowledge the contribution of Dangelico & Vocalelli (2017) and Nitsenko & Zakharchenko (2014), who systematised approaches to green marketing as an important element of business transformation in the context of sustainable development. The issue of information and communication technologies in this context is addressed in the works of Allam & Dhunny (2019), in which artificial intelligence and big data are considered as tools for urban sustainability.

A study by Acheampong et al. (2023) demonstrates the manner in which digital marketing contributes to sustainable economic development in different countries, including those that are less developed. Finally, Strapchuk (2023) proposes an integrated business model for sustainable development for the agricultural sector, which can be used as an example of an industrial application of digital transformation.

In light of these considerations, an empirical study was conducted in the form of a questionnaire survey as part of the Jean Monnet BeSustainAble educational module. The objective of this study is to collate the opinions and experiences of educators, early-career researchers and business representatives with regard to the impact of digital technologies on the sustainable development of business models. This enables the verification of the theoretical foundations outlined in the scientific literature, as well as their expansion through the prism of the regional and educational context.

### **3. Methods**

The study involved 210 respondents, of which 68% were teachers and researchers, with the remainder comprising postgraduate students, students and business representatives. This sample composition facilitates the acquisition of diverse perspectives on the issues under analysis and the derivation of generalised conclusions, with the objective of enhancing the educational content of the module and facilitating the development of subsequent research initiatives. The study was conducted from January 15 to 29, 2025.

Methodologically, the study was based on a structured questionnaire that covered four blocks: general information about the respondent, use of digital technologies, knowledge and attitudes towards sustainable business models, and assessment of the potential of digitalisation for sustainable development in Ukraine.

The data was collected online, and the analysis included both quantitative (descriptive statistics, cross-sectional analysis) and qualitative interpretation of open-ended responses.

A number of research hypotheses were proposed, particularly:

1. Individuals with a superior understanding of sustainable development are more likely to acknowledge the favourable impact of digital technologies on business models.

2. The utilisation of particular digital technologies (e.g., Big Data or cloud solutions) has been demonstrated to be associated with a more profound comprehension of the tenets of sustainable development.

3. The most common barrier to the implementation of sustainable business models in the digital environment is the lack of knowledge and competencies.

4. Teachers demonstrate a greater propensity to prioritise the social and ethical dimensions of digitalisation in comparison to business representatives.

The present study has several important objectives. Firstly, it enables an assessment of the current level of awareness and readiness of different groups to implement the concept of sustainable digital business models. Secondly, the results obtained facilitate the adaptation of the content of the BeSustainAble module to the real needs of the target audience, thereby providing a basis for the personalisation of educational trajectories. Thirdly, the data obtained can be used to further develop interdisciplinary research at the intersection of digital innovation and sustainable development, including focus group design and case study research.

## 4. Results

The empirical component of the Jean Monnet module not only complements the theoretical framework, but also forms the basis for building an educational and research ecosystem that contributes to the formation of a new generation of sustainable digital business leaders. The profile of the respondents by the status of the research participants reveals the predominant share of teachers and researchers (67.6%), which indicates the orientation of the study towards the academic environment. Students and postgraduates make up smaller groups (12.4% and 11.4% respectively), see Table 1.

Table 1

Breakdown of respondents by participation status (%)	
Status	The share of respondents (%)
Teacher / Researcher	67.6
Student	12.4
Postgraduate / Doctoral student	11.4
Other	8.6

Source: designed by the authors.

The distribution of the levels of expertise in sustainable development demonstrates the prevalence of the average level (30%), while only 19.5% of respondents have expert knowledge. In general, the basic understanding of the concept prevails (Table 2).

The data on the use of digital technologies reveal a polarisation: 21.9 per cent of respondents use them weekly, while a similar proportion (21.9 per cent) never use them (Table 3). The bimodal distribution (with 'Weekly' and 'Never' values dominating) 1) highlights significant differences in usage practices.

Table 2

Level of respondents' knowledge about sustainable development (%)	
Level of knowledge	Share of respondents (%)
Elementary	23.8
Intermediate	30.0
Advanced	26.7
Expert	19.5

Source: designed by the authors.

Table 3

Frequency of using digital technologies in the context of sustainable development (%)

Frequency of use	Share of respondents (%)
Daily	17.6
Weekly	21.9
Once a month	17.1
Rarely	21.4
Never	21.9

Source: designed by the authors.

The shares of opinions on the impact of technology on SBM are almost even (Table 4): 26.2% of respondents recognise the positive impact, while 24.8% deny it. Obviously, there is no clear consensus among the participants.

The main advantage of digitalisation is 'creating new value' (22.9%), which reflects the focus on innovation. However, a significant proportion (19%) highlighted other factors that were not included in the proposed list, which indicates a diversity of views. Table 5 summarizes the results.

The assessment of the potential of technology for sustainable development in Ukraine is bipolar (Table 6): 22.9% of respondents consider it 'very high', while 19% consider it 'very low'. Whereas the general tendency relates to overwhelming optimism, there exist respondents with critical positions.

Table 4

Perception of the impact of digital technologies on sustainable business models (%)

Answer	Share of respondents (%)
Yes	26.2
Partially	25.7
No	24.8
It is difficult to answer	23.3

Source: designed by the authors.

Table 5  
Main benefits of digital transformation for sustainable business (%)

Selected benefit	Share of respondents (%)
Reduced emissions and resource consumption	18.1
Process automation and resource savings	18.6
Transparency and traceability of supply chains	21.4
Creating new value for consumers	22.9
Other	19.0

Source: designed by the authors.

Table 6  
Assessment of the potential of digital technologies for sustainable development in Ukraine (%)

Assessment level	Share of respondents (%)
Very low	19.0
Low	16.7
Medium	21.9
High	19.5
Very high	22.9

Source: designed by the authors.

The study reveals a number of patterns, the analysis of which requires a deeper study of the cause-and-effect relationships. Firstly, the dominance of teachers in the sample (67.6%, Table 1) may cause the results to be skewed in favour of academic perceptions of digital technologies, while the views of students and businesses remain underrepresented. This necessitates a separate analysis of the relationship between participant status and assessment of technology potential (e.g., whether the opinions of teachers differ from those of students in terms of prioritising the benefits of digitalisation).

Second, the relationship between the level of knowledge (Table 2) and the frequency of technology use (Table 3) indicates the critical role of education in the development of digital competence. The fact that 78% of experts use technology on a daily/weekly basis (Table 7), while only 35% of beginners do so, suggests that without systematic training in digital SBM tools, their implementation will remain the

privilege of a limited group. This justifies the need to analyse how increasing the level of knowledge affects the practical use of technology.

Third, the polarisation of opinions on the impact of technology (in Table 4, only a 1.4 p.p. difference between 'Yes' and 'No' is noted) and its potential (in Table 6, 22.9% for 'very high' vs. 19% for 'very low') indicates the presence of deeper factors that are not directly captured in the questionnaire. For example, scepticism may be related to the experience of unsuccessful technology implementations or lack of information about successful cases. Establishing dependencies between these variables (for example, through regression analysis) will help to identify the key determinants of positive/negative attitudes.

Fourth, the data on the main benefits of digitalisation (Table 5) reveals a discrepancy between expectations of new value creation (22.9%) and other factors, such as environmental efficiency (18.1%). This may indicate that participants associate sustainability with innovation rather than resource efficiency. However, the presence of 19% of 'Other' answers indicates that the questionnaire did not take into account these aspects. Analysing the correlation between these preferences and the professional profile of the respondents will help to determine whether the priorities of teachers, students and business representatives differ.

Respondents with an expert level of knowledge are much more likely to use digital technologies such as AI and Big Data than those with a beginner level. In particular, 78% of experts use these tools on a daily or weekly basis, while among beginners this figure is only 35% (Table 7). The correlation of 0.67 indicates a moderately strong relationship between knowledge level and frequency of use. The conclusion is that a higher level of knowledge about sustainability is directly correlated with more active use of digital tools.

Table 7  
Dependence of knowledge level on frequency of technology use

Level of knowledge	Frequency of technology use (daily or weekly)	Rank Correlation
Expert	78%	0.67
Primary	35%	

Source: designed by the authors.

The results demonstrate a strong link between the belief in the effectiveness of digital technologies and their potential. Per Table 8, 85% of respondents who believe that technologies are effective rate their potential as high or very high. In contrast, only 12% of sceptics who do not believe in their effectiveness gave a positive assessment. Linear regression shows that belief in technology explains about 60% of the variance in potential ratings. The conclusion is that subjective beliefs about the effectiveness of technologies have a significant impact on expectations about their future potential.

The data shows that participation in the specialised BeSustainAble module significantly increases interest in the topic of sustainable development. In particular,

64% of the module participants left their email addresses to receive the results, while among those who did not participate, this figure is only 22% (Table 9). In addition, 41% of the module participants chose topics related to circular models and AI, which indicates their active interest. Participation in training programmes contributes to the growth of interest in the topic.

Table 8  
Dependence of the impact of digital technologies on the assessment of their potential

Attitudes towards the effectiveness of technologies	Assessment of potential (high/very high)	Coeff. of determination (linear regression)
Yes (effective)	85%	60%
No (sceptics)	12%	

Source: designed by the authors.

Table 9  
Dependence of participation in the module on interest in outcomes

Group of participants	Leave an email for results	Selected topics (circular models and AI)
Participants of the BeSustainable module	64%	41%
Did not participate	22%	-

Source: designed by the authors.

The findings allow us to deepen our understanding of the interaction between digital transformation and sustainable business models in the educational context. The data confirms that the level of expert knowledge (Table 2) is a critical factor in the active use of digital tools (Table 7: CORREL=0.67). This is in line with the findings of Weissbrod and Bocken (2023) that digital literacy forms the basis for innovation in SBM. However, the presence of 23.8% of respondents with an ‘elementary’ level of knowledge (Table 2) indicates a systemic training deficit that requires the integration of ESG modules into basic training courses.

The polarisation of opinions on the impact of technology on SBM (Table 4: 26.2% ‘yes’ vs. 24.8% ‘no’) indicates a lack of consensus, which may be a consequence of the fragmented implementation of digital solutions in the business environment. This underscores the need to develop standardised performance indicators as proposed by Elia et al. (2020). It is noteworthy that the main benefit of digitalisation is ‘creation of new value’ (22.9%, Table 5), which is consistent with Lüdeke-Freund's (2020) concept of service-oriented SBM.

Participation in the BeSustainable module (Table 9) correlates with an increased interest in circular models and AI, which confirms Noguera-Méndez's (2024) thesis on the role of education in shaping mental change. However, the limited share of



students in the sample (12.4%, Table 1) does not allow us to generalise the findings to younger generations, which is a limitation of the study.

Technological barriers (Table 3: 21.9% use technology ‘never’) highlight the need for infrastructure changes, including the development of cloud solutions for small universities. This requires public-private partnerships, as proposed in the Antikainen (2021) model.

Given the identified patterns, the study findings show that digital transformation is not a clear-cut factor in accelerating sustainable development, but rather a complex and multidirectional phenomenon that combines the potential for innovation with the risks of unequal access, cognitive barriers and cultural inertia. Given a favourable educational and institutional environment, digital tools can significantly enhance the ability of organisations to adapt to sustainability. However, their effectiveness depends on the level of digital literacy, trust in technology, and cross-sectoral cooperation.

One of the important implications of the study is to justify the need for curriculum standardisation. The introduction of mandatory educational modules covering the basics of artificial intelligence ethics and ESG monitoring can help foster a critical vision of digital transformation. This is in line with global trends in the academic unification of competence frameworks in the field of digital sustainability (Brundiers et al., 2020; Noguera-Méndez et al., 2024).

Practice-oriented initiatives in education, such as the creation of ‘living laboratories’ in cooperation with IT companies, allow testing digital solutions in the context of real-world sustainable business challenges. Similar formats have proven effective in European applied education projects (Elia et al., 2020), where models of cooperation with the private sector not only increase the relevance of knowledge but also contribute to the development of social capital.

To understand the dynamics of transformation, it is advisable to establish mechanisms for systematically monitoring changes in attitudes towards sustainable business models, including through longitudinal surveys of student and teaching communities. Such an approach allows identifying trends, hidden shifts in priorities, and the effects of educational interventions. Additional empirical data can also form the basis for building adaptive strategies for the development of educational and research ecosystems.

The study revealed the contradictory nature of digital technologies as a catalyst for sustainable business models. On the one hand, they are able to open up new vectors of innovation, increasing transparency, adaptability and efficiency of processes. On the other hand, in the absence of an ethical framework, equal access to technology and critical reflection on its impact, digitalisation can create a ‘gap’ between those who integrate into new systems and those who remain on the sidelines. Bridging this gap requires not only technical solutions, but above all systemic changes in education, support at the policy level, and the formation of a common ethical space where the value of sustainable development is not a declaration but a fundamental principle.

## 5. Discussion

The unevenness in the level of digital activity and perception of the potential of technology, as revealed in the results of this study, is reflected in the wider academic context. For example, Ghosh et al. (2023) point out that the key barriers to digital transformation in the academic sector are a lack of trust in technology, weak institutional support, and fragmented digital strategies. This directly echoes the scepticism among respondents who assessed the potential of digitalisation as ‘very low’ (19%, Table 6).

The issue of digital culture is of particular importance. According to a study by Lehrer et al. (2021), the transformation of educational business models occurs not only through technological implementation, but also through the formation of an appropriate culture of participation, openness, and trust. In our survey, this can be seen in the high interest of the BeSustainAble module participants in the results (Table 9), which can be seen as a sign of the growth of a culture of responsible digital thinking.

Infrastructural constraints and uneven access to digital solutions remain a major challenge. According to Troise et al. (2022), in many regions, the key factors hindering sustainable digital transformation are not only technical aspects, but also low levels of cooperation between universities and businesses. Therefore, public policy should take into account not only technological but also organisational conditions for sustainable change.

Finally, the role of education in ensuring long-term change is supported by Brundiers et al. (2020), who show that integrating sustainability principles into curricula promotes critical thinking, which in turn is positively correlated with technological adaptability.

Thus, the research results not only confirm the relevance of the topic but also open up prospects for interdisciplinary cooperation within education, innovative entrepreneurship, and public policy. Understanding digital transformation as a sociotechnical process, not just a technological upgrade, is key to developing effective strategies for implementing sustainable business models.

## 6. Conclusions

The study emphasises that digital transformation in higher education is a multifaceted socio-technical process, necessitating systemic changes in infrastructure, mindset, and institutional collaboration. The findings of the empirical study demonstrate a moderate correlation (0.67) between expertise in sustainable development and the frequency of digital technology use. This is in alignment with global trends, in which digital literacy is a driving factor in the innovation of sustainable business models. However, the low proportion of students in the sample (12.4%) underscores the necessity to prioritise youth engagement through the implementation of targeted educational initiatives.

Ukraine faces considerable technological and infrastructural challenges, with 21.9% of respondents reporting no digital tool usage, a problem that has been

compounded by wartime disruptions to internet infrastructure. In order to address this issue, it is imperative that standardized performance metrics and public-private partnerships are utilised in order to facilitate the scaling of cloud-based solutions and to ensure the fostering of equitable access. The polarisation of opinions on the potential of digitalisation (22.9% "very high" vs. 19% "very low") reflects fragmented implementation strategies and underscores the necessity of ethical frameworks to guide AI and blockchain integration.

Educational innovation, particularly interdisciplinary programmes such as the BeSustainAble module, has been demonstrated to be a successful endeavour. A significant proportion of the participants, 41% to be precise, demonstrated an increased level of interest in the principles of the circular economy and the applications of artificial intelligence. Such practice-oriented formats, when combined with international collaborations (e.g., EU digital education frameworks), have the potential to harmonise Ukrainian standards with global sustainability agendas. However, the fact that 24.8% of respondents expressed scepticism regarding the impact of technology on sustainable business models suggests the presence of more profound issues, including distrust in fragmented digital strategies and a lack of transparency.

The policy implications of this shift emphasise the alignment of educational curricula with labour market demands, such as the integration of ESG principles and digital project management into degree programs.

The utilisation of longitudinal studies is advocated for the purpose of evaluating the long-term ramifications of educational interventions on sustainable business practices. Moreover, Ukraine's strategic objective to augment the IT sector's contribution to the GDP to 10% by 2025 necessitates synchronised efforts between academia, industry, and policymakers, encompassing legal frameworks to support tech-driven sustainable enterprises.

In conclusion, it is evident that Ukraine's higher education system possesses the capacity to act as a catalyst for sustainable development. However, this necessitates a holistic approach, encompassing the modernisation of infrastructure, the cultivation of digital-ethical competencies, and the fostering of cross-sectoral collaboration. The integration of artificial intelligence (AI), blockchain, and cloud technologies into curricula must extend beyond mere technical upgrades to foster critical thinking and ethical responsibility. The attainment of success is contingent upon the balancing act of innovation with inclusivity, thereby ensuring that digital transformation functions as a catalyst for equitable progress rather than as a wellspring of division.

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