The impact of new technologies on contemporary Polish craftsmanship - environmental, social, and economic responsibilities of sustainable development

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***Abstract*— This article focuses on the positive aspects of incorporating new technologies into crafts, particularly in mitigating economic, environmental, and social challenges. It examines the significance of new technologies for sustainable development in the non-artistic crafts sector, drawing on the results of a survey conducted among students of vocational schools in the first and second cycles in the Opole Voivodeship (Poland). Young people struggle to define the types of responsibility associated with new technologies. A lack of significant correlation was found between family craft traditions, career plans, and the perception of new technologies in the context of environmental and social responsibility. At the same time, a correlation was confirmed between these traditions and career plans, as well as the association of new technologies with economic responsibility.**

Keywords— craft; new technologies; craft traditions; plans related to craft work; sustainable development; environmental, social, and economic responsibilities.

I. INTRODUCTION

Technology is an abstract concept, difficult to interpret, dynamic in nature, and variously defined (Gródek-Szostak, 2022). It is interpreted, among others, as: i) practical application of knowledge (Marriam-Webster Dictionary, n.d), ii) the process of producing products and services, iii) a set of synthetic sciences, iv) a means of achieving goals, and v) an important resource/capability (Gudanowska, 2021). It is also compared to a catalyst for cultural exchange, innovation and adaptation (Alsaleh, 2024). New technologies, in particular, play a crucial role in enhancing the efficiency, transparency, and enforcement mechanisms of environmental law regulations (Zhang & Bilawal Khaskheli, 2025). New technologies enable a "technological leap" that could be a factor in restructuring many economies. Particular hopes are pinned on their potential to support production and industrial processes, stimulate infrastructure investment, develop innovation, and mobilize grassroots economic activity (UN, 2019). Many countries are using digital technologies (including information and communication technologies) to implement the Sustainable Development Goals (SDGs). China, the European Union, and the United States are incorporating them into their long-term sustainable development programs (Zhang & Bilawal Khaskheli, 2025). The potential of these solutions is described as transformative, as they enable mitigation and counteracting complex environmental and social challenges, including through entrepreneurial activities (Holzmann & Gregori, 2023). It is also worth noting that new technologies can not only contribute to achieving the SDGs, they can also disrupt economic development and replace workers but only in specific tasks (UN, 2019).

Big Data, the Internet of Things (IoT), 3D printing, biotechnology, nanotechnology, renewable energy technologies, and satellites can contribute to the achievement of many SDGs. They can positively impact poverty reduction, effectively monitor the implementation of SDGs and indicators, strengthen food security, support sustainable energy and social transformation, improve public health, and increase the availability and quality of human capital through education (UN, 2019). The IoT, artificial intelligence (AI), and Big Data analytics enable increased flexibility in production processes, reduced resource consumption, and more efficient energy management. The use of advanced sensors, automation systems, and analytical tools enables the optimization of energy consumption, reduction of carbon dioxide emissions, ongoing monitoring of manufacturing processes, and the shaping of more sustainable supply chains, ultimately leading to a gradual transition towards a circular economy (Ingaldi & Ulewicz, 2025). Kasinathan et al.'s (2022) analysis of the potential of disruptive technologies indicates that the concepts of Industry

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5.0, characterized by stronger integration of humans with technology, and Society 5.0, which sustainably connects cyberspace and the physical world to improve social well-being, play a key role in shaping strategies supporting the implementation of the SDGs. The authors further emphasize that broadly understood technologies are a crucial tool for accelerating progress toward achieving these goals (Kasinathan et al., 2022). In turn, Drejeris & Ozeliene (2019) argue that sustainable development encompasses a technological dimension, which serves as the defining axis for the remaining parts of sustainable development.

Green technological innovations, i.e., new solutions that reduce human impact on the environment, such as reducing emissions, energy consumption, raw material consumption, and waste generation, are seen as drivers of green economic growth. This growth is linked, among other things, to the rational use of natural capital. Digitalization, on the other hand, is seen as a means of promoting this development (Yang et al., 2022). The results of the study by Yang et al. (2022) suggest that digitalization has a more significant long-term impact on green economic development than green technological innovations. Furthermore, these innovations also have promotional implications, albeit in the short term. According to Vinues et al. (2020), AI could impact the ability to achieve all Sustainable Development Goals. Analyzing the specific goals, only 59 of them identified AI's impact as a slowdown. The researchers identified AI's positive impact across three pillars of sustainable development: environmental (93%), social (82%), and economic (70%). The most significant positive impact of AI on the SDGs is therefore identified within the following goals: no. 1 – No poverty, no. 4 – Quality education, no. 6 – Clean water and sanitation, no. 7 – Affordable and clean energy, no. 8 – Decent work and economic growth, no. 11 – Sustainable cities and communities, no. 14 – Life below water, and no. 15 – Life on land. Detailed percentage data by type of impact (positive / negative) and individual SDGs are presented in Table 1.

TABLE 1. POSITIVE AND NEGATIVE IMPACT OF AI ON THE IMPLEMENTATION OF THE SDGS.

SDG	Pillar	Positive impact*	Negative impact*
No. 1	Society	100%	43-86%
No. 2	Society	69-75%	13-25%
No. 3	Society	69%	8%
No. 4	Society	93-100%	60-70%
No. 5	Society	44-56%	31-33%
No. 6	Society	100%	28-63%
No. 7	Society	100%	40%
No. 8	Economy	90-100%	25-33%
No. 9	Economy	77-92%	34-50%
No. 10	Economy	75-90%	55-70%
No. 11	Society	90-100%	10-20%
No. 12	Economy	59-82%	16-27%
No. 13	Environment	70-80%	20%
No. 14	Environment	90%	13-30%
No. 15	Environment	99-100%	8-33%
No. 16	Society	52-58%	15-25%
No. 17	Economy	15-26%	5-11%

* The percentage range depends on the type of evidence material analyzed.
Source: own elaboration based on Vinuesa et al. (2020).

The revival of crafts is closely linked to the dynamic development of internet technologies, the expansion of global sales platforms, the popularization of cashless transactions, and the implementation of modern and effective distribution methods (Gudowska, 2020). The topic of new technologies and crafts in the context of sustainable development is addressed primarily within the creative industries and/or traditional crafts. Research on these areas indicates, among other things, that: i) traditional crafts require innovation to remain competitive (Shafi et al., 2022), ii) the development of traditional skills and products should take into account changes in the environment of craftsmen, including among consumers of craft products/services; iii) economic efficiency does not have to result solely from the use of new technologies, it may also involve the use of traditional tools and technologies (Połeć & Murawska, 2022), iv) innovative design plays a vital role in the sustainable development of the craft industry, supporting the economic development of, among others, the local community (Oyekunle & Sirayi, 2018), v) the gradual implementation of innovations (i.e., small but significant changes) contributes to the sustainable economic, social, and environmental development of craft enterprises (Shafi et al., 2022). New technologies have the potential to improve craft practice, including by making the learning process more diverse and accessible, building more engaged communities (e.g., increasing the engagement of craft consumers, enabling the transformation of hobbyists into creators), supporting design, accelerating the execution of tasks, cost-saving, reducing waste of raw materials, and protecting cultural heritage. For example, within the construction industry, the use of digital technologies has the potential to address energy efficiency, life-cycle assessment, renovation, building sustainability assessment, and management (Li et al., 2025).

In this article, the authors explore the impact of new technologies on sustainable development in non-artistic crafts, drawing on the results of a survey conducted among students of the first and second degree of vocational schools. The authors highlight how future craftspeople perceive new technologies in the context of their potential impact on the development of more responsible production and consumption models, analyzed from the perspective of environmental, social, and economic responsibility.

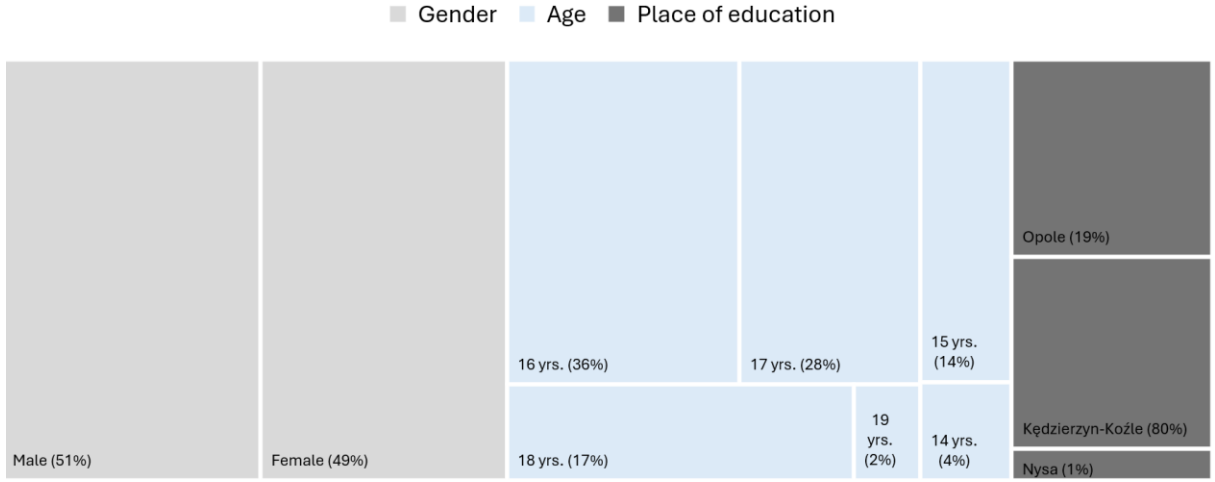
II. MATERIALS AND METHODS

The article describes the results of the first stage of research conducted in the Opole Voivodeship (Poland) among students of vocational schools of the first and second degree, who are being educated in crafts: i) Academy of Crafts and Entrepreneurship at the Opole University of Technology, ii) Center for Vocational and Continuing Education in Nysa, and iii) School Complex No. 1 named after the Silesian Insurgents in Kędzierzyn-Koźle. This study was conducted between April and June 2024 using an online survey created as part of a Google Form, the link to which was sent to schools. The response rate was 166.

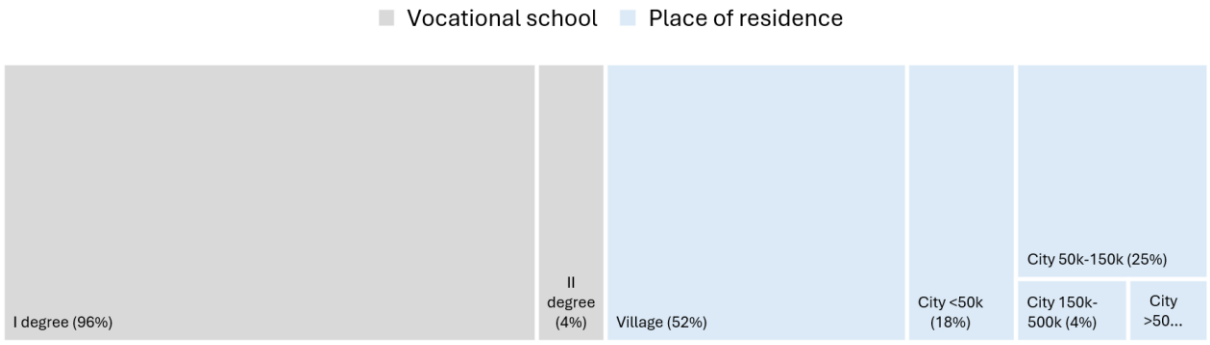
Fifty-one percent of the respondents were women. The students were aged 14-19, with 16- and 17-year-olds constituting the largest groups (36% and 28%, respectively).

More than half of the respondents (52%) lived in rural areas, and a quarter (25%) lived in cities with populations between 50,000 and 150,000. Four-fifths of the students were trained as craftsmen in Kędzierzyn-Koźle city (80%), and less than one-fifth in Opole city (19%). 96% of the respondents received their education in a second-cycle vocational school (96%). A more detailed demographic and social profile of the respondents is presented in Figures 1a and 1b.

FIGURE 1A-B. SOCIO-DEMOGRAPHIC FACTORS CHARACTERIZING THE RESPONDENTS: A) GENDER, AGE, PLACE OF EDUCATION, B) VOCATIONAL SCHOOL AND PLACE OF RESIDENCE.



A)



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Source: own stud

This article is the third in a series of studies that combine new technologies and craftsmanship from the perspective of vocational school students. The first article examines the perception and application of new technologies in craft education and craftsmanship. The second text focuses on the career aspirations and professional intentions of vocational school students, with a particular emphasis on their plans to work in Poland and abroad. This one focuses on crafts people's perception of new technologies in terms of their impact on more responsible production and consumption, which is considered from three perspectives:

- environmental responsibility - including saving natural resources, reducing the carbon footprint, eliminating harmful substances from production processes, recycling, circular economy,
- social responsibility - including ethical treatment of employees, ensuring equal opportunities, access to education, decent working conditions,
- economic responsibility - including access to adequate means of subsistence and stable operations in the future.

The research results were analyzed in terms of the dependence of decisions made by vocational school students studying crafts on their family's craft traditions and their plans to pursue work in their chosen profession after completing their education at a vocational school.

Using Microsoft Excel 2016 spreadsheet, the statistical analysis of the Chi-squared test was performed to test the following research hypotheses related to the dependence of two characteristics of people learning crafts: i) family craft traditions, and ii) plans to take up craft work after completing education, with the linking of new technologies with environmental / social / economic responsibilities:

- H0. The craftsmen's linking of sustainable development aspects (environmental / social / economic responsibility) with new technologies did not depend on family craft traditions (N0.1) / plans to take up a craft job after completing education (N0.2).
- H1. The craftsmen's linking of sustainable development aspects (environmental / social / economic responsibility) with new technologies depend on family craft traditions (N1.1) / plans to take up a craft job after completing education (N1.2).

P-values greater than 0.05 indicated that the null hypothesis (H0) could not be rejected, whereas p-values below 0.05

provided evidence in support of the alternative hypothesis (H1).

III. Results

Nearly half of the surveyed vocational school students (49%) are unsure if they have craftspeople in their family, while one-third (32%) have a family tradition of crafts. Despite pursuing craftsmanship, nearly half of the respondents are unsure whether they will seek employment in their chosen profession. 42% indicated a positive response (see Figure 2) When asked about linking new technologies to the pillars of sustainable development, young people struggled to determine which type of responsibility new technologies could be associated with. In the case of environmental responsibility, 23% of respondents saw this connection, social responsibility – 28%, and economic responsibility – 27% (see Figure 3). The authors wish to emphasize that a large number of "I don't know" responses may not necessarily indicate a lack of understanding of a given topic. Young people learn and develop in cognitive and social settings, accumulating life experiences that develop the ability to formulate confident opinions

The Chi-squared test (details in Tables 2 and 3) allowed for the identification of two groups of positive verifications (see Table 4):

- confirming the lack of correlation between both craft traditions and plans to take up work in the profession and environmental and social responsibility,
- confirming the existence of correlation between both craft traditions and plans to take up work in the profession and economic responsibility.

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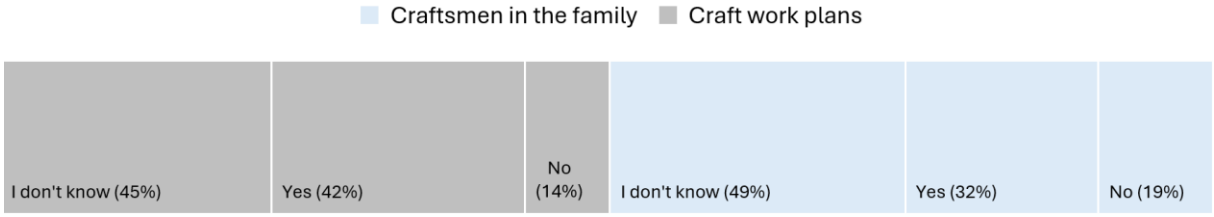
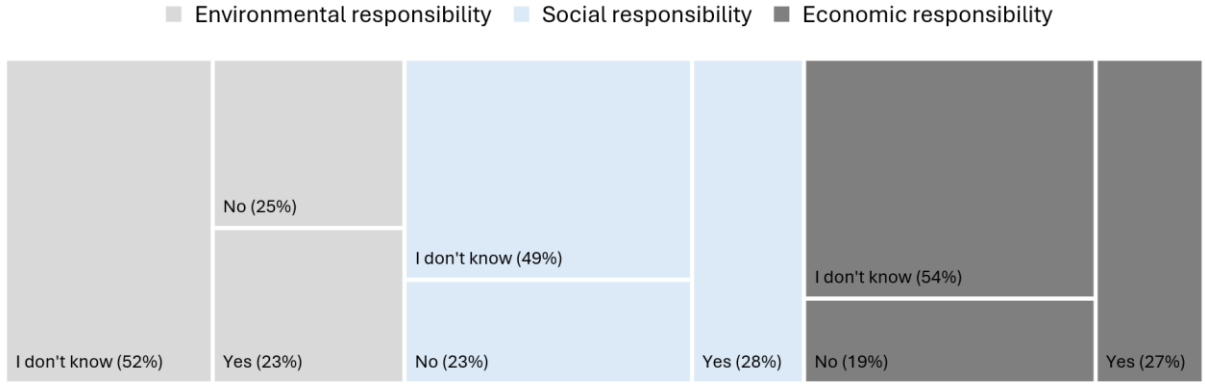
Figure 2. Respondent characteristics: family craft traditions and plans to take up a craft career after completing education.



Source: own study.

Figure 3. Linking new technologies with environmental/ social/ economic responsibility.



Source: own study.

Table 2. Family craft traditions in the context of combining new technologies with more responsible production and consumption in terms of environmental, social, and economic responsibilities.

Answer		Observed			Expected			p-value
		Family craft traditions						
		No	I don't know	Yes	No	I don't know	Yes	
Environmental responsibility	No	12	16	13	7,9036	20,0060	13,0904	0,4040
	I don't know	14	46	27	16,7711	42,4518	27,7771	
	Yes	6	19	13	7,3253	18,5422	12,1325	
Social responsibility	No	13	15	10	7,3253	18,5422	12,1325	0,1308
	I don't know	12	42	28	15,8072	40,0120	26,1807	
	Yes	7	24	15	8,8675	22,4458	14,6867	
Economic responsibility	No	12	9	11	6,1687	15,6145	10,2169	0,0321
	I don't know	14	48	27	17,1566	43,4277	28,4157	
	Yes	6	24	15	8,6747	21,9578	14,3675	

Source: own study.

Table 3. Plans related to working in learned profession in the context of combining new technologies with more responsible production and consumption in terms of environmental, social, and economic responsibilities.

Answer		Observed			Expected			p-value
		Plans related to working in learned profession						
		No	I don't know	Yes	No	I don't know	Yes	
	No	15	6	20	17,0422	5,6807	18,2771	

Answer		Observed			Expected			p-value
		Plans related to working in learned profession						
		No	I don't know	Yes	No	I don't know	Yes	
Environmental responsibility	I don't know	31	15	41	36,1627	12,0542	38,7831	0,0833
	Yes	23	2	13	15,7952	5,2651	16,9398	
Social responsibility	No	16	3	19	15,7952	5,2651	16,9398	
	I don't know	27	14	41	34,0843	11,3614	36,5542	0,0775
	Yes	26	6	14	19,1205	6,3735	20,5060	
Economic responsibility	No	12	6	14	13,3012	4,4337	14,2651	
	I don't know	28	13	48	36,9940	12,3313	39,6747	0,0062
	Yes	29	4	12	18,7048	6,2349	20,0602	

Source: own study.

TABLE 4. SUMMARY OF THE HYPOTHESES AND THEIR VERIFICATIONS.

Confirmed hypotheses			p-value
N0.1	There is no dependence of craft traditions with linking new technologies with…	environmental responsibility	p>0,05
		social responsibility	p>0,05
N1.1	There is dependence of craft traditions with linking new technologies with…	economic responsibility	p<0,05
N0.2	There is no dependence of plans to take up a craft job with linking new technologies with…	environmental responsibility	p>0,05
		social responsibility	p>0,05
N1.2	There is dependence of plans to take up a craft job with linking new technologies with…	economic responsibility	p<0,05

Source: own study.

IV. DISCUSSION

As Gudowska (2020) notes, crafts can also make a positive contribution to the Sustainable Development Goals through their impact on employment, fair trade, and ethical production. This contribution is particularly visible in local communities where craft traditions have been cultivated for generations, strengthening social cohesion and supporting local economies. Crafts often provide stable employment opportunities rooted in place-based knowledge, while their relatively small-scale character allows for greater transparency in production processes and closer adherence to ethical standards. In addition, the growing involvement of women in craft-based entrepreneurship highlights the social dimension of sustainability, as crafts create inclusive economic opportunities and support gender equality.

The role of crafts in promoting well-being further reinforces their social value. Craft activities are increasingly recognized for their therapeutic and educational benefits, contributing to mental health, community engagement, and intergenerational exchange. At the same time, contemporary craftsmanship shows a growing pro-ecological orientation, particularly through practices such as upcycling, recycling, and the conscious use of local or natural materials. These approaches align closely with environmental responsibility and demonstrate how traditional craft knowledge can be adapted to address current ecological challenges.

Teaching craft skills using natural materials promotes the concept of sustainable development and plays a significant role in shaping contemporary craftsmanship (Dai & Hwang, 2019). Such education fosters an understanding of material life cycles, resource limitations, and the environmental impact of production, thereby encouraging more responsible consumption and production patterns. Importantly, these educational practices help bridge traditional knowledge with modern sustainability principles, allowing crafts to evolve without losing their cultural and ecological foundations.

Furthermore, education for sustainability through crafts can be implemented both within standard school subjects and through specialized craft education at universities (Väänänen & Pöllänen, 2021). Integrating sustainability topics into vocational and higher education curricula may help address the difficulties identified in this study, particularly the limited awareness among young people of the environmental and social responsibilities associated with new technologies. When combined with digital tools and modern production technologies, craft education can offer a holistic learning environment that links economic efficiency with ethical, social, and environmental considerations.

In this context, new technologies should not be seen as opposing traditional craftsmanship, but rather as tools that can enhance its contribution to sustainable development. Digital fabrication, energy-efficient machinery, and environmentally friendly materials have the potential to reduce waste, optimize resource use, and improve working conditions. However,

realizing this potential requires deliberate educational strategies that emphasize sustainability alongside technical competence. Strengthening this link may support a more balanced perception of new technologies among future craftspeople and reinforce the role of contemporary craftsmanship as an active contributor to the Sustainable Development Goals.

To synthesize the main themes discussed above, Table 5 presents a structured overview of the role of craftsmanship and new technologies across the environmental, social, economic, and educational dimensions of sustainable development.

TABLE 5. CRAFTSMANSHIP AND NEW TECHNOLOGIES IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT – SUMMARY OF KEY DIMENSIONS.

Dimension of sustainable development	Role of craftsmanship	Role of new technologies	Educational implications
Environmental	Use of natural materials, upcycling and recycling practices, local production with a lower environmental footprint	Optimization of resource use, waste reduction, energy-efficient production processes	Teaching material life cycles, responsible production, and environmentally friendly practices
Social	Strengthening local communities, supporting well-being, intergenerational knowledge transfer, development of women-led craft businesses	Improvement of working conditions, facilitation of new forms of cooperation and communication	Developing awareness of the social responsibility of technology in craftsmanship
Economic	Job creation, ethical production, stability of local markets, fair trade practices	Increased efficiency, competitiveness, and economic sustainability of craft enterprises	Building professional competences that combine tradition with modern tools
Educational (cross-cutting)	Learning through practice, development of manual, cultural, and creative skills	Integration of digital tools with traditional craft techniques	Embedding sustainable development principles in vocational and higher education curricula

Source: own study.

However, the analysis of literature reveals substantial heterogeneity in their examination of technology impacts on Polish craftsmanship, though this heterogeneity reflects complementary rather than contradictory perspectives across different craft sectors, geographic regions, and analytical foci.

Different findings across studies reflect distinct craft sector characteristics rather than conflicting evidence. Mazur-Włodarczyk & Łukaniszyn-Domaszewska (2026) identified diverse technologies including 3D environments, computer-aided design, virtual reality, and AI in vocational education contexts. This contrasts with Murzyn-Kupisz & Hołuj (2021) study, which focused on ecological material production technologies in fashion and Starzyk et al. (2025) emphasis on passive architectural strategies in construction. These differences arise from sector-specific technological requirements, digital tools for general craft education, material innovation for textiles, and design strategies for construction, rather than representing divergent conclusions about technology effectiveness.

Study conducted by Foltys et al. (2015) notably lacks environmental and social sustainability integration, focusing exclusively on financial mechanisms, while studies from 2021 onward explicitly address triple bottom line considerations. This temporal pattern suggests sustainability consciousness in Polish craftsmanship has strengthened substantially since 2015, with newer studies demonstrating more sophisticated integration of environmental, social, and economic dimensions.

Regional variations within Poland exert a significant influence on research outcomes. Studies focusing on the Opole Voivodeship reveal dynamics that differ from those observed in the Warsaw Praga district (Sadowy & Brodowicz, 2021) or in analyses emphasizing major urban centers (Murzyn-Kupisz & Hołuj, 2021). The distinctive characteristics of Opole's regional craft cluster contrast with the post-industrial urban renewal context of Warsaw and the institutional landscapes of metropolitan fashion hubs. These geographic differences help explain discrepancies in findings related to the quality and accessibility of institutional support, with the interplay between private and public educational institutions exerting a more pronounced effect in urban fashion education than in regional vocational training.

Studies reveal an apparent tension between preserving traditional skills and adopting new technologies (Murzyn-Kupisz & Hołuj, 2021; Foltys et al.; 2015; Starzyk et al., 2025; Sadowy & Brodowicz, 2021, Mazur-Włodarczyk et al., 2024). Concerns about losing traditional craft skills and resistance to technology adoption contrast with findings that traditional skills are being transmitted to younger generations while new technologies enhance competitiveness. This tension resolves through recognizing that successful technology integration requires balancing preservation and innovation, combining traditional high-quality European craft with innovation, integrating local heritage with sustainable practices, and using digital representation for craft preservation. The synthesis suggests technology adoption succeeds when positioned as enabling rather than replacing traditional knowledge.

Research indicates that educational system inadequacy constitutes a central barrier across craft and fashion sectors, though it manifests differently depending on the context. Studies focusing on the Opole Voivodeship highlight gaps in vocational training and insufficient integration of modern tools, whereas analyses in Warsaw's Praga district (Sadowy & Brodowicz, 2021) emphasize the need for multidimensional curriculum adjustments in fashion design education. Research on major urban centers (Murzyn-Kupisz & Hołuj, 2021) further confirms that general craft education often lacks mechanisms for effectively combining traditional skills with technological innovation. This convergence suggests that educational reform represents a high-leverage intervention point, capable of simultaneously addressing skills gaps, challenges in knowledge transmission, and workforce preparedness. Successful approaches identified in the literature, holistic three-dimensional pedagogical strategies, the active incorporation of

technology by instructors, and close collaboration with industry, offer practical directions for reform that balance preservation of traditional craft knowledge with the adoption of new technologies.

Environmental and economic objectives can exhibit synergies in certain contexts, yet result in trade-offs in others. For example, wooden façade technologies achieve both low emissions and economic viability by utilizing locally sourced materials (Starzyk et al., 2025), while energy-efficient technologies reduce environmental impact and operational costs simultaneously. Conversely, the adoption of sustainable materials in the fashion sector is often constrained by higher costs, creating evident economic–environmental trade-offs (Murzyn-Kupisz & Hołuj, 2021). These divergent outcomes primarily reflect differences in material supply chain maturity, with well-established local wood supply chains contrasting sharply with the limited availability of sustainable textiles (Murzyn-Kupisz & Hołuj, 2021), rather than indicating an inherent incompatibility between sustainability dimensions. As sustainable material adoption continues to evolve, addressing supply chain limitations and cost barriers will be critical to harmonizing environmental and economic goals across diverse craft and design sectors.

Recent research on craft production (Sadowy & Brodowicz, 2021) highlights the small-scale, manual, and locally rooted nature of traditional crafts, whereas studies on vocational education point to the introduction of automation and digital technologies, which may potentially challenge these artisanal qualities. This apparent tension, however, reflects different positions along the spectrum of the craft sector, from fully artisanal to semi-industrial, rather than contradictory findings. Both approaches, small-scale manual production and technology-enhanced productivity, play complementary roles in promoting sustainable Polish craftsmanship. The optimal balance between tradition and innovation depends on factors such as product complexity, market positioning, and the cultural significance of the craft, suggesting that sustainability in the sector requires context-sensitive strategies rather than universal solutions.

V. Conclusion

Effective environmental management is one of the key challenges facing humanity today, and the eco-industry is one of the fastest growing sectors of the global economy (Shafi et al., 2022). In this context, the integration of new technologies into contemporary Polish craftsmanship emerges as an important factor supporting sustainable development, particularly within the non-artistic crafts sector. The findings of this study indicate that technological innovation is primarily perceived by young people as a driver of economic responsibility, enhancing efficiency, competitiveness, and the long-term viability of craft professions (Sadowy & Brodowicz, 2021).

However, the research also reveals clear limitations in the understanding of social and environmental responsibilities associated with new technologies. Students of vocational schools showed difficulties in identifying these dimensions, and no significant correlation was observed between family craft traditions, career plans, and the perception of new technologies in terms of environmental and social responsibility (Murzyn-Kupisz et al., 2021). This suggests that sustainability-oriented values related to technology use are not sufficiently embedded in either family traditions or vocational education frameworks.

At the same time, the confirmed relationship between family craft traditions and career plans underscores the continued relevance of intergenerational knowledge transfer in shaping professional trajectories (Murzyn-Kupisz et al., 2021). The association between these traditions and the perception of new technologies in the context of economic responsibility further indicates that technological solutions are more readily accepted when they are seen as complementary to traditional craft practices rather than as a threat to them (Sadowy & Brodowicz, 2021).

Overall, the results suggest that while new technologies offer significant potential to support the sustainable development of Polish craftsmanship, this potential is currently realized mainly in the economic sphere. To achieve a more balanced approach, greater emphasis should be placed on integrating environmental and social responsibility into vocational education and training. Strengthening awareness of the broader implications of technological change may contribute to a more holistic understanding of sustainability, ensuring that contemporary craftsmanship develops in line with economic resilience, environmental protection, and social responsibility (Gudowska, 2020; Dai & Hwang, 2019; Väänänen & Pöllänen, 2021).

In conclusion, fostering sustainable craftsmanship in Poland requires a multi-dimensional strategy that bridges tradition and innovation. Policy makers, educators, and craft institutions should collaborate to embed sustainability principles, economic, social, and environmental, into both formal curricula and informal training. Encouraging technology adoption as a complement to traditional skills, promoting environmentally conscious practices, and cultivating social responsibility can create a resilient craft sector capable of meeting contemporary economic and ecological challenges while preserving cultural heritage. Future research should continue to explore region-specific dynamics (Sadowy & Brodowicz, 2021; Murzyn-Kupisz et al., 2021) and the evolving role of technology, providing actionable insights for shaping a sustainable and inclusive craft ecosystem in Poland.

References

Alsaleh, A. The impact of technological advancement on culture and society, Scientific reports 2024, 4, 32140. https://doi.org/10.1038/s41598-024-83995-z.

Bilozub, L.; Volodymyr, O.; Osadchyi, V., Diachenko, A.; Bondarchuk, Y. (2025). Digital Art and Design for a Sustainable Future: Innovation, Ethics, and Identity. European Journal of Sustainable Development 2025, 14(2), pp. 381-396. https://doi.org/10.14207/ejsd.2025.v14n2p381.

Dai, Y.; Hwang, S.-H. (2019). Technique, Creativity, and Sustainability of Bamboo Craft Courses: Teaching Educational Practices for Sustainable Development. Sustainability, 11, 2487. https://doi.org/10.3390/su11092487.

Drejeris, R.; Ozeliene, D. New Approach to the technological aspect of corporate sustainable development, Verslas: Teorija ir Praktika / Business: Theory and Practice 2019, 20, pp. 363–371. https://doi.org/10.3846/btp.2019.34.

Foltys, J.; Dębicka-Ozorkiewicz, G.; Królczy,k J.B.; Hiadlovský, V. Financing Craft Enterprises Associated in the Polish Craft Association. E&M Economics and Management 2015, 18(4). http://dx.doi.org/10.15240/tul/001/2015-4-012

Gródek-Szostak, Z. Upowszechnienie transferu technologii w sieci innowacji; C.H. Beck, Warszawa 2022.

Gudanowska, A.E. Technology mapping methodology in foresight studies (in Polish: Metodyka mapowania technologii w badaniach foresight); Politechnika Białostocka, Białystok 2021.

Gudowska, B. (2020). Arts and crafts and UN Sustainable Development Goals, International Journal of New Economics and Social Sciences, 1(11), pp. 277-288. https://doi.org/10.5604/01.3001.0014.3547.

Holzmann, P.; Gregori, P. The promise of digital technologies for sustainable entrepreneurship: A systematic literature review and research agenda. International Journal of Information Management 2023, 68, 102593. https://doi.org/10.1016/j.ijinfomgt.2022.102593.

Ingaldi, M.; Ulewicz, R. Sustainable development and technological advancement in industry 4.0: overcoming barriers in SME sector integration. Management Systems in Production Engineering 2025, 33(2), pp. 144. https://doi.org/10.2478/mspe-2025-0015.

Kasinathan, P.; Pugazhendhi, R.; Elavarasan, R.M.; Ramachandaramurthy, V.K.; Ramanathan, V.; Subramanian, S.; Kumar, S.; Nandhagopal, K.; Raghavan, R.R.V.; Rangasamy, S., et al. Realization of Sustainable Development Goals with Disruptive Technologies by Integrating Industry 5.0, Society 5.0, Smart Cities and Villages. Sustainability 2022, 14, 15258. https://doi.org/10.3390/su142215258.

Li, Y.; Zhao, X.; Liu, C.; Zhang, Z. Applications of Digital Technologies in Promoting Sustainable Construction Practices: A Literature Review. Sustainability 2025, 17, 487. https://doi.org/10.3390/su17020487.

Marriam-Webster Dictionary. Technology. Retrieved from: https://www.merriam-webster.com/dictionary/technology, accessed: 11.01.2026.

Mazur-Włodarczyk, K.; Rajchel, A.; Ruszczak, B. Perception and use of new technologies in crafts education and craftsmanship among young craftsmen: a study of sustainable practices. Economics and Environment 2024, 4(91), pp. 1-25. https://doi.org/xxxx10.34659/eis.2024.91.4.946.

Mazur-Włodarczyk, K.; Łukaniszyn-Domaszewska, K. Harnessing new technologies to prevent the migration of craftsmen, Scientific Papers of Silesian University of Technology. Organization and Management Series 2026, Silesian University of Technology Publishing House, in print.

Murzyn-Kupisz, M.; Hołuj, D. Fashion design education and sustainability: Towards an equilibrium between craftsmanship and artistic and business skills?. Education Sciences 2021, 11(9), 531.

Oyekunle, O.A.; Sirayi, M. The role of design in sustainable development of handicraft industries. African Journal of Science, Technology, Innovation and Development 2018, 10(4), pp. 381-388. https://doi.org/10.1080/20421338.2018.1461968.

Połeć, W.; Murawska, D. The Social Constraints on the Preservation and Sustainable Development of Traditional Crafts in a Developed Society. Sustainability 2022, 14, 120. https://doi.org/10.3390/su14010120.

Sadowy, K.; Brodowicz, D.P. New Craft Production in Europe - between Creative Class and Industrial Manufacturing. European Research Studies Journal 2021, XXIV(3) - Part 2, pp. 896-920. https://doi.org/10.35808/ersj/2546

Shafi, M.; Szopik-Depczyńska, K.; Cheba, K.; Ciliberto, C.; Depczyński, R.; Ioppolo, G. Innovation in traditional handicraft companies towards sustainable development. A systematic literature review. Technological and Economic Development of Economy 2022, 28(6), pp. 1589–1621. https://doi.org/10.3846/tede.2022.17085.

Starzyk, A. Contemporary wooden facades in Poland: an architectural analysis of materials and pro-environmental technologies. Inżynieria i Budownictwo 2025, LXXXI(5), 611-616. https://doi.org/10.5604/01.3001.0055.2520.

UN. The impact of rapid technological change on sustainable development United Nations conference on trade and development; Geneva, United Nations, New York 2019.

Väänänen, N.; Pöllänen, S. Sustainability in Finnish craft education: United Nations Sustainable Development Goals of the 2030 Agenda as a frame for an overview. In, Filho W.L., Lange Salvia A., Frankenberger F. Eds., Handbook on Teaching and Learning for Sustainable Development, 2021, pp. 121132. https://doi.org/10.4337/9781839104657.00015.

Vinuesa, R.; Azizpour, H.; Leite, I.; Balaam, M.; Dignum, V.; Domisch, S.; Felländer, A.; Langhans, S.D.; Tegmark, M.; Fuso Nerini, F. The role of artificial intelligence in achieving the Sustainable Development Goals. Nature Communications 2020, 11(233). https://doi.org/10.1038/s41467-019-14108-y.

Yang W., Chen Q., Guo Q., Huang X. Towards Sustainable Development: How Digitalization, Technological Innovation, and Green Economic Development Interact with Each Other. International Journal of Environmental Research and Public Health 2022, 19, 12273. https://doi.org/10.3390/ijerph191912273.

Zhang Y., Bilawal Khaskheli M. The Role of Digital Technologies in Advancing Sustainable Economic Development into Intersections of Policy, Law, Environmental Economics, and a Comparative Study of China, the EU, and the USA. Sustainability 2025, 17, 8666. https://doi.org/10.3390/su17198666.