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A visual analysis of new technologies and craft aspects in the context of sustainable development

Katarzyna Mazur-Włodarczyk

ABSTRACT

Objective: The objective of the article is to present the state of the latest research and identify emerging trends and research gaps related to the use of new technologies in crafts, perceived as a tool enabling moving towards sustainable development, as well as to show trends focusing on popularity and novelty. Crafts are experiencing a renaissance and are increasingly marking their presence on the domestic and international markets as an intensively developing sector. Crafts are also a relatively 'new' but increasingly popular area of scientific research within economic sciences. New technologies in the area of craft involve several vital issues, including an obvious consequence of progressing economic development; tools useful for craftsmen at work but not necessary for them; expensive tools that affect the price of the final product; tools of the young generation of producers whose products are interested in the young generation of consumers; a mega trend affecting the possibility of applying for subsidies; tools of companies specializing in new technologies that provide goods and services intended for craftsmen; and tools enabling moving towards sustainable development.

Research Design & Methods: The article presents the results of a bibliometric study devoted to the issues of new technologies and crafts in the context of the last of the aspects mentioned above. It aims to present the state of the latest research and identify emerging trends and research gaps in the selected topic. The aim was to give the subject of using new technologies in crafts, perceived as a tool by enabling a movement towards sustainable development, and to isolate trends focusing on popularity and novelty. A systematic literature review was conducted on documents created and indexed until November 2023 in the Scopus database – one of the most popular databases of scientific texts.

Findings: The visualization of quantitative data (words appearing in titles and abstracts) was presented as cluster maps of terms generated by the VOSviewer program and word clouds created using the WordArt program.

Implications & Recommendations: More publications need to refer to Sustainable Development Goals number 8, 9, and 12. Attention was drawn to the need to redefine what contemporary craftsmanship is, considering the use of new technologies.

Contribution & Value Added: The article emphasizes the importance of sustainable development in preserving cultural heritage and reducing production waste, including pollution prevention. It indicates areas for further research and technological solutions that support craftsmen and enable more sustainable development. Technological advancements can aid sustainable development in crafts but require supportive programs, subsidies, and training, particularly for SMEs.

Article type:	original literature review
Keywords:	crafts; new technologies; innovative technologies; sustainable development; cultural economics
JEL codes:	Q01, Q56, Z10

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INTRODUCTION

Crafts are an essential part of economic life (Li, 2016). However, scholars describe it as an ambiguous construction, especially from the point of view of the separation between issues related to culture and economy (Berta, 2023). We may notice another ambiguity in issues relating only to the practical orientation of crafts and even the developing craft science (Westerlund *et al.*, 2022), *i.e.* its scientific and academic approach. Its orientation not only to practice but also to knowledge is associated with changes in the perception of crafts within the knowledge-based economy (Klamer, 2012). Another area of ambiguity is linking crafts with the space of tradition and legacy (*e.g.* traditional crafts and folk crafts) or linking them with development and modernity (*e.g.* within contemporary crafts, innovative crafts, and virtual crafts). The factors supporting craft enterprises, classified by Walker *et al.*'s team, in addition to elements such as multi-factor accessibility included (Walker *et al.*, 2022):

- educational resources and training,
- cultural events providing opportunities for sales, dissemination, demonstrations, workshops and raising awareness of crafts,
- organizations supporting culture and regional policies related to maintaining heritage creation practices,
- transport and tourism infrastructure,
- tourist attractions, regional cuisine, natural beauty, galleries, and museums,
- the national or international profile of the region by, for example, obtaining the status of a UNESCO World Heritage Site.

The next factor include the use of modern tools, including new technologies.

New technologies are crucial for the transformation of economies. In the craft space, they are sometimes described as an obvious consequence of progressing economic development – a consequence of changes introduced as part of business activities, including those related to production. Their use may influence the interest of a given group of consumers, especially those representing younger age groups and people interested in the future's new trends and technologies. On the other hand, UNESCO (2003) draws attention to the importance of conducting training for creators of creative works (including craftsmen) on, among others, copyright, and neighbouring rights, which are still serious due to digital network technologies and the phenomenon of piracy, especially in developing countries and in countries in transition.

New technologies are also treated as tools used in craftwork. In this context, they are sometimes perceived as (see: Mazur-Włodarczyk et al., 2024):

- useful at work but not necessary for craftsmen,
- expensive and affecting the price of the final product,
- issues enabling applying for available national and EU subsidies, etc.,
- tools used primarily by the young generation of craftsmen,
- tools used by companies specializing in modern technologies whose clients are craftsmen,
- tools whose use contributes to moving towards sustainable development.

New technologies are used in crafts, including craft product design. Digital technologies, in particular, make it possible to improve the performance and aesthetics of modern products (Zhao & Chen, 2022). Craftsmen see the possibilities that technology offers, including increasing creators' productivity and creativity (Song, 2022). New technologies may also influence the development of particular crafts or other areas not previously associated with crafts. Examples include eTextiles/Smart Textiles integrating textile materials with electronics (Posch & Fitzpatric, 2021), virtual crafts development thanks to e-tools such as Tilt Brush enabling creation in virtual reality (Kim, 2023), the use of a Gore-Tex membrane in production handcrafted footwear by the Italian company AKU (Polski Caravaning, 2015), providing 'services of the future' in the field of optics and optometry (KRIO, 2023), using new material technologies in the manual production of furniture, combining technology with craft knowledge and an understanding of the material (Besch, 2019), *etc*. Artificial intelligence (AI) is used, among others, in craft education (Vartiainen &

Tedre, 2023). Generative AI is also starting to be integrated into manufacturing and creation projects, especially in idea generation and exploring the design space, trying different form factors for the same object type, design options, etc. (Druga & Hammond, 2023).

Another application of new technologies in connection with crafts is digitizing craft knowledge related to traditional craft techniques. These activities contribute to reviving dying crafts, making them more accessible. HORIZON-CL2-2022-HERITAGE-01-04 is a program that combines old craft techniques with the latest new technologies. Its assumptions emphasize that new technologies enable the conservation and restoration of cultural goods and the creation of new products and services, as well as the need to conduct training and create platforms connecting researchers, craftsmen, enterprises, and innovators (European Commission, 2022). Thus far, four projects are being implemented (European Commission, 2023a-c):

- HEPHAESTUS – Heritage in EuroPe: new techHologies in crAft for prEserving and innovating fUtureS. This project involves mapping knowledge of ancient techniques and materials and digitizing craft heritage to achieve social, cultural, environmental, and economic sustainability,
- Colour4CRAFTS – Color for Combining, Re-engineering, Applying, Futuring, Transforming, Stretching. This focuses on studying biological textile dyeing from a traditional historical perspective and combines it with state-of-the-art dye biosynthesis technologies and anhydrous application techniques. They aim to develop craft skills in textile dyeing and transform traditional processes into sustainable processes, referring to Sustainable Development Goals 4, 8, and 11,
- Tracks4Crafts – Transforming crafts knowledge for a sustainable, inclusive, and economically viable heritage in Europe. This project is related to achieving Sustainable Development Goals 4, 8, and 11, which seek to develop new digital technologies, strengthen and transform the transmission of knowledge about traditional crafts, and thus achieve a more effective economic and social valuation of crafts,
- CRAEFT – Craft Understanding, Education, Training, and Preservation for Posterity and Prosperity. This project is related to craft education and training space using digital aids, telecommunications, craft-specific simulators, advanced immersion, and advanced digitalization.

These programs are planned for several years of implementation (2023-2026/2027), and their financing focuses only on the EU contribution (amounts from USD 3-4 million). They cover more developed European countries (Denmark, Finland, Belgium, and Greece) and therefore are characterized by uneven geographical benefits.

Given the current conditions and ways of functioning of crafts presented above. I conducted a bibliometric study devoted to the issues of new technologies and crafts in the context of striving for sustainable development. It is planned to present the state of the latest research and identify emerging trends and research gaps in this topic. The aim was to present the topic of the use of new technologies in crafts, perceived as a tool enabling moving towards sustainable development, as well as to isolate trends focusing on popularity and novelty. Given the above, I identified three research questions.

RQ1: What are the key research areas?

RQ2: What are the key emerging research trends?

RQ3: What are the research gaps?

A systematic literature review was conducted in November 2023 based on texts from the Scopus scientific materials database.

The composition of this article includes a presentation of the applied SLR and quantitative analysis process, characterization of the specificity of the selected texts (including subject areas, distribution of publications on the timeline, form of publication, and territorial assignment), the specificity of the bibliographic data (including aspects of co-authorships and citations) and the specificity of the text data (including the most frequently occurring words in titles and abstracts, clusters of specified key terms and their visualization). The discussion section refers to the following groups of terms: 1) 'Columbia' and 'Madeira', 2) 'wood', 'construction industry' and 'construction organization', 3) 'knowledge' and 'technology', 4) 'intangible culture', 'inheritance', and 'culture', and 5) 'sustainability',

'sustainable development', and 'pollution prevention'. In summary, apart from addressing the research questions posed, the need to redefine what craft is today was also emphasized.

MATERIAL AND METHODS

The article describes the bibliometric study within which the Structured Literature Review (SLR) was conducted. The study was guided by two main research questions as part of scientific texts devoted to crafts, new technologies, and sustainable development:

RQ1: What are the emerging trends?

RQ2: What are the research gaps?

To find answers to the formulated research questions, I used the interdisciplinary and ranking database of scientific texts the Scopus published by Elsevier, *i.e.* a database of abstracts and citations, enabling precise narrowing of the search area. This database has been operating since 2004 and includes texts published since 1970, including the latest literature on the subject. This database does not index all scientific texts but only those that met a group of selection criteria, including those related to the regularity of publication, review process, having abstracts in English, statements of ethical principles, online availability, reputation, and high quality. Scopus is sometimes treated as an 'indicator of a scientist's authority' (Scientific Publications, 2022) and, above all, as the largest database of scientific texts, allowing access to scientific publications from any discipline (Library of the Faculty of Philology of the Jagiellonian University, 2023). Within this database, I used narrowing through search criteria combining the phrases: *new technologies/ modern technologies/ innovative technologies/ artificial intelligence/ 3D printing/ virtual reality/ augmented reality, craft*, and *sustainable development*. In this way, I obtained 17 texts devoted to the selected issues. I narrowed the search to the article title, abstract, and keywords, and then downloaded the CSV file. Figure 1 shows the detailed SLR process.

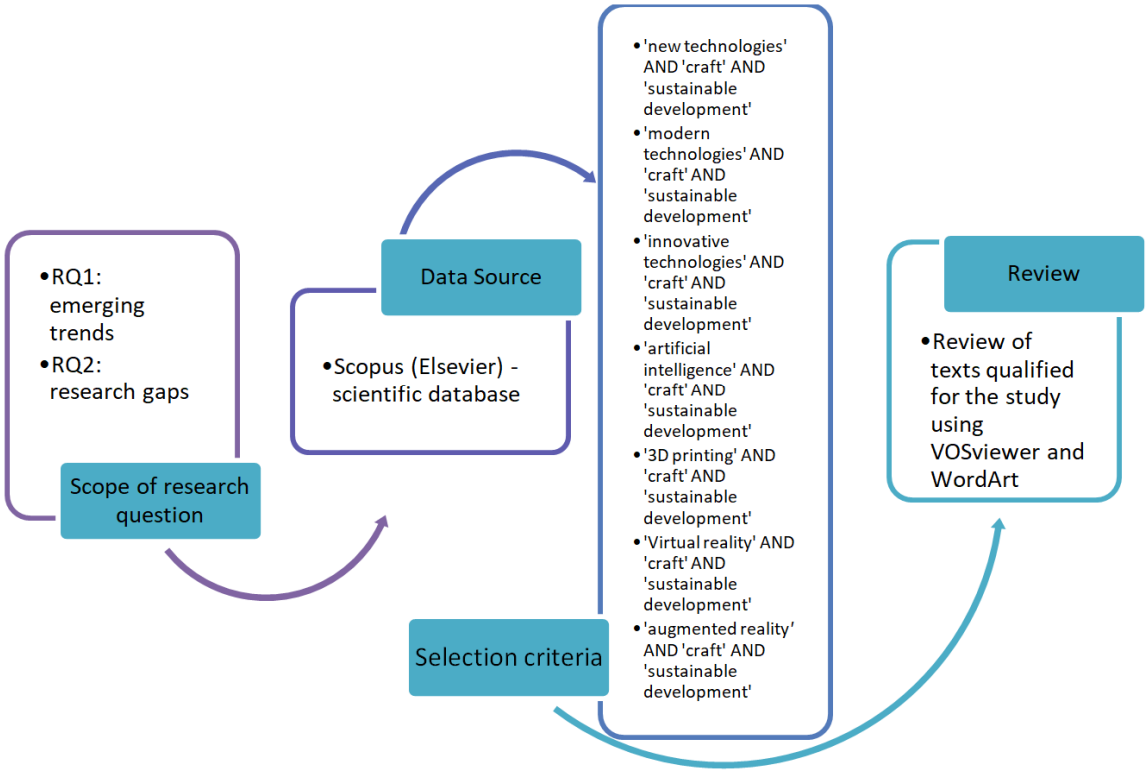


Figure 1. SLR process
Source: own elaboration.

In the next step, I performed a quantitative analysis using programs specializing in data visualization, such as VOSviewer and WordArt. The first one allows for the creation of maps based on

bibliographic data (including cooperation between authors and between representatives of given countries) and text data (derived from the titles and abstracts of indexed works). The second program allows for the visualization of the most frequently occurring words/phrases in the text, showing the results as transparent word clouds.

LITERATURE REVIEW AND THEORY DEVELOPMENT

The Specificity of the Indexed Texts

The selected texts can be divided into 12 subject areas (Figure 2), within which the most significant number of texts is devoted to the areas of engineering (5 texts), environmental science, computer science, and physics and astronomy (4 texts each). The publications were published between 2003 and 2023. In this period, the most significant number of publications was published in 2019 (Figure 3). The indexed documents are dominated by conference papers, journal articles (eight texts each), and one book chapter. The authors of the texts mainly represent the People's Republic of China (5 texts), the United States (3 texts) and Great Britain (2 texts) (Figure 4). The dominant language of the indexed materials was English (16 texts). Only one text was published in another language, *i.e.* in Croatian.

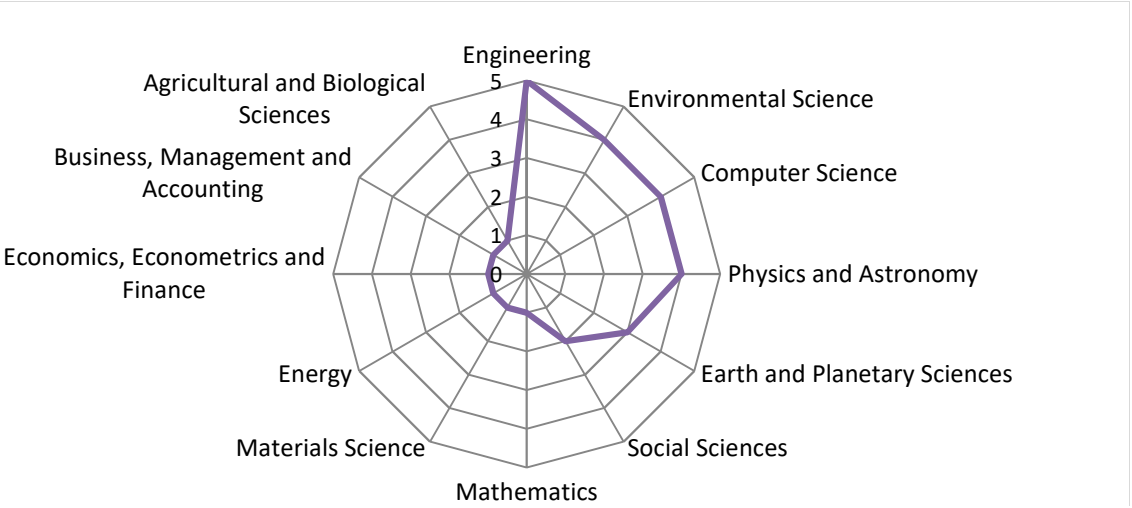


Figure 2. Subjects area
Source: own elaboration.

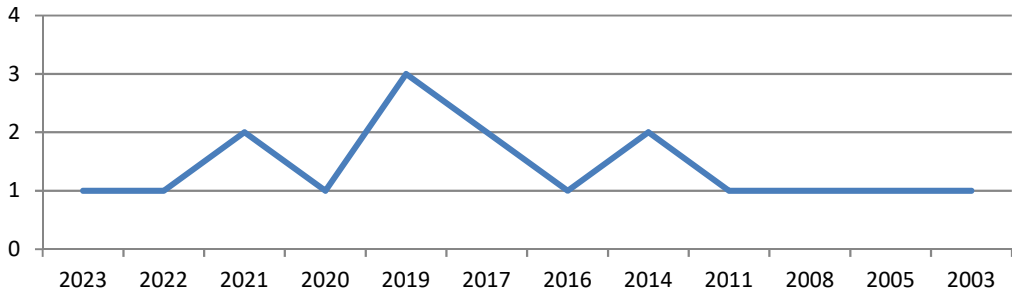


Figure 3. Publication date
Source: own elaboration.

Creating authorship maps within the selected texts in VOSviewer was impossible. When selecting complete counting methods and the minimum number of documents of an author – 2, the total link strength for all items was 0. Cooperation between authors within the researched issues therefore applies only to individual texts. The most frequently cited texts were the texts by Nasso *et al.* (2019), which had 20 citations, and the team of Benford *et al.* (2017), which had 13 citations. Detailed information is presented in Figure 5.

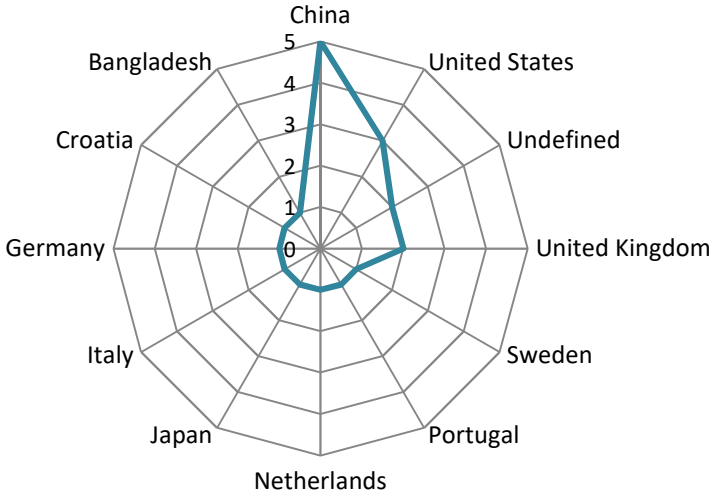


Figure 4. Country/ territory
Source: own elaboration.

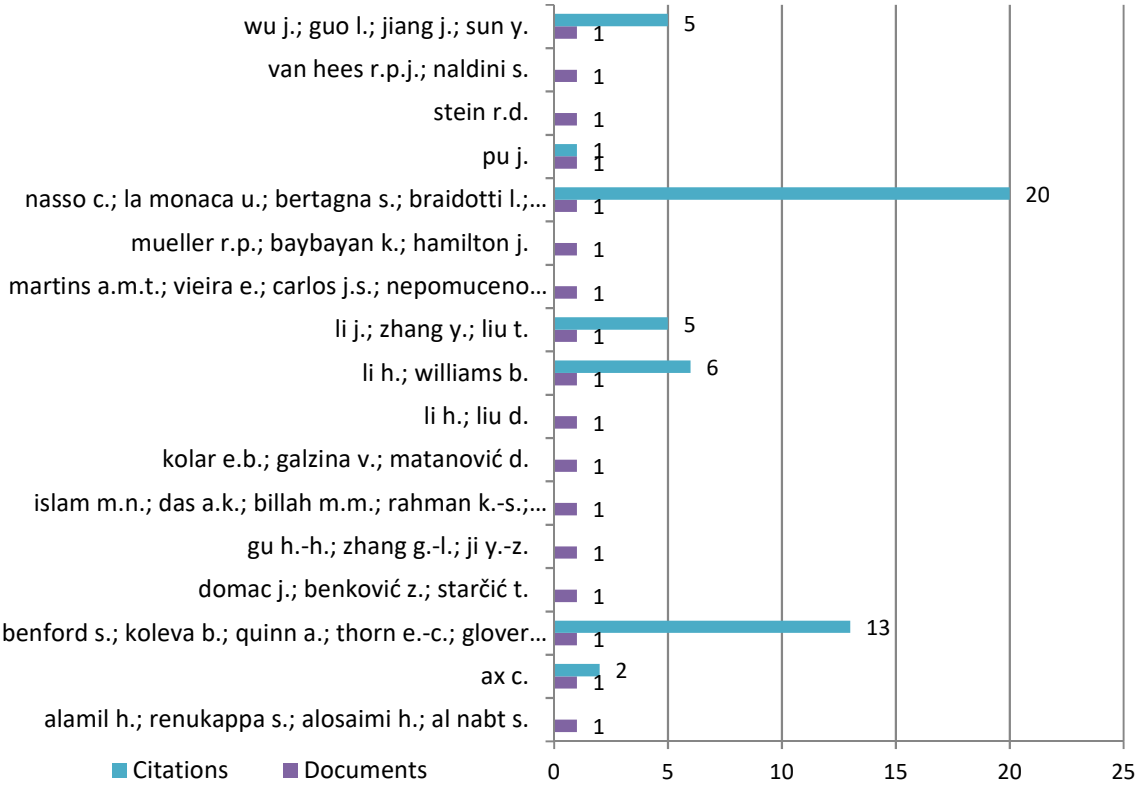


Figure 5. Co-authorship: authors
Source: own elaboration.

Similarly, in the case of cooperation between countries, I could not generate a country co-authorship map. After selecting complete counting methods and the minimum number of documents of an author, in 2 of the 14 countries, 3 meet the threshold. For each of them, the total link strength was 0. Out of 14 specific countries, only three representatives cooperated on the researched topic; these included scientists from the United States, China, and Great Britain. The cited texts also came from Great Britain – 13 citations, China – 11 citations, and the United States – 6 citations.

The Specificity of the Text Data

The most frequently appearing entries in the titles of the selected texts included *sustainable, craft, industry, sustainable, culture*, and *heritage*. However, within the abstracts, the most frequently appearing

words were *technology, culture, craft, products, charcoal, knowledge, intangible*, and *wood*. Figures 6a and 6b present word clouds generated by WordArt illustrating all the components of titles and abstracts. Within them, the font size indicates the frequency of appearance in titles or abstracts, respectively.

6a. Titles

6b. Abstracts

Figure 6a-b. Wordclouds for titles (a) and abstracts (b). WordArt
Source: own elaboration.

Using the VOSviewer program, we can generate maps based on the text data, including information contained in the title and abstract fields. I selected the whole counting method and specified the minimum number of term's occurrences: 3. In this way, of the 889 terms, 75 meet the threshold. I divided the terms into 6 clusters (Figure 7a):

- the knowledge cluster is marked in purple, which includes elements such as *knowledge, construction industry, process, person, interactive decoration*, and *construction organization*,
- the blue colour combines the craft element: *craft/crafts, intangible culture, inheritance, protection, intangible cultural heritage, processing, information, influence, art, value*, and *development*,
- the sustainability cluster is marked in red, including the following elements: *sustainability, action, learning, cost, Madera, Columbia, space, shoe, creation, new technology, solution, learning, construction*, and *cost*,
- the yellow colour indicates the technology cluster, elements: *technology, problem, resource, sustainable development, mining area, pollution prevention, area*, and *industry*,
- the green-production cluster, containing such elements as *production, producer, Croatia, market, demand, charcoal, tonne, water management*, and *economy*,
- the turquoise colour – wood cluster with elements*: wood* and *product*.

Within network maps, the 'bubble' size indicates the multiple occurrences and the number of connections with other terms appearing in publications. Figure 7b shows the overlay map – network visualization from the publication dates page. The darker the colour of the 'bubble,' the earlier the term appeared. The oldest terms include *mining area, economy, environmental protection, producer, water management,* and *construction*. The newest ones were *craft, wood, space, Columbia, Madeira, sustainability, art, intangible culture, inheritance, protection, culture, construction industry*, and *construction organization*.

The last visualization, *i.e.* the density map (Figure 7c), shows the previously presented terms from the point of view of exploring a given topic (the most frequently researched issues). The brighter the fields (yellow), the greater the research intensity. The brightest areas include technology, craft, knowledge, production, and action.

Only three of the terms listed in VOSviewer refer directly to sustainable development. These included the following terms: *sustainability, sustainable development*, and *pollution prevention*, as shown in Figures 8a-c. Of these, the first two had the most connections with other terms. Within them, the term sustainability was associated with a more significant number of terms from newer publications, *i.e.* published after 2020, while the term *sustainable development* was associated with terms assigned to publication dates between 2010 and 2015.

Another distinctive group of terms relates to issues of culture and heritage (Figures 9a-c), *i.e.* with terms such as *intangible cultural heritage, intangible culture*, and *culture*. Among them, the term culture had the most connections. Moreover, terms containing the word culture were associated with newer publications than those containing the word *heritage*.

The last group of terms listed concerned the names of geographical locations: *Columbia, Croatia*, and *Madeira* (Figures 10a-c). Within this group, *Croatia* had the most connections with other terms, but most of them concerned older issues, including those related to publications from before 2010.

DISCUSSION

The selection criteria used only 17 publications from the Scopus database, which may indicate that the topic combining the issues of crafts, new technologies, and sustainable development is relatively new and yet to be very popular in the scientific community. Using the VOSviewer and WordArt programs, the frequencies of terms in their titles and abstracts were visually compared. The conducted. analysis made it possible to specify the most popular, contemporary topics as well as the newest and least researched aspects within the examined issues, *i.e.:*

1. trends related to the latest terms: craft, wood, space, Columbia, Madeira, sustainability, art, intangible culture, inheritance, protection, culture, construction industry, and construction organization,
2. trends related to the most intensively explored issues: *technology, craft, knowledge, producer*, and *action*,
3. other distinctive terms directly referring to sustainable development are *sustainability, sustainable development*, and *pollution prevention*.

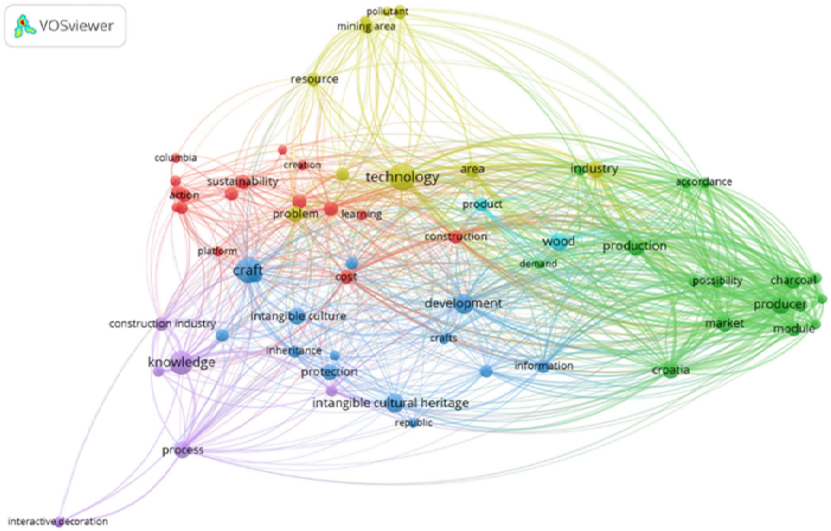
Terms: 'Columbia' and 'Madeira'

The term *Columbia* does not directly refer to the country in South America. It stands for STS-52 Columbia, *i.e.* the thirteenth mission of the Space Shuttle Columbia and the fifty-first space shuttle program. It appeared in a text devoted to contemporary sea voyages in small vessels with a minimum crew, comparable in size to crews exploring space. The text devoted to this issue focuses on applying systems engineering solutions. As a case study, the author cites an ancient Hawaiian sailing ship used to explore the Pacific (Mueller *et al.*, 2021).

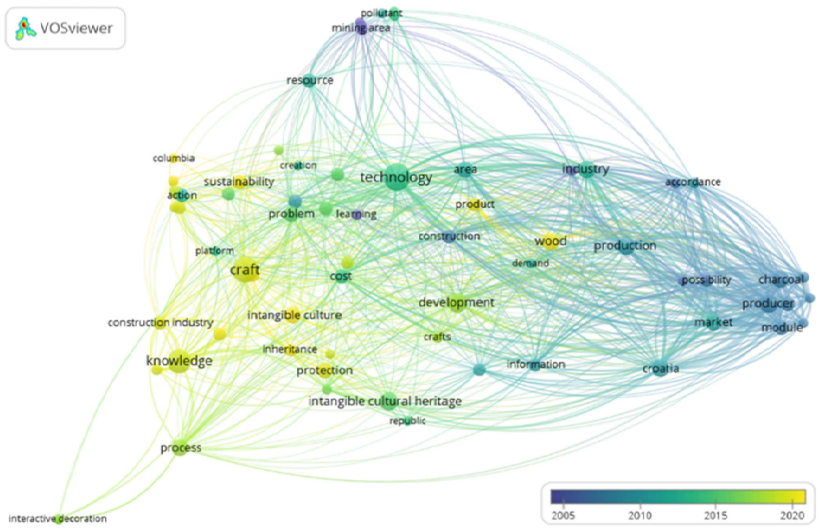
The term *Madeira* refers to the archipelago of volcanic origin of Madeira in Portugal. It used architecture rooted in local tradition, created by local craftsmen. In the literature, this issue presents the need for sustainable buildings using lessons from folk architecture. It highlights the importance of protecting native building resources, an overview of Madeira vernacular architecture, and the importance of exchanging information beneficial from the point of view of both the preservation of objects of the past and the know-how used in contemporary sustainable construction (Martins *et al.*, 2019).

Terms: 'wood', 'construction industry' and 'construction organization'

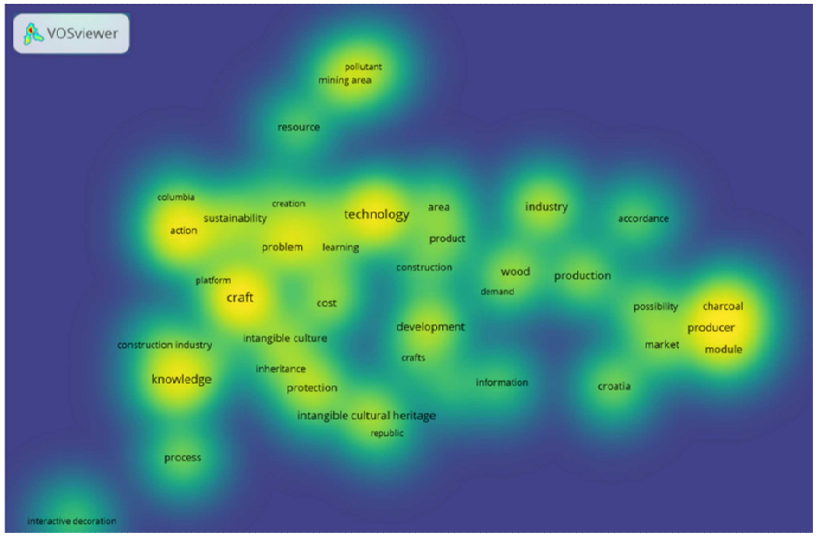
Issues related to wood refer to three aspects of craftsmanship and new technologies. The first shows wood as a renewable material, defined as one of the most valuable and standard new technologies used, among others, to create advanced wood-based products – using lasers in architecture and producing furniture, toys, and artistic crafts. The use of lasers to determine the quality of wood, improve work, design in wood, and clean monuments made of wood may contribute to the sustainable development of wood-based products and industries through the efficient use of resources and – very significantly – may affect the protection of forests and the mitigation of climate change (Islam *et al.*, 2023).



7a. Network visualization



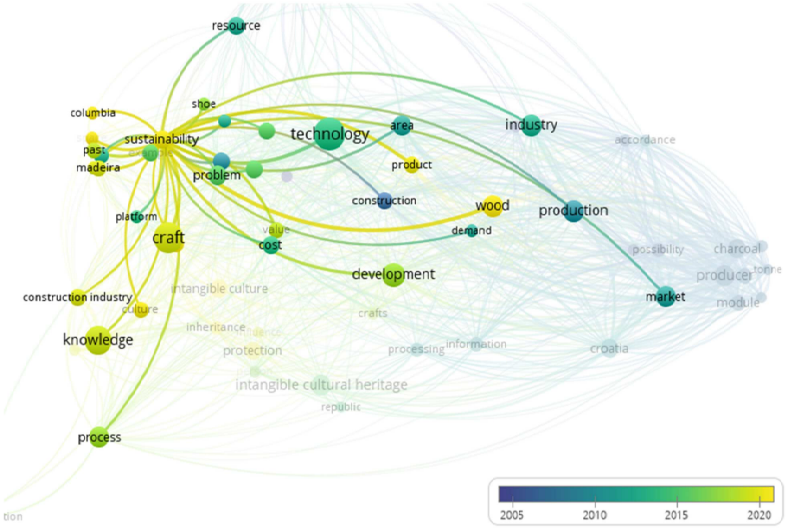
7b. Overlay visualization



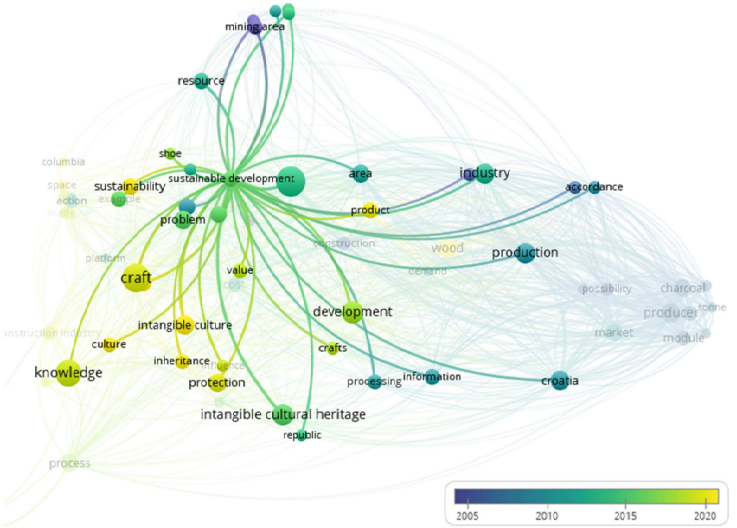
7c. Density visualization

Figure 7a-c. Network visualization (a), overlay visualization (b), density visualization (c)

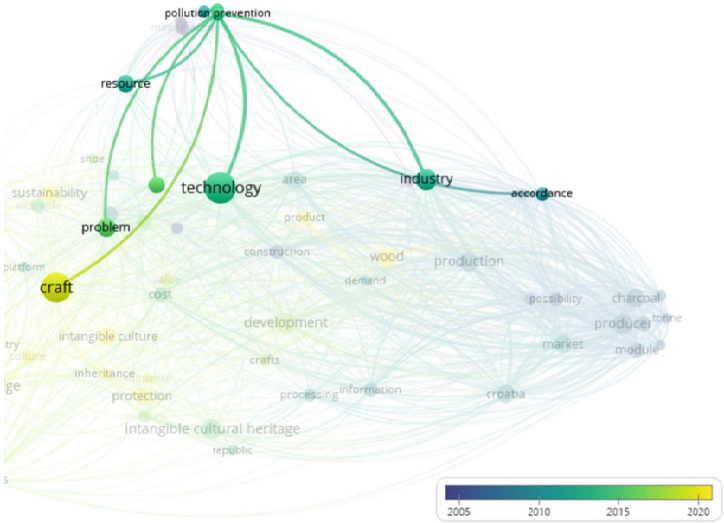
Source: own elaboration.



8a. Term *sustainability*



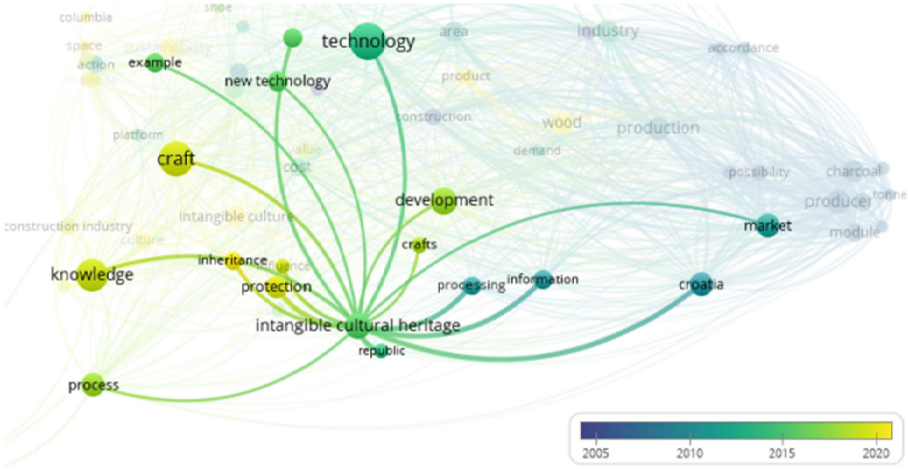
8b. Term *sustainable development*



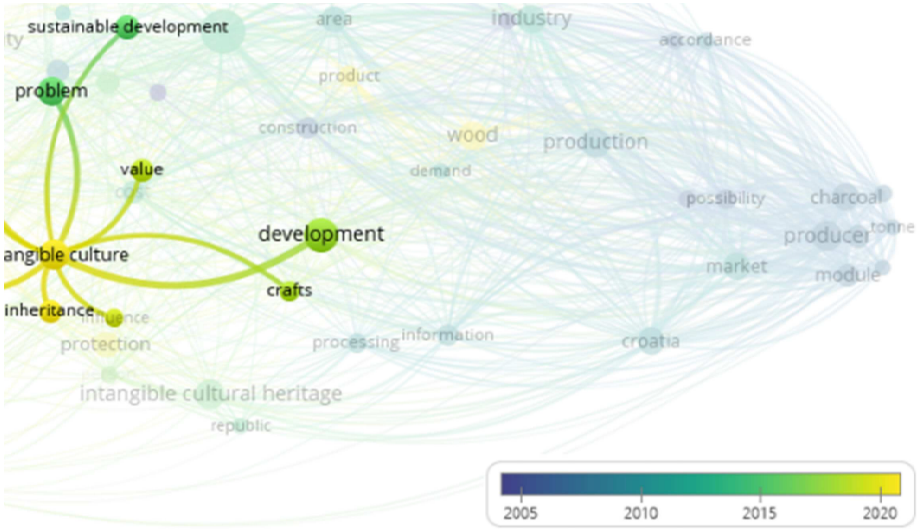
8c. Term *pollution prevention*

Figure 8a-c. Overlay map for terms: *sustainability* (8a), *sustainable development* (8b), and *pollution prevention* (8c)

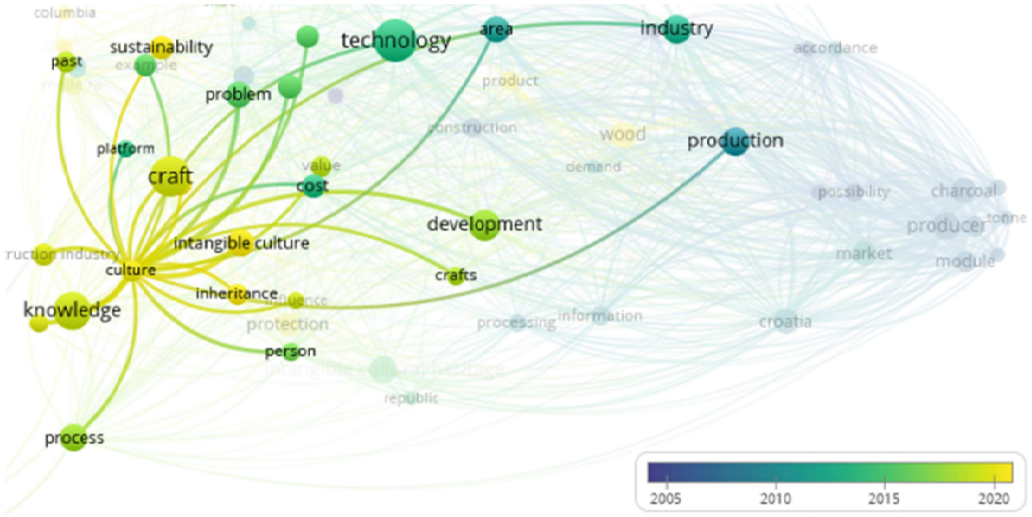
Source: own elaboration.



9a. Term *intangible cultural heritage*



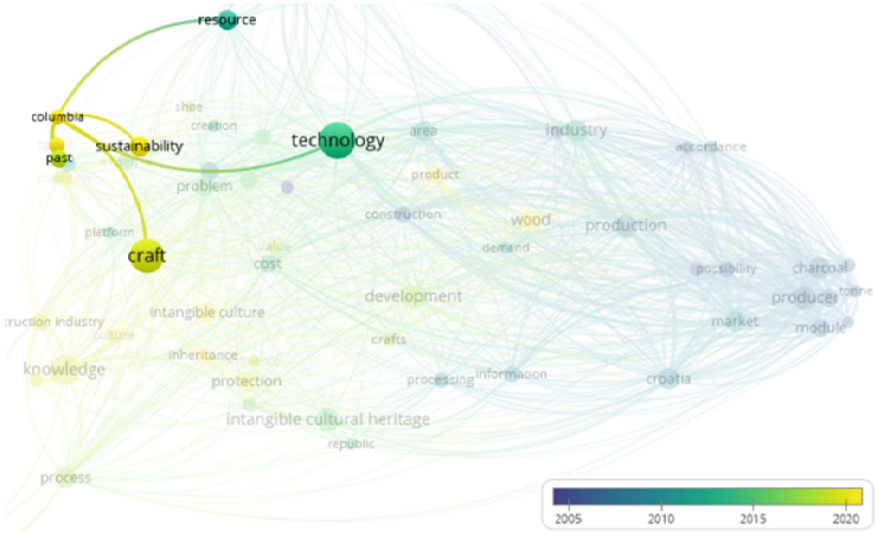
9b. Term *intangible culture*



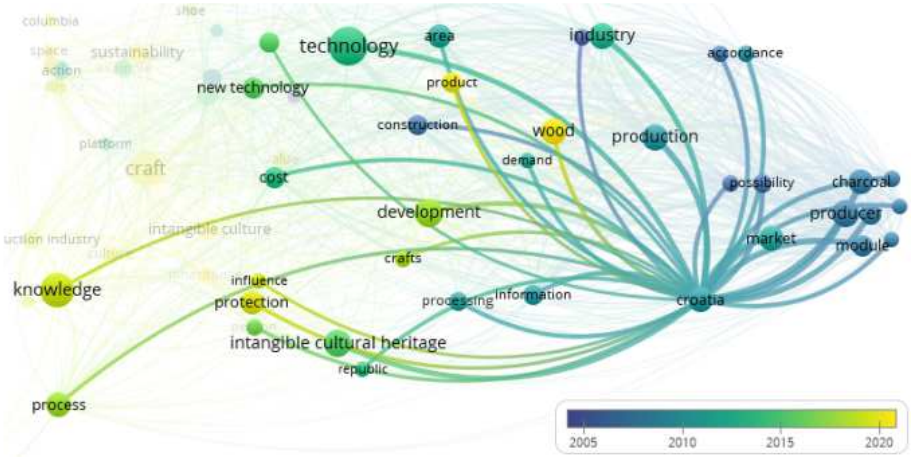
9c. Term *culture*

Figure 9a-c. Overlay map for terms: intangible cultural heritage (9a), intangible culture (9b), and culture (9c)

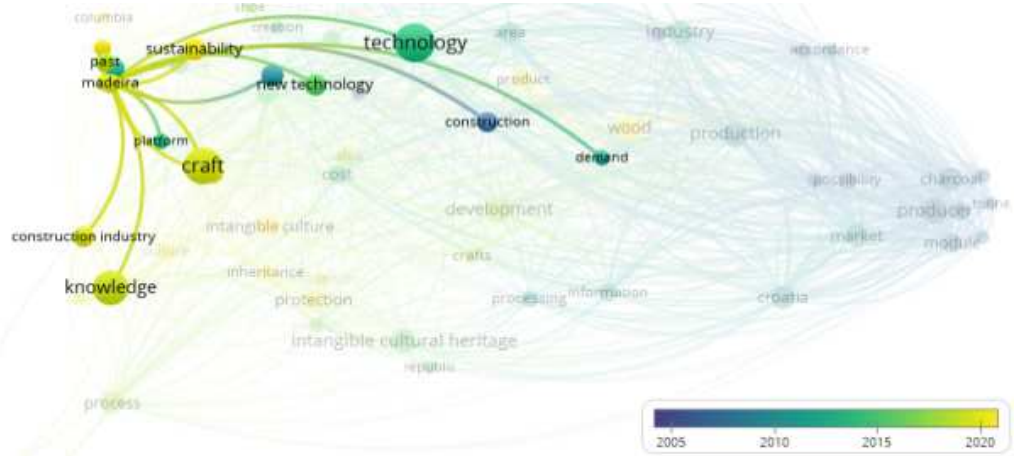
Source: own elaboration.



10a. term *Columbia*



10b. term *Croatia*



10c. term *Madeira*

Figure 10a-c. Overlay map for terms: Columbia (10a), Croatia (10b), and Madeira (10c)
Source: own elaboration.

The second aspect raises the issue of traditional methods of charcoal production, requiring renovation and modernization to improve the efficiency of converting wood into charcoal and to cope with national and international competition in the raw material (wood) and product (charcoal) markets, and thus improve the situation, among others in Croatia in terms of income obtained in this industry and reducing the level of unemployment in rural areas. Activities aimed at sustainable charcoal production include information and training, analysis and research of costs associated with obtaining raw materials, the production process and the price of final products, technical, economic, and environmental competitiveness within existing technologies and industries of charcoal production, determining the profitability of various methods of charcoal production, as well as the implementation of integrated policies and programs in the studied area (Domac *et al.*, 2008).

The last aspect concerns reducing air pollution in the transport system, including inland navigation, by building wooden ships and using a hybrid electric power system. The choice of wood as a material is considered more sustainable, especially in the context of the disposal problem of ships at the end of their service life (Nasso *et al.*, 2019).

Terms related to *construction* were presented in six selected texts (*i.e.* in over 1/3 of the analysed materials). They concern aspects of wood production (described above) and:

- the use of wood in architecture, rooted in local tradition in Portugal (Martins *et al.*, 2019),
- aspects of folk architecture and construction based on nature and adaptation to the prevailing climate, including combining the vernacular approach with modern technologies for the purposes of, among others, technical maintenance (Stein, 2003),
- the topic of structuring exploration and reconstruction activities conducted in mining areas to optimize operations, cleaner production, and the production of ecological products (Gu *et al.*, 2005),
- aspects of knowledge management in the construction industry of the Kingdom of Saudi Arabia, including sharing design knowledge and experience in craft positions (Alamil *et al.*, 2019).

Terms: 'knowledge' and 'technology'

The issue of protection of craft knowledge, practice, and skills as part of the intangible cultural heritage of the Republic of Croatia is the topic of research by Emina Berbić Kolar's team (2014). These researchers list areas in which new technologies may be helpful. These include data collection – digitization, processing, storage, and making it available to end users (Kolar *et al.*, 2014).

The second text related to the space of non-material culture refers to the local knowledge system within the Chinese art and craft culture of Jingdezhen. It proposes developing an intangible culture based on an artificial intelligence decision support system. The study conducted among porcelain producers indicates a positive impact of using new technologies in this craft, visible in the increased rate of technical progress by 2.4% (Li & Liu, 2022).

The issue of knowledge management in the construction space of the Kingdom of Saudi Arabia as an essential element enabling a competitive advantage is the subject of research by Hani Alamil *et al.* (2019). This text highlights that sharing know-how (including experience and design knowledge) is a critical element in the age of knowledge and even a survival strategy for a construction company. It employs various workers, including craftsmen. However, groups sharing knowledge and ideas – including recognizing opportunities and threats related to new technologies – should obtain institutional support (Alamil *et al.*, 2019).

The categories of knowledge and technology on interactive decorations are also discussed in the text, in which craft knowledge applies to creating aesthetic and functional decorations on products such as ceramic bowls, embroidered gift cards, fabric souvenirs, and acoustic guitars. Meanwhile, new technologies were used to create a portfolio of interactive artifacts – everyday objects decorated with patterns- triggering digital interactions when scanning the developed codes. An essential aspect of the project is mapping the physical artifact and the digital content. An example may be posting a code that links to a restaurant's menu or a piece of music that can be listened to using a mobile device (Benford *et al.*, 2017). Another example is using a laser to preserve and dry wood and produce wood-based products (Islam *et al.*, 2023). The new direction of technical con-

servation combines craftsmanship based on building traditions, local craft knowledge, and modern technologies (Van Hees *et al.*, 2016; Stein, 2003).

Moreover, in some crafts, technology directly serves to prevent and control pollution, including through a real-time monitoring system and a decision support system. An example is the extraction of vanadium from hard coal and the prevention and control of pollution in wastewater, gases, and slags to guarantee ecological safety and human health and improve production capacity and crafts (Li *et al.*, 2014). Another example within the same industry is using new technologies to support land reclamation of former mining areas, especially in e-economy optimization, cleaner production (pollution control based on ecological industrial technology), and organic crops (Gu *et al.*, 2005).

An example specific to new technologies is artificial intelligence (AI). Within arts and crafts, big data and software enable innovation. Among others, AI allows arts and crafts design, the development and inheritance of contemporary arts and crafts, and opens up space for educational opportunities. The last of these aspects facilitates the creation of a personalized educational network, including supporting resources and tools, recommending the best teachers, creating an interactive form of explanations and tips, and sharing experiences (Pu, 2020). The educational network may also be addressed not only to artists and craftsmen themselves (as part of talent training) but also to the recipients of their products.

Terms: 'intangible culture', 'inheritance', and 'culture'

Scholars also discuss intangible cultural heritage, among others, Croatia's cultural heritage. Many issues related to sustainable development exist; the need to order them and insufficient documentation regarding intangible assets are emphasized. It is also emphasized that the task of current and future generations is to work on preserving cultural heritage. New technologies can be used, among others, to digitize data, process it to the level of information, store it, and further make it available. However, this requires not only the involvement of new technologies but also the recruitment of a carefully selected, educated staff. Moreover, the factors necessary for this include providing collectors and researchers with mobile and good digitization equipment, an adapted vehicle with a place to store equipment and collected items, creating a digital repository, organizing an appropriately equipped exhibition space for the exhibition of the collected heritage, which is to enable its sharing through multiple channels and in a usage-oriented manner (Kolar *et al.*, 2014). Another aspect of intangible culture concerns the technical conservation of objects, some of which are included in the UNESCO World Heritage List (Stein, 2003). Scholars also discuss this topic from the point of view of difficulties with inheriting precious intangible culture. In this space, new technologies serve to promote craft regional brands and apply intangible cultural innovations (Li & Liu, 2022).

Terms: 'sustainability', 'sustainable development', and 'pollution prevention'

Scholars describe sustainability mainly in two ways. On the one hand, as the previously discussed activities aimed at preserving the intangible cultural heritage, and on the other hand, as activities implemented in the craft production system, including those that have an impact counteracting the phenomenon of unemployment or pollution prevention.

Regarding the first of the issues mentioned above, new technologies serve in the digitization process. This results in the creation of a database of digital cultural content, including images, multimedia, digital animations, network communications, and cloud storage services. Haifeng Li and Dongcheng Liu (2022) present an example of Chinese crafts from Jiangxi Province, pointing to 18 folk cultures and ten types of intangible cultural heritage in this area (Li & Liu, 2022). Another example from the People's Republic of China is the issue of the inheritance of bamboo weaving crafts in Dongyang. It included, among others, virtual reality and digital 3D programming tools used to gain a deeper understanding of traditional crafts and the need to protect and inherit intangible cultural heritage (Wu *et al.*, 2021).

Among others, the production area is shown in research conducted by Christine Ax (2017) on resource efficiency in manual and industrial footwear production. Tailoring shoes is associated with the aspects of a labour-intensive production method, the possibility of repairing existing shoes and their durability, which not only affects the production of ecological products but also enables the

creation or maintenance of jobs (Ax, 2017). The space relating to production and environmental protection appears, among others, in the context of a more sustainable exploitation of resources, restoring utility or natural values, including controlling pollutants (Gu *et al.*, 2005).

CONCLUSIONS

The conducted bibliographic study indicates a low representation of texts in the literature on the subject that combine the issues of crafts, new technologies, and sustainable development. The latest texts, *i.e.* those published after 2020, mainly concern issues related to the need to preserve intangible cultural heritage, crafts related to wood-based products, and the construction industry. The topics most intensively explored thus far relate to craft knowledge and production activities. However, references to sustainable development mainly refer to the need to preserve cultural heritage and facilitate the acquisition of qualifications and production, as well as activities related to the minimization of production waste, including pollution prevention.

Noteworthy, the conducted study can contribute to the implementation of sustainable programs oriented towards crafts and new technologies in the information aspect, emphasizing the existing bridge between the world of science, crafts, and their environment. It also indicates existing areas for further research and technological solutions that support craftsmen and enable more sustainable development. The influence on public policy decisions regarding crafts may include, among others, the development of reports, recommendations, and other scientific studies, as well as the development of innovations and building cooperation between different stakeholder groups.

New technologies can aid more sustainable development of crafts and the region/country where craftsmen work. However, this requires the introduction of programs supporting the development of technologies in the craft sector, not only in the institutional sense but also aimed at individual manufacturers – the SME sector. They can include subsidies, tax relief, or dedicated training to introduce technical solutions that facilitate not only the production process but also the management process in the craft enterprise. Providing protection of intellectual property, product certification, consumer and data protection, and minimizing other concerns related to new technologies.

Considering the importance of crafts, their increasing popularity, and the fact that various crafts are currently experiencing a renaissance and are increasingly marking their presence as an intensively developing sector, we can state that the area of research gap includes primarily the space of economic responsibility, the space of the economic sphere related to problem areas. Sustainable development refers to the fair distribution of benefits resulting from economic development. These include, for example, the situation of craftsmen on the labour market, reflected, among others, by employment offers, employment stability, the ratio of remuneration to market realities and aspects of satisfactory income, opportunities to conduct craft entrepreneurship, and achieving profitable, high-quality production. To sum up the above, there is a lack of publications referring to Sustainable Development Goals number 8, 9, and 12, namely: promoting stable, sustainable, and inclusive economic growth, full and productive employment and decent work, building a stable infrastructure, promoting sustainable industrialization and supporting innovation and ensuring sustainable consumption and production patterns (UN, n.d.). Due to the use of new technologies in crafts, there is also a need to redefine what contemporary craftsmanship is, emphasizing aspects other than manuality (traditional approach) that distinguish craft products, such as creating tailor-made goods/services, building trust and personal relationship with consumers of crafts, etc.

This study, like any SLR, is associated with certain limitations resulting from the specific structure of article selection limited to searches based on subjectively defined terms and logical operators AND and OR. Further limitations include focusing on the analysis of texts from only one database of scientific texts, and in a broader scope, not analysing scientific texts that have not been indexed in such databases.

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Author

Katarzyna Mazur-Włodarczyk

PhD in economics. A researcher at the Faculty of Economics and Management at the Opole University of Technology (Poland). Winner of a scholarship for an outstanding young scientist (2022). Her research interests include economic culture, management culture, perspectives related to the Belt and Route Initiative, the socio-economic situation of the PRC, Sino–European Union business communication, and sustainable production and consumption.

Correspondence to: Katarzyna Mazur-Włodarczyk, Ph.D. Eng., Opole University of Technology, Faculty of Economics and Management, Luboszycka 7, 45-036 Opole, Poland, e-mail: k.mazur-wlodarczyk@po.edu.pl

ORCID https://orcid.org/0000-0002-4822-9328

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