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ICT adoption in the textile and jewelry industries for sustainable fashion: A systematic review

George Kwame Fobiri ^{a,*}, Solomon Kwame Fobiri ^b, Cyril Etonam Adala ^c, Raphael Kanyire Seidu ^d, Abdul-Razak Seini Yussif ^a, Rowena Fatchu Kansanba ^a, Nana Banimaa Oduro Boateng ^a

^a Department of Fashion Design and Textiles Studies, Kumasi Technical University, Kumasi, Ghana

^b Department of Information Technology, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, Kumasi, Ghana

^c Department of Industrial Art, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

^d School of Fashion and Textiles, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

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ABSTRACT

Information and Communication Technology (ICT) adoption in manufacturing industries is gaining attention in academic discourse as a result of the undeniable improvement it has brought to industries in the past decades and the promising future it has for manufacturers that embrace it. The present study adds to the discourse from jewelry, textile, and fashion product manufacturing perspectives. With the PRISMA flowchart, data is gathered from the Scopus online database and analysed systematically to address research questions such as; what is the publication trend on ICT adoption in the jewelry and textile industries? How useful is ICT in the textiles and jewelry industries for sustainable fashion? How is the fashion industry sustained through textiles and jewelry making? The study reveals that technology adoption has helped the textiles and jewelry industries to meet market demand and sustain the fashion industry. Through digitalization, online marketing strategies have been adopted by firms to sustain the fashion industry. It is recommended that small-scale producers in the textile, jewelry and fashion industries should adopt technology to the fullest in their practices for a sustainable industry.

Introduction

Information and Communication Technology (ICT) has been adopted in many industries to achieve laudable results in recent times. It has been a helpful tool across all disciplines from the first to the current (fourth) industrial revolutions. Nonetheless, its adoption in the third and fourth industrial revolutions is incredible [1]. An account is given of the crucial role played by ICT innovations in the agricultural sector in developing countries [2,3]. In the area of education, scholars [4–7] have deliberated extensively on the benefits of ICT adoption to both the teacher and the learner. The level of its usage, however, is significantly influenced by the knowledge of individuals and the training received [8,9]. Other areas such as architecture/engineering [10–13], business [14–17], health [18–21], etc. have seen a great improvement recently through the use of ICT. Although concerns have been raised about ICT economy, not respecting environmental limits, being unfair and less resilient in recent times [22], its acceptance in practical-intensive industries is crucial. Over the past few years, ICT adoption in the fashion and textile industries has seen a great increase, and it has been a major tool

* Corresponding author at: P.O. Box 854, Kumasi Technical University, Kumasi, Ghana.
E-mail address: kfobiri@gmail.com (G.K. Fobiri).

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for satisfying the swift shift in consumers' tastes [23,24]. The jewelry and textiles production industries precisely have gained a lot with the advent of ICT in such manufacturing industries.

The textiles and jewelry industries play a major role in the initiation and propagation of trends in fashion design. The textile sector feeds the fashion industry with seasonal-inspired fabrics of all kinds (woven, knitted, non-woven, printed, dyed, etc.) for garment production, whereas the jewelry sector also comes in with trendy accessories (necklaces, bracelets, rings, etc.) as complements for sustainable fashion. The scientific and technical nature of operations in these sectors undoubtedly calls for the use of sophisticated machinery and concepts for increased efficiency and sustainability. Diversification of skills and collaboration in product design has made way for different approaches to manufacturing in the jewelry industry [25–27]. With the various advancements observed in these industries, the role of technology cannot be downplayed. Jin and Shin [1] posit that technologies adopted in the fourth industrial revolution in the fashion industry, for instance, are purposed to solve three major problems such as ensuring an increase in productivity in the sector, instilling a sustainable environment, and hyper-personalization.

The textile industry has also gone through several technological advancements since the first industrial revolution and is performing better in the fourth Industrial Revolution. The fourth industrial revolution, often referred to as Industry 4.0, denotes a fast advancement in technology in the 21st century. It is characterized by automation and robotization of production processes (Bikse, et al., 2022). With Artificial intelligence - AI (the adaptation of human intelligence in computer systems), Internet of Things – IoT (the incorporation of technologies in devices to help in data exchange using the internet), Robotics (the use of robots in performing tasks in the industry through automatic or semiautomatic means), etc., the industry 4.0 has been helpful to the textile industry in the 21st century. The magnificent improvement of the textile sector in the past few decades and the role of technology in such improvement is observed [28]. The likes of John Kay's discovery of a flying shuttle in 1733 and Joseph Marie Jacquard's invention of the popular Jacquard loom in 1801 are evidence of the role of technology in the sustainability of the textile industry [29,30]. Also, technological innovations such as the designing of automatic looms in the late 19th century [31] cannot be overlooked in accounting for the role of technology in fabric production in the sector. In the jewelry production industry, the adaptation of digital models saw an extremely significant increase in production efficiency, which is highly recommended for the sustainability of the industry [32]. Lu, et al. [33] report on a Microbeam XRF technology used for accurate analysis of the precious metal content of necklaces. Technologies of this nature are smart means to sustain the fashion industry.

Sustainability in the fashion industry is largely anchored on the ability to constantly satisfy customers with the needed fashion products through environmentally friendly processes. This, nonetheless, requires the use of ICT for the implementation of innovative concepts to sustain the environment [34]. Mesjar, et al., [35] define sustainable fashion as not wasting resources in the various stages involved in the production, supply, and consumption of fashion products. Sustainability as a broad term could also be defined to cover the preservation of natural resources, the promotion of biodiversity, the mitigation of environmental harms, and the striking of a balance between environmental preservation and human progress [36]. It also connotes enhancing and maintaining a sound economic, ecological, and social system [37]. It is established that the fashion industry is one of the most prevailing sectors globally, and stands as a major contributor to the global economy [38,39]. It is a \$2.4 trillion-dollar industry that employs 300 million people worldwide [40]. It again serves as a unique instrument for modern cultural movements [41]. Also, along with the food and energy industries, the global fashion industry makes clothing available to help humanity survive [40,42]. The complex nature of the fashion industry [43] requires keen attention to all the various sectors, especially the accessories manufacturing areas to keep the industry running. Sustaining the fabrics and jewelry-making industries promises a secure future for the fashion industry. This has compelled the industry to significantly adopt ICT in the Industry 4.0 era for sustainable operation [44]. Adaptation of technologies has made fashion product manufacturing easier. The application of technological concepts like 3D printing recently, for instance, has helped to diversify the esthetic and functional performance of textile prints for the fashion designer's daily exploration at the studio [45,46]. An account is given of innovative textile products with exceptional properties achieved with 3D printing technology [47]. Such products are made in a more accelerated manner with less production time, due to technology adoption in their manufacturing [48].

The textiles and jewelry industries are made up of several subsections that intern rely on ICT for massive productivity and regular advancement for the continuity of fashion. It is worth saying that ICT adoption cannot be sidelined in the quest to sustain the fashion industry. Its incredible contribution to the booming of the fashion industry needs recognition. However, theoretical studies on ICT adoption in the textiles and jewelry industries precisely are still aspiring to gain more attention in academic discourse. The need to conduct a systematic literature review to understand ICT adoption in textiles and jewelry making becomes considerable. This systematic review aims to address the following questions:

RQ1. What is the publication trend on ICT adoption in the jewelry and textile industries?

RQ2. How useful is ICT in the textiles and jewelry industries for sustainable fashion?

RQ3. How is the fashion industry sustained through textiles and jewelry making?

The study is structured into four major sections. The introductory part is followed by a discussion of the methodology used. The results are analyzed, and discussed in detail with the findings summarised to address the questions set for the study. Finally, conclusions are drawn and recommendations are given based on the findings of the study.

Methodology

The present study adopts the Systematic Literature Review (SLR) method to probe into the role of ICT in textiles and jewelry manufacturing for sustainable fashion. As SLR entails a qualitative assessment of published articles in a given area through a rigorous

search method [49], this study adopted a requisite search strategy in the Scopus online database using search terms. It was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework [50]. The framework makes provision for the identification of data through a thorough search in a recognized online academic database, screening of the identified data, determining the eligibility of the data, and the subsequent inclusion of such data in a study. Fig. 1 presents the PRISMA model followed to conduct the present study. The Scopus online academic database was used to search and extract data for the study. While other online database such as the Web of Science is more tailored and makes comparison difficult sometimes, Scopus has quite better coverage which makes comparison easier [51]. This merit makes it a preferred online database by most researchers, especially for scholarly studies like systematic reviews; hence its adoption in this study to obtain reliable data for analysis.

Search strategy

A search was done in the document search option of the Scopus database with the terms ("Jewelry" OR "Jewellery" OR "Jewel industry" OR "Textile industry" OR "fashion industry" AND "Technology adoption") OR ("Metal Jewelry" OR "metal Jewels" OR "Goldsmithing"). The initial search gave rise to a total of 183 documents which were further subjected to titles, abstracts and keywords screening to exclude irrelevant studies as far as this study is concerned. The screening was done with the search block "TITLE-ABS-KEY ("Jewelry" OR "Jewellery" OR "Jewel industry" OR "Textile industry" OR "fashion industry" AND "Technology adoption") OR ("Metal Jewelry" OR "metal Jewels" OR "Goldsmithing")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re") OR LIMIT-TO (DOCTYPE, "cp")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j"))" to limit the document type, language and source type to include only studies eligible for the study. A total of 86 documents were excluded through the screening process to obtain 97 eligible studies.

Eligibility and inclusion criteria

All documents published in the areas of Jewelry, textiles and fashion were considered eligible for this review. Upon further assessment, 63 documents were excluded with the reasons being that; [1] they were not relevant for the analysis of the present study, [2] They had no full text. The inclusion criteria were set as Document type (Article, review and conference paper), Language (English) and Source type (journal). After the application of the inclusion criteria and a careful assessment, 34 studies were adjudged qualified for the analysis.

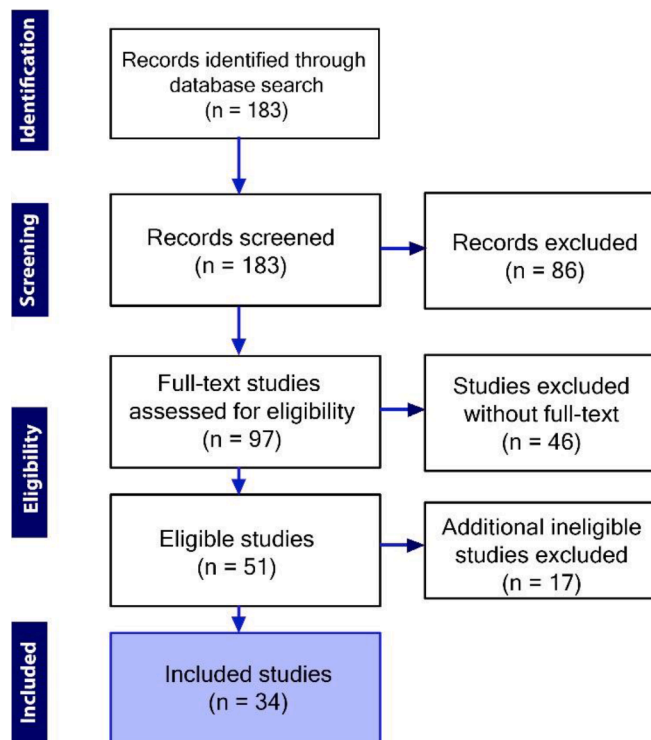


Fig. 1. The PRISMA flowchart used for the selection of studies.

Table 1
Details of studies included for analysis.

S/ No.	Authors	Title	Journal name	Cited by
1	Baiomy [52]	Children's drawings as input for the development of designs for the contemporary metal jewelry	Mediterranean Journal of Social Sciences	0
2	Gonzalez, et al. [53]	Web Adoption and Firm Performance in the Fashion Industry: The Moderating Role of Social and Economic Rational Managerial Perceptions	Journal of Organizational Computing and Electronic Commerce	4
3	Bortamuly and Goswami [54]	Determinants of the adoption of modern technology in the handloom industry in Assam	Technological Forecasting and Social Change	20
4	Demandt [55]	Early gold ornaments of southeast Asia: Production, trade, and consumption	Asian Perspectives	4
5	Cooper and Al-Saad [56]	Metal jewelry from burials and socioeconomic status in rural Jordan in late antiquity	Mediterranean Archaeology and Archaeometry	1
6	Li and Wu [57]	Environmental management system adoption and the operational performance of firm in the textile and apparel industry of China	Sustainability (Switzerland)	24
7	Knowles [58]	Ornament in the kitchen garden: The pea as motif for goldsmithing in the France of Louis XIII	Art History	0
8	Scuotto, et al. [59]	The performance implications of leveraging internal innovation through social media networks: An empirical verification of the smart fashion industry	Technological Forecasting and Social Change	113
9	Martinón-Torres, et al. [60]	Goldsmithing traditions and innovations in colonial Colombia: an analytical study of crucibles from Santa Cruz de Mompox	Post-Medieval Archaeology	3
10	Chen, et al. [61]	Estimating the environmental and economic impacts of widespread adoption of potential technology solutions to reduce water use and pollution: Application to China's textile industry	Environmental Impact Assessment Review	23
11	Burat et al. [62]	Gold&silver recovery from jewelry waste with combination of physical and physicochemical methods	Waste Management	17
12	Ahmad et al. [44]	Exploration of influential determinants for the adoption of business intelligence system in the textile and apparel industry	Sustainability (Switzerland)	10
13	Bai et al. [63]	Industry 4.0 technologies assessment: A sustainability perspective	International Journal of Production Economics	422
14	Lorenzo-Romero, et al. [41]	Omnichannel in the fashion industry: A qualitative analysis from a supply-side perspective	Heliyon	18
15	Rahman et al. [64]	The use of biotechnologies in textile processing and environmental sustainability: An emerging market context	Technological Forecasting and Social Change	16
16	Muller [65]	Wearable activity-tracking device feature preference amongst south african generation y students	International Journal of eBusiness and eGovernment Studies	11
17	Cooper [66]	Anglo-Saxon bling — a warrior king's Golden Helmet	Gold Bulletin	0
18	Silva and Bonetti [67]	Digital humans in fashion: Will consumers interact?	Journal of Retailing and Consumer Services	35
19	Okazaki [68]	Disentangling the effects of technological and organizational changes during the rise of the factory: the case of the Japanese weaving industry, 1905?14†	Economic History Review	1
20	Kanungo and Chakrabarti [69]	Gold governance and goldsmithery: Economic sociology of an informal manufacturing sector in India	Contributions to Indian Sociology	2
21	Wang [70]	Technical Studies of Balkan White Metal Jewellery of the Nineteenth–Twentieth Centuries	Studies in Conservation	1
22	Jin and Shin [1]	The power of 4th industrial revolution in the fashion industry: what, why, and how has the industry changed?	Fashion and Textiles	17
23	Fromhold-Eisebith, et al. [71]	Torn between digitized future and context dependent past – How implementing 'Industry 4.0' production technologies could transform the German textile industry	Technological Forecasting and Social Change	37
24	Shen et al. [72]	Digital technology adoption, digital dynamic capability, and digital transformation performance of textile industry: Moderating role of digital innovation orientation	Managerial and Decision Economics	28
24	Li [73]	Metal Jewelry Craft Design Based on Computer Vision	Computational Intelligence and Neuroscience	0
26	Li [74]	Numerical Simulation and Optimization Control of Precious Metal Jewelry Process Based on VR Virtual Technology	Wireless Communications and Mobile Computing	0
27	Fanni et al. [75]	PAVEL: Decorative Patterns with Packed Volumetric Elements	ACM Transactions on Graphics	0
28	Nespoli et al. [76]	Use of 4D-printing and shape memory alloys to fabricate customized metal jewels with functional properties	Rapid Prototyping Journal	3
29	Conlon [77]	Using product lifecycle management (PLM) to re-think fashion business education: an assessment of pedagogical practices and learning benefits	Research Journal of Textile and Apparel	0
30	Park and Lim [78]	Fashion and the metaverse: Clarifying the domain and establishing a research agenda	Journal of Retailing and Consumer Services	0
31	Scott et al. [79]	Investigating knitwear product development in small and medium enterprises: A report of practices related to environmental sustainability	Cleaner Logistics and Supply Chain	0
32	Mavri et al. [80]	Survey analysis for the adoption of 3D printing technology: Consumers' perspective	Journal of Science and Technology Policy Management	2
33	Martinez [81]	The Zenú and the funga: Mushroom representations in pre-Hispanic Colombia goldsmithing	Microbial Biosystems	0
34	Shi et al. [82]	The Evolution of Corporate Innovation in the O2O Model—Case Studies in the Chinese Jewelry Retail Sector	Sustainability	0

Results and discussion

A total of 183 documents were obtained on the initial search in the Scopus online database. This number of studies was screened to obtain 97 eligible studies which were subsequently assessed to include only 34 relevant studies for the analysis. The studies range from the year 2013 to 2023. Details such as the authors' names, the title of the document, the name of the journal and the number of citations of the included studies are presented in [Table 1](#).

Keywords analysis

A co-occurrence analysis of keywords of the included studies was conducted with the VOSviewer software (version 1.6.19) to observe the number of occurrences of keywords in published studies. With the extracted documents ($n = 34$), the minimum number of occurrences of a keyword was set at 2, where 33 keywords met the threshold out of the 385 keywords identified. After running the data, 4 clusters were observed with 147 links and a total link strength of 207. Four major keywords identified in the analysis each in a cluster using the number of occurrences include; technology adoption ($n = 14$), textile industry ($n = 8$), gold ($n = 5$), and technology ($n = 4$). [Fig. 2](#) shows the results of the co-occurrence of keyword analysis made.

What is the publication trend on ict adoption in the jewelry and textile industries?

To answer the first research question (RQ1), the total number of studies obtained from the Scopus database search after the screening of titles, abstracts and keywords ($n = 97$) were analysed by juxtaposing the number of publications with the years they were published. Although, 'year range' was not applied in the screening process, the studies obtained from the search fall within the years 1975–2023. The results as presented in [Fig. 3](#) show that the early years saw a slow publication rate in the adoption of ICT in the areas in question (jewelry, textiles, and fashion industries). Until 2007 when 4 publications were recorded, the preceding years (1975, 1984, 1988, 1995, 1997, 2001, 2002, 2004 and 2006) recorded only one publication each. It is also observed in the figure that the year 2019 recorded the highest number of publications ($n = 13$) followed by the year 2022 ($n = 12$). Finally, the number of studies dropped to six (6) documents in the year 2023 as far as the scopus online database and the keywords used for the data search are concerned. It could be said that the publication trend observed in [Fig. 3](#) suggests a possible future increase since a significant rise is recorded from the years 2020 to 2022; thus, 2020 ($n = 9$), 2021 ($n = 10$) and 2022 ($n = 12$).

Geographic classification of studies

The geographic characteristic of the publications is analysed using the top 10 contributing countries among the 35 countries observed in the study including the unidentified category of countries. Out of the total 97 documents obtained from the data search, the United States has the highest number of studies ($n = 21$), followed by the People's Republic of China ($n = 16$). The third, fourth and fifth highest contributing countries include the United Kingdom ($n = 12$), India ($n = 9$) and Italy ($n = 7$) respectively. Also, Japan and Spain have equal contributions ($n = 4$) each, whereas South Africa and Poland also have an equal number of studies ($n = 3$). Australia appears last on the top 10 contributing countries list with 2 publications. These statistics are shown in [Fig. 4](#).

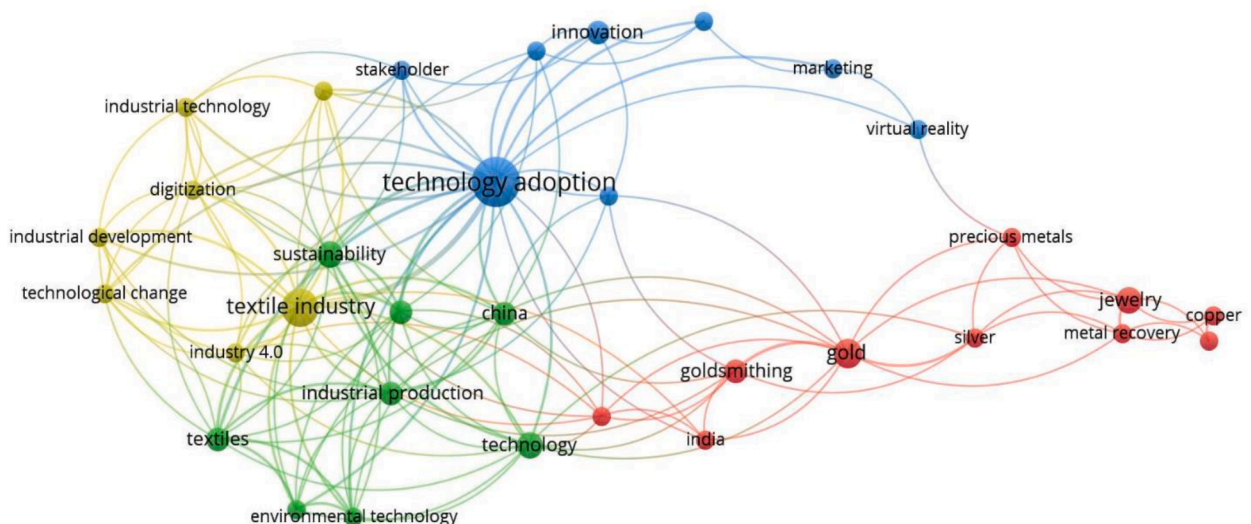


Fig. 2. Co-occurrence of keywords.

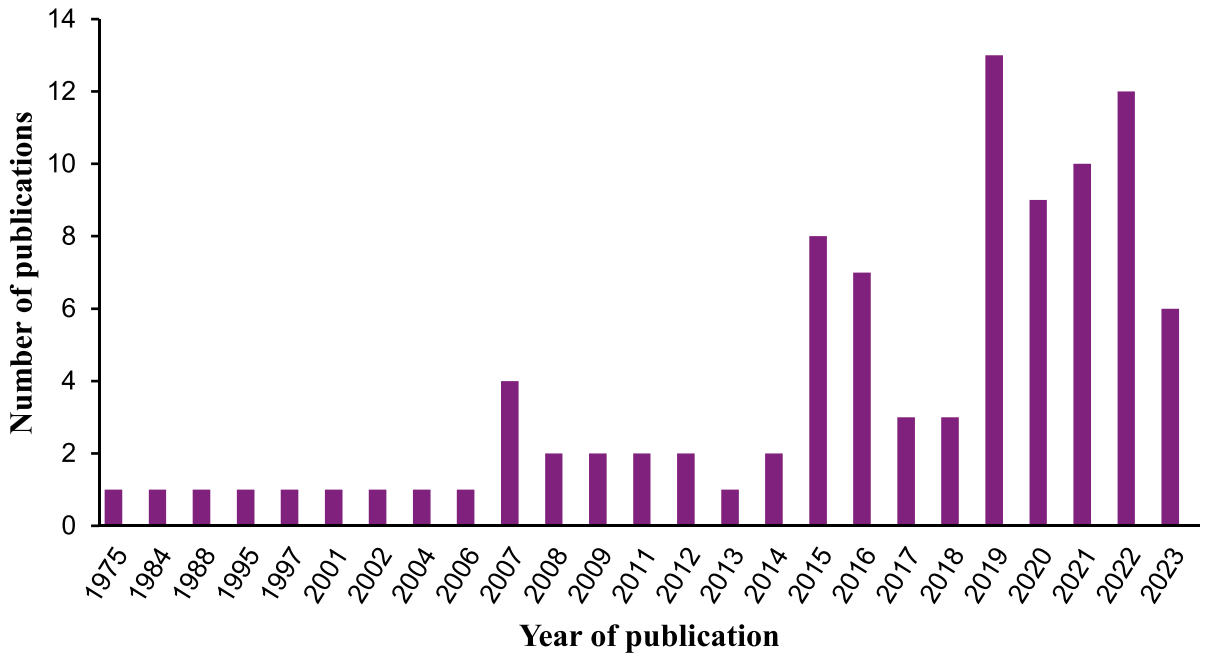


Fig. 3. Publications trend on ICT adoption in jewelry and textiles making for sustainable fashion.

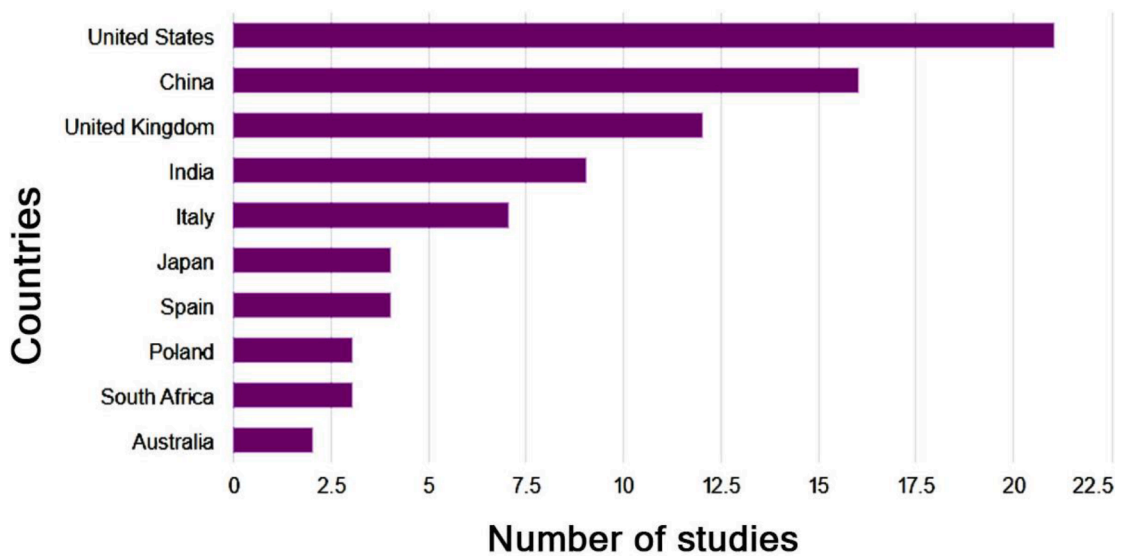


Fig. 4. Top 10 contributing countries on studies published in jewelry, textiles and fashion areas.

Classification of studies by discipline

A total of 11 disciplines including unidentified ones contributed to the number of publications identified in the Scopus database search. The disciplines and their respective percentage of contributions as shown in Fig. 5 are; Arts and Humanities (15.2%), Business/management (15.2%), Social sciences (14.6%), Environmental science (9.9%), Engineering (5.3%), Medicine (5.3%), Economics (4.7%), Materials science (4.7%), Chemistry (4.1%), Computer science (4.1%) and other disciplines unspecified (17.0). The statistics show a great contribution made by the Arts/Humanities and Business/Management disciplines as they appear to be the highest contributing disciplines. The statistics again show that the least contributing disciplines include Chemistry and Computer science with 4.1 % each.

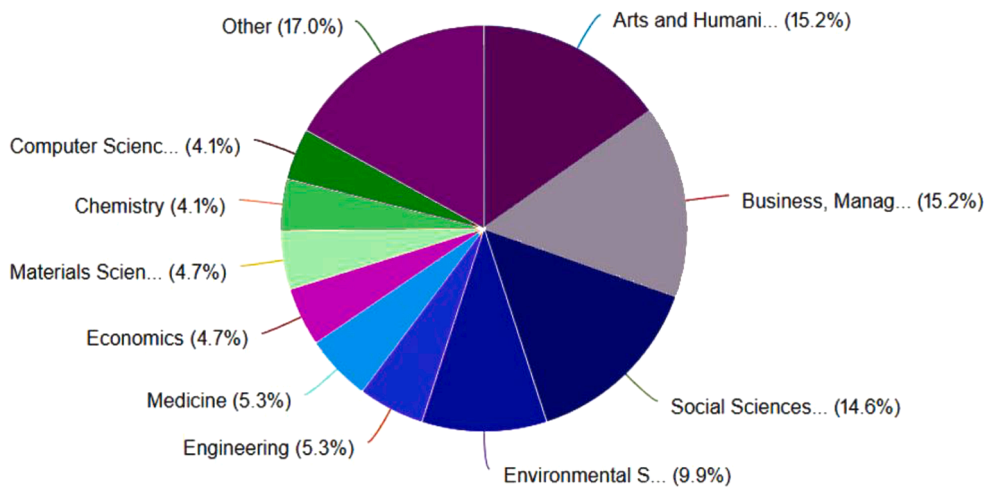


Fig. 5. Top contributing disciplines to studies published on jewelry, textiles and fashion.

How useful is ICT in the textiles and jewelry industries for sustainable fashion?

Several techniques are used by artists to obtain adorable artistic pieces for consumption and promotion in several sectors including the jewelry, textiles and fashion industries. The use of technology to achieve this aim is obvious in contemporary studio practices. It is interesting to know how useful children's drawings could be in the manufacturing of fashionable metal pieces of jewelry for sustainable fashion, in which technology is indispensable [52]. The adoption of ICT in industries and households gained roots several years ago and has brought a great increase in productivity to many nations including the United States which took advantage of technology adoption massively in the 1990s. In the 21st century when sustainability is encouraged in all industries, ICT adoption is a reliable approach to keep the environment green in waste-generating industries like the metal product manufacturing sector. Nespoli, et al. [76] confirm that 3D printing reduces the quantity of materials used in industrial manufacturing, which subsequently reduces the amount of waste generated in the industry. Again, industry 4.0 technology is acknowledged in the supply chain and production processes of industries for sustainable development [63]. Technology adoption in industries varies based on the individual activities carried out in such industries.

The jewelry industry

Advancements in technology and the rise in people's standard of living have encouraged the advent of new sectors in the metal art industry to meet the demands of customers [73]. With standards set for jewelry manufacturing and sale in various nations, industries are required to meet specifications in jewelry making to be accepted on the market. In the United States for instance, the Federal Trade Commission outlines rules such as precious metal jewelry requiring a label indicating the purity of the metal used, the method used in treating stones in the case of gemstones requiring a disclosure, Lead content making known to consumers, etc. In the United Kingdom, hallmarking systems are regulated by the Assay Offices to ensure trusted jewelry is sold to consumers. They ensure standards such as metal contents, Assay Office marks, coupled with the sponsor's marks and other relevant contents being indicated. Nickel content restrictions are also among the various standards set and required to be followed in the production and sale of jewels in the United Kingdom to ensure consumers are safe from allergic reactions. Similar standards as set in the United States and the United Kingdom are established and enforced in various nations. This calls for sophisticated procedures championed by ICT to meet the specified requirements of the country. Consumers have also developed tastes for jewels with complex designs which are easily achieved with the help of a computer and innovative technologies like 3D and 4D printing [76]. Li [73] posits that traditional jewelry manufacturing techniques such as forging, chiseling, welding and casting have been taken over by modern technologies including metal forming and surface treatment technologies. These technologies are helping the jewelry industry gain more patronage for sustainable operations. With the PAVEL method, Fanni, et al. [75] demonstrate innovative means of decorating surfaces, which is recommended in jewelry making for customer satisfaction.

Jewelries are not only used as accessories in fashion but serve as a significant means of expressing one's cultural identity, social status and history [55,56,58,60,66,70,73,81]. Jewelry-making over the centuries has been classified as a traditional craft [69], which helps to convey messages as the pieces carry cultural elements and symbolism. Cooper and Al-Saad [56] reiterate that metal jewelry has been used as significant artifacts by archaeologists as evidence of wealth and socioeconomic status. Although clothes play an important role in cultural identity, the incorporation of beliefs in the manufacturing and wearing of jewelry [70], coupled with the use of precious minerals such as gold, diamond, emeralds, etc. as raw materials in production, makes them more valuable fashion products that could be used to connote the financial status or identity of a person. This, however, makes jewelry more valuable artifacts that receive maximum attention from artists in the manufacturing process. The jewelry industry employs technologies in its operation from manufacturing to the sale of the end products. In manufacturing, for instance, it is established that technologies like 3D printing help

customize products for customers in industries [80], hence its usage in addition to 4D technology in jewelry making [76]. From an effective supply chain in industries [63] to online promotion and sales of jewels, ICT is acknowledged as a notable tool for advancement in the jewelry industry.

The textile industry

Recently, the use of ICT in the textile industry has become more evident in the products and services it renders to keep the fashion industry running. The fashion industry depends largely on the textile industry for sustainable operation, hence the adoption of technologies of all kinds at all levels in the textiles industry including traditional technologies in rural communities where modern equipment is inaccessible [54]. Smart textiles have come to stay, and the increased acceptance of such textiles including wearable activity-tracking devices [65] is evidence of the essence of ICT and its adoption in the textile industry for smart product manufacturing to meet the demands of customers. It is observed that the adoption of digital technology in the textile industry recently has led to a significant improvement in the subsections of the textile industry [72].

The various sectors of the textiles industry such as weaving, dyeing, printing, packaging, marketing, etc. have seen the light of the day through technology. In the weaving sector, for instance, Okazaki [68] argues that the invention of power looms ensured a massive increase in production in the textile industry. The use of 3D and 4D printing technologies coupled with online sales of textile products using technologies like Virtual Reality is proof of how far technology can promote the textile and clothing industry for sustainable fashion [1,80]. Also, the textile industry is known to be one of the major industries that generate toxic chemicals in its operations, hence causing environmental pollution through the waste generated. Emerging technologies are therefore adopted to reduce the amount of water used in the industry to ensure eco-friendly operations in the sector [61]. Scholars [64] recommend biotechnologies in the textile industry since it promotes environmental sustainability as compared to the traditional method of chemical processing.

The influence of jewelry on fashion and textiles

Apart from fulfilling their basic function of protecting the body, products from the fashion and textiles industries (fabrics and clothes) serve a crucial function of adorning the body. With a focus on aesthetics in fashion recently, the role of jewelry in sustaining textiles and fashion brands can never be overemphasised. The concept of adornment in fashion is, however, best interpreted by placing jewelry in the middle of the discussion. Jewelry is indispensable as it serves as a driving force to the perfection of brands in fashion and textiles. Precious jewels often complement clothes to effectively communicate the social and economic status among other qualities of people within society [56]. It could be said that the jewelry industry has an influential factor in the sustenance of fashion brands as they add more meaning and round up the esthetic importance of textiles in the world of fashion.

The fast-changing nature of the clothing and textiles industry results in the term '*fast fashion*', making clothes lack longevity in the system recently [1], unlike jewelry. As jewels often come in precious minerals, preserving such products and their subsequent influence on one's wardrobe furnishing (cloth purchase) is prevalent, especially amid '*fast fashion*'. In contrast to the transient nature of fast fashion, jewelry's enduring quality and timeless appeal place it on top of its influential ability on sustainable fashion. It is evident that technology adoption is widespread in the textiles, fashion, and jewelry industries. However, the rate at which fashion and textile trends fade out of the system in the name of fast fashion calls for a second look at the long-lasting nature of 'jewelry trends' and a subsequent incorporation of such concepts in fashion and textiles in brand initiation towards sustainable development.

Sustainable fashion through ICT

Ahmad, et al. [44] analyze the adoption of the Business Intelligence System in the clothing and textiles industries and report on how useful the technology has become to firms who adopt it fully in their operations. To sustain the fashion industry, Park and Lim [78] believe brands need to go strategic by using technologies like the "Metaverse" in promoting their products online through exhibitions and shows to widen their market scope. This assertion is supported by Gonzalez, et al., [53] who posit that the adoption of web technologies in designing business models for online marketing is a commendable strategy to sustain the apparel industry. Research on the analysis of digital humans in the apparel industry [67] reveals several desirable transformations brought about in the fashion industry through ICT toward its sustainability. With the increased adoption of Artificial Intelligence (AI) in the fashion industry, a sustainable future is secured [67]. The use of Product Lifecycle Management (PLM) in the textile and apparel industry [77], the use of digital tools under industry 4.0 for digital coordination in the textile industry [71], the application of Omnichannel in digital fashion marketing [41], etc. are all strategies discussed in research as a step to increase productivity and sustain the fashion industry.

How is the fashion industry sustained through textiles and jewelry making?

The fashion industry depends largely on the textiles and jewelry industries among others for significant propagation as established earlier. Irrespective of the amount of contribution given by the various sectors of the jewelry and textile industry, the fashion industry benefits in the long run. A recent study shows how SMEs are developing a great interest in producing sustainable products in the knitting industry for sustainable fashion [79]. The textile and jewelry industries for the past decades have both been taken up by SMEs who are contributing immensely to sustain the clothing industry. With a focus on the fashion industry, products from the textiles and jewelry industries are tailored to suit current trends in order to get high patronage. This has influenced jewel and textile artists to follow fashion trends in their practices to adopt new concepts and technologies for mass patronage of the products. In addition to the proper utilization of raw materials to reduce waste for a sustainable environment, practitioners are adopting several techniques to keep

the metal jewelry industry running for the onward benefit of the fashion industry. From strategic means of adopting digital retailing in marketing [82] to the adoption of innovative digital methods in manufacturing [59], a lot is contributed through research for the benefit of the metal and apparel industry. Methods such as physical and physicochemical are presented in research as appropriate means of recovering precious metals [62], all in the name of ensuring the fashion industry is provided with accessories to keep it running.

Kanungo and Chakrabarti [69] establish that goldsmithing in India for instance was operated by a typical traditional method of casting until a high demand was placed on it to raise a new group of goldsmiths with improved methods. As the fashion industry depends on the jewelry and textile industries, so do the latter industries depend on the former to get their products patronised. However, the continuous operation of the textiles and jewelry industries is an assurance of the sustenance of the fashion industry. It could also be posited that the increase in textile production across the globe is an assurance that the fashion industry would contribute to its consumption. This assertion to the fact that about 13.18% of manufacturing industries in China, for instance, are into apparel manufacturing with products from the textile industry [57]. It could be said that technology adoption in the textile and jewelry industry helps to make raw materials available for the fashion industry, which in turn relies on ICT in different ways for an effective and efficient running of services.

Summary of findings

Publication trend shows that researchers' interest in the areas of jewelry, textiles, sustainable fashion and ICT adoption increased in the years 2019 and 2022 which is assumed to have increased because of the global pandemic (COVID-19) which propelled most people to go digital. Again the major contributing country to studies in the above-mentioned areas is the United States, whereas the top two disciplines include Arts/Humanities and Business/Management. Technology adoption has existed for several decades and is contributing greatly to the improvement of manufacturing industries that adopt it in their operations. Technological approaches to product manufacturing such as 3D and 4D printing in the Industry 4.0 era help in sustainability as they encourage less usage of raw materials, leading to waste reduction in industries.

The jewelry industry needs technology in order to meet the standards and tastes of consumers. It helps to obtain the required content of a given precious metal in jewelry making. Technology has also come to help the jewelry industry produce complex designs that mostly receive wider patronage on the market. With the advent of ICT, old techniques of manufacturing jewelry such as forging, chiseling, etc. are diminishing. Adaptation of new digital techniques in jewelry making would help provide the needed accessories to sustain the fashion industry.

The benefits of technology adoption in the textiles industry are felt in the innovative products manufactured to sustain the fashion industry and make life easier. Products and techniques such as smart textiles, 3D and 4D printing, etc. are championed by technology. The introduction of power looms some decades ago, for instance, has contributed a lot to improvement in the weaving industry. Also, technology is indispensable in online marketing strategies such as Virtual Reality, Metaverse, Omnichannel etc. adopted by many firms to sell their products. The fashion industry on the other hand benefits a lot from the use of ICT in the jewelry and textile industries. It is provided with enough raw materials to keep it running for a sustainable industry.

Future research direction

This study conducted a systematic review of thirty-six (36) documents from the Scopus database. Findings from these selected studies revealed critical issues that are worth mentioning for future studies as discussed next. First, the use of machine learning and artificial intelligence should be advanced within the jewelry and textiles industry. Further studies should understand social and environmental implications, and explore the utilization of machine learning and artificial intelligence to achieve high optimization in reducing waste, improving the production process, and design of sustainable products. This will influence how these products coupled with sustainable practices can be adopted for e-commerce and digital platforms within the sustainable textile and jewelry industry. Studies on how effective these platforms could promote responsible sourcing, initiatives in the circular economy and transparency, should be the next areas for research. Thirdly, the use of technology such as 3D printing could play a critical role in promoting sustainability. Studies should advance on the potential use of non-harmful materials in 3D printing technology for production purposes. This will contribute to reducing waste for a positive environmental impact.

The application of virtual and augmented reality within the fashion industry is set to revolutionize the industry. Studies on the benefits of these technologies for enhanced virtual showrooms, virtual try-on and customer experiences, will provide insights into their feasibility, economic and potential environmental advantages. This will lead to an effective implementation of these technologies. The use of the Internet of Things (IoT) applications within the manufacturing section in the fashion industry could be investigated by studies to assess its relevance for control and real-time monitoring during the production process. This will uncover the relevance of IoT towards a more sustainable performance. Aside from the use of technology within the production process, investigating how human-computer interaction technologies could improve worker satisfaction and sustainable practices for labours engaged in the fashion and jewelry industry. Lastly, effective knowledge transfer between the fashion and jewelry industry on open innovation and collaborative platforms would be of great interest for studies to investigate the challenges and benefits of such platforms for sustainable development.

Limitations of the study

These limitations to be stated here should be considered when interpreting the study's findings. The authors of this present study acknowledge that the Scopus database was only used to research the relevant documents for the discussion of the findings. This database may not have contained all the appropriate publications to fully address the focus of the study. Additionally, the use of the search keywords may not have utilised all the appropriate keywords to reflect the broad scope of the research area. Future studies may adopt other databases and keywords in the search process and utilization of the necessary publications for discussion.

Conclusion

With the increasing application of ICT in various disciplines for an effective transformation, the fashion industry has not exempted itself from this trend. Several approaches have been explored to keep the industry on track in its operations in the digital world. In this systematic review, technology adoption in the textiles and jewelry industries has been juxtaposed with the fashion industry. With research questions clearly stated, the study discovered the interest of researchers regarding the textiles, jewelry and fashion industries. The years 2019 and 2022 saw a great contribution from scholars, with the United States and China emerging as the top two contributing countries to the published studies. A co-occurrence analysis of keywords also discovered a diverse number of keywords, their occurrences and link strengths. It was again observed in the study that ICT is an indispensable tool in the quest to sustain the fashion industry through textiles and jewelry making. Its adoption in homes and industries has brought about several transformations.

Commendable technologies such as Industry 4.0 packages, Metaverse and Omnichannel in digital fashion are discovered in the study. It is believed that the fashion industry is assured to be sustained when the industry is flooded with digital concepts in its operations. Again, the sustenance of the textiles and jewelry industries is a hope for the booming of the fashion industry since they are the source of raw materials for the fashion industry. With the immense contribution made by ICT to the nourishment of the textiles, jewelry and fashion industries, mass adoption of technology is recommended for small-scale producers in these sectors since producers in underdeveloped communities are rarely using it to the fullest.

CRedit authorship contribution statement

George Kwame Fobiri: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Solomon Kwame Fobiri:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Cyril Etornam Adala:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Raphael Kanyire Seidu:** Conceptualization, Formal analysis, Investigation, Writing – review & editing. **Abdul-Razak Seini Yussif:** Conceptualization, Formal analysis, Investigation, Writing – review & editing. **Rowena Fatchu Kansamba:** Conceptualization, Investigation, Writing – review & editing. **Nana Banimaa Oduro Boateng:** Conceptualization, Investigation, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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