

## The Role of Digital Innovation (AI, IoT, and Big Data) in Accelerating Circular Economy Business Models in the Creative Industries: A Systematic Literature Review

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### ABSTRACT

*This study investigates the role of digital innovation, specifically Artificial Intelligence (AI), the Internet of Things (IoT), and big data, in accelerating the adoption of circular economy business models within the creative industries. Using a Systematic Literature Review (SLR) guided by PRISMA 2020, 26 empirical and conceptual studies published between 2020 and 2025 were analyzed across the fashion, textile, and design subsectors. The findings reveal that IoT is the most frequently implemented technology, primarily enabling real-time tracking, life cycle monitoring, and resource optimization. Big data analytics supports evidence-based decision-making and predictive modeling for waste reduction and efficient logistics, while AI contributes to intelligent sorting, demand forecasting, and digital servitization for circular business model innovation. Collectively, these technologies foster transparency, automation, and collaboration, allowing creative firms to close material loops, extend product life cycles, and enhance traceability. The results highlight that the integration of digital tools creates synergistic ecosystems that embed sustainability into creative production and consumption. However, disparities in digital readiness, financial capacity, and regulatory frameworks continue to constrain large-scale adoption, particularly among small and medium enterprises. Theoretically, this research advances understanding of digital circularity as a strategic interface between technological innovation and sustainable transformation, contributing a conceptual synthesis that links digital capabilities with circular economy mechanisms in creative sectors. The study concludes that future research should explore cross-sectoral governance, data standardization, and the sociocultural dimensions of digital sustainability to strengthen the systemic transition toward regenerative creative economies.*

**KEYWORDS** *Artificial Intelligence, Big Data, Circular Economy, Creative Industries, Internet of Things*



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### INTRODUCTION

The creative industries have become one of the driving forces of global economic growth, contributing significantly to GDP, employment, and trade while simultaneously presenting challenges related to resource consumption and environmental sustainability. This sector, which includes fashion, product design, digital media, and cultural production, is characterized by innovation, cultural value creation, and aesthetic differentiation. Globally, the creative industries contribute approximately 3% of the world's GDP, with a total added value of USD 2.25 trillion (Klein et al., 2021; Pletsan et al., 2022). In the European Union, the sector accounts for around 4.4% of GDP (EUR 558 billion in 2015) (Manioudis & Angelakis, 2023) and employs 8.3 million people, representing 3.8% of the total workforce (Kalfas et al., 2024). Worldwide, the industry supports around 29.5 million jobs (6.2% of total employment) (Dasgupta & Clini, 2023), which highlights its economic and cultural importance. Beyond these indicators, creative industries also promote regional revitalization, cultural identity, and innovation-led growth across both developed and emerging economies (Arshad & Irijanto, 2022; Cerisola & Panzera, 2021). However, their dependence on intensive material use and

short product lifecycles contributes to increasing ecological pressures that threaten long-term sustainability.

The sustainability challenges within the creative industries, particularly in the *fashion* and textile sectors, have become increasingly alarming due to overproduction, excessive material dependency, and growing waste generation. The global textile industry produces approximately 92 million tons of waste annually and is projected to reach 160 million tons by 2050 if current patterns continue (Fan et al., 2024; Wagaw & Babu, 2023). Only about 14–15% of textile waste is recycled, while 75–85% ends up in landfills or is incinerated (Shirvanimoghaddam et al., 2020). Moreover, textile production is responsible for roughly 8% of total global carbon emissions and 20% of industrial water pollution (Wagaw & Babu, 2023). In regional contexts, countries such as Switzerland generate 1,505 tons of textile waste annually from 15,880 tons of production (Schmutz & Som, 2022), while Chile's landfilled textiles produce around 423.4 kg CO<sub>2</sub>eq per ton of waste (Espinoza-Pérez et al., 2022). These figures illustrate a global pattern of inefficiency and environmental degradation, exacerbated by declining product lifespans, which have decreased by 36% over the past 15 years (Wagaw & Babu, 2023). The dependence on petrochemical-based fibers, representing nearly 64% of global textile materials, further intensifies the environmental burden (Damayanti et al., 2021). Consequently, achieving sustainability within creative sectors requires systemic transformation supported by innovation, circular strategies, and effective policy intervention.

The circular economy (CE) framework has emerged as a crucial paradigm for addressing these challenges. It redefines the traditional linear “take-make-dispose” model by emphasizing resource efficiency, product longevity, and regeneration through the principles of reduce, reuse, recycle, repair, and remanufacture. International organizations such as the Ellen MacArthur Foundation, OECD, and UNEP advocate CE as a pathway to decouple economic growth from resource depletion (Aranda-Usón et al., 2020; Henry et al., 2020; Suchek et al., 2021). Within the creative industries, CE fosters business model innovation through strategies such as product-as-a-service, sharing platforms, upcycling design, and closed-loop supply chains. The Material Circularity Indicator (MCI), developed by the Ellen MacArthur Foundation, serves as a key metric for assessing product-level circularity (Abdelmeguid et al., 2022). European small and medium-sized enterprises (SMEs) have demonstrated progress in adopting circular strategies, particularly in design, energy efficiency, and waste reduction, though material recovery remains limited (Dey et al., 2022). Despite these advancements, the transition toward circularity continues to face barriers such as technological constraints, lack of standardization, and inconsistent regulations across regions (Abdelmeguid et al., 2022; Stumpf et al., 2021).

Digital innovation is increasingly recognized as a transformative enabler of circular economy implementation in the creative industries. Artificial Intelligence (AI), Internet of Things (IoT), and Big Data analytics can optimize resource use, enhance transparency, and accelerate the shift toward sustainable production systems. AI facilitates predictive analytics and generative design, supporting demand forecasting, waste minimization, and personalized eco-friendly products (Akhtar et al., 2024; Nisa et al., 2025; Tutore et al., 2024). IoT enables material tracking and real-time monitoring throughout the supply chain, ensuring traceability and supporting reuse and repair strategies (Fraga-Lamas et al., 2021; Kristoffersen et al., 2020; Zhang et al., 2024). Big Data supports evidence-based decision-making through the analysis of consumption patterns, logistics optimization, and closed-loop supply chain management

(Rusch et al., 2021; J.-P. Schöggel et al., 2023). Case studies in Europe and Asia demonstrate that integrating these technologies enhances operational efficiency, transparency, and circularity performance (Huynh, 2021; Zhang et al., 2024). Nevertheless, barriers persist, including limited digital readiness, high technological investment requirements, and fragmented data ecosystems (Tutore et al., 2024).

Despite the growing body of research, there remains a significant research gap regarding the integrated application of digital innovation and circular economy within the creative industries. Most prior studies have explored these topics separately, focusing either on technological innovation or sustainability, without offering a unified conceptual framework that connects the two domains (Bressanelli et al., 2022; Cagno et al., 2021; Q. Liu et al., 2022). Empirical validation is still limited, as many studies remain conceptual or descriptive rather than analytical (Khan et al., 2022; Wynn & Jones, 2022). Furthermore, research predominantly concentrates on manufacturing sectors in developed economies, leaving creative industries and emerging markets underexplored (Sahu et al., 2021; Suchek et al., 2021). Therefore, this study aims to systematically identify, synthesize, and analyze existing evidence on how AI, IoT, and Big Data accelerate the adoption of Circular Economy Business Models (CEBMs) within creative industries. The expected outcome is the development of a conceptual taxonomy that connects digital technologies, circular strategies, and creative subsectors, providing both academic insight and practical guidance toward sustainable transformation. The growing environmental footprint of the creative industries, despite their substantial economic and cultural contributions, highlights the urgent need for transformation toward more sustainable models of production and consumption. While creative sectors such as fashion, product design, and digital media generate significant value, their reliance on rapidly changing consumer trends, intensive material use, and short product lifecycles has created patterns of unsustainable resource utilization and excessive waste generation. These challenges require innovative approaches that combine technological advancement with circular and sustainable business practices.

The main research problem addressed in this study is the lack of integration between digital innovation and circular economy strategies within the creative industries. Although digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and Big Data analytics are increasingly recognized as key enablers of sustainable transformation, their practical application in creative sectors remains limited and fragmented. Previous research tends to examine these topics separately, either focusing on the technological dimension of digitalization and data-driven processes or on the sustainability dimension that emphasizes material recovery and waste reduction (Cagno et al., 2021; Bressanelli et al., 2022). This separation has resulted in a limited understanding of how digital tools can operationalize circular principles such as reduce, reuse, recycle, repair, and remanufacture in creative contexts. Furthermore, empirical evidence remains scarce. Most studies rely on conceptual or manufacturing-based analyses, leaving creative industries such as fashion and design underexplored (Suchek et al., 2021; Wynn & Jones, 2022). As a result, the mechanisms through which digital innovation accelerates the transition toward Circular Economy Business Models (CEBMs) in the creative industries are still not fully explained.

To address this gap, the present study systematically investigates and synthesizes existing empirical and conceptual research on digital innovation and circular economy within the The Role of Digital Innovation (AI, IoT, and Big Data) in Accelerating Circular Economy Business Models in the Creative Industries: A Systematic Literature Review

creative industries. The goal is to identify how digital technologies contribute to the adoption and acceleration of circular business models and to explain the mechanisms that link technological capabilities with sustainable outcomes. This study therefore has two main objectives. The first is to map and categorize the digital technologies most frequently applied in support of circular strategies. The second is to develop a conceptual understanding of how these technologies enhance efficiency, transparency, and sustainability in creative business ecosystems.

Based on these objectives, this research seeks to identify which digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), and Big Data are most frequently used to support the implementation of circular economy business models in the creative industries, as well as to examine how these technologies facilitate and accelerate the transition of creative industries toward sustainable circular business models.

The novelty of this study lies in its comprehensive integration of digital innovation and circular economy perspectives within the creative industries, a relationship that remains underexplored in current academic research. Unlike previous studies that address digitalization or sustainability independently, this research systematically synthesizes both domains to construct a conceptual taxonomy connecting technology type, circular strategy, and creative subsector. Through this integration, the study positions digital innovation as a strategic accelerator for sustainable transformation. It contributes theoretical insight for scholars and provides practical guidance for policymakers and industry practitioners aiming to align creative economy growth with global sustainability goals. The findings are expected to enrich the academic discourse on digital circularity and support the development of actionable frameworks for achieving resource-efficient and resilient creative business models.

## **METHOD**

This study employed a Systematic Literature Review guided by the PRISMA 2020 reporting standard (Page et al., 2021). The review is designed to identify, evaluate, and synthesize scholarly evidence on how digital innovation, specifically Artificial Intelligence, Internet of Things, and Big Data, accelerates the adoption of Circular Economy Business Models in the creative industries. The protocol defines the research approach, data sources, search strategy, eligibility criteria, screening procedures, and synthesis plan. Four major databases were queried: Scopus, Wiley Online Library, Taylor & Francis Online, and ScienceDirect. Two complementary Boolean search strings were used to ensure coverage and precision. The long form was applied to Scopus, Wiley, and Taylor & Francis: ("Circular Economy" OR "Circularity" OR "Circular Business Model\*") AND ("Creative Industries" OR "Creative Sector" OR "Fashion Industry" OR "Textile Industry" OR "Design Industry") AND ("Digital Innovation" OR "Digital Technology" OR "Industry 4.0" OR "Artificial Intelligence" OR "AI" OR "Internet of Things" OR "IoT" OR "Big Data" OR "Data Analytics"). Given field constraints on ScienceDirect, a compact string was used:

("Circular Economy" OR "Circular Business Model") AND ("Creative Industries" OR "Fashion" OR "Textile" OR "Design") AND ("Digital Innovation" OR "Industry 4.0" OR "Artificial Intelligence" OR "IoT" OR "Big Data"). The long form searches returned 99 documents in Scopus, 115 in Wiley, and 28 in Taylor & Francis. The compact string returned 90 documents in ScienceDirect, yielding an initial pool of 332 records before deduplication.

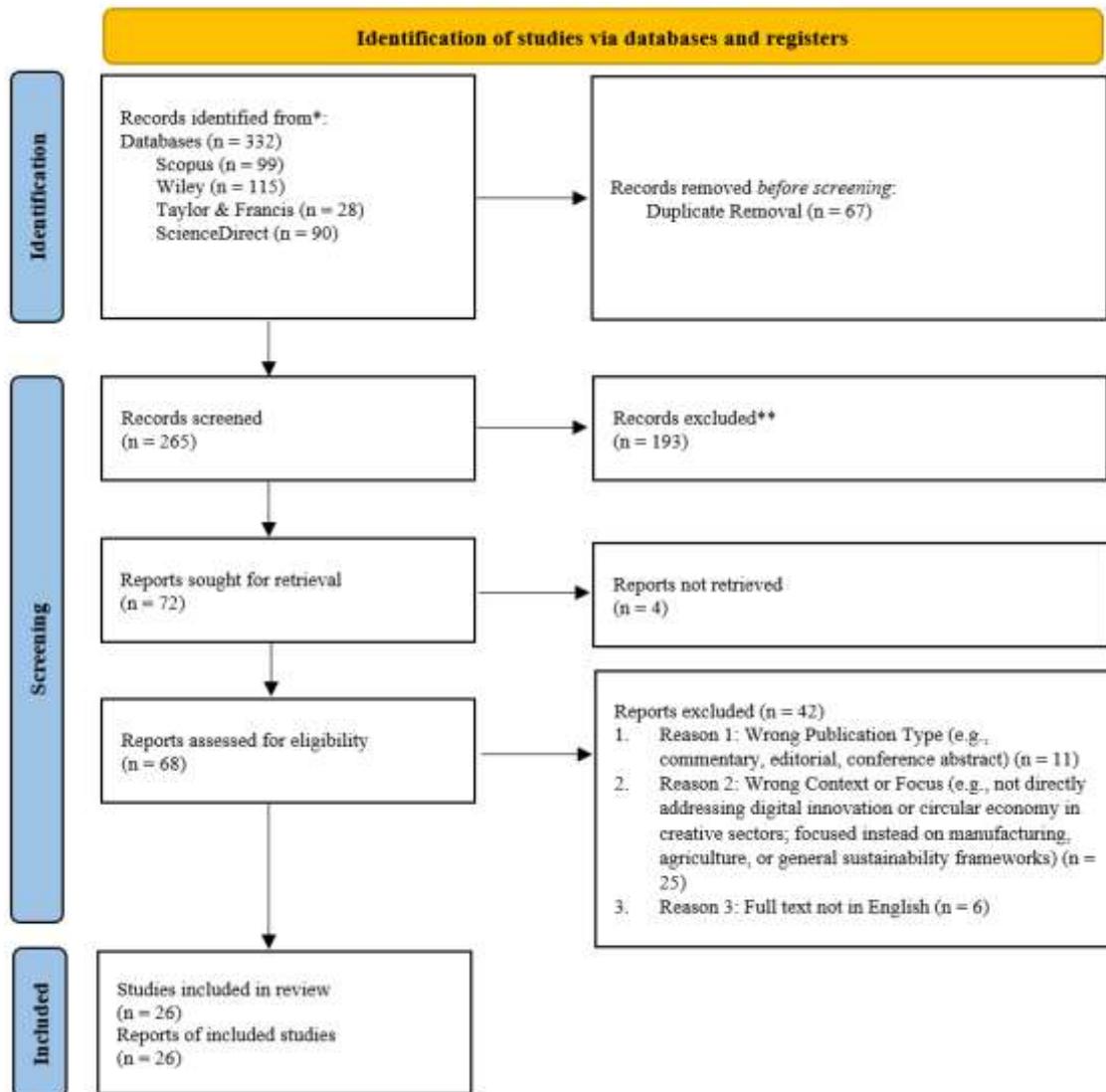
Searches targeted publications from 2020 to 2025 to capture contemporary developments in digital circularity within creative sectors, while allowing the retention of a small number of pre-2020 seminal works where constructs or indicators remain foundational to the field. Records were exported and consolidated, then deduplicated. Title and abstract screening was conducted by two reviewers against prespecified criteria: inclusion required peer-reviewed journal articles or conference proceedings that examine creative industry subsectors such as fashion, textile, design, media, or cultural production, contain substantive discussion of circular economy principles or Circular Economy Business Models, and analyze or operationalize at least one focal digital technology. Exclusion criteria removed purely technical engineering papers without circular economy relevance, noncreative sector studies, nonempirical or purely pedagogical notes without analytical contribution, gray literature without peer review, and literature reviews or bibliometric analyses, which are outside the scope of this evidence synthesis. Full texts passing screening underwent eligibility assessment to confirm direct relevance to the research questions and to extract study characteristics, contexts, technological mechanisms, circular strategies, and reported outcomes. Data extraction followed a structured template covering bibliographic metadata, subsector, technology, circular principle, business model features, methodological approach, and findings. Quality appraisal was performed using the Mixed Methods Appraisal Tool (MMAT 2018) with independent ratings and consensus resolution. Given heterogeneity in designs and measures, synthesis used narrative integration and evidence mapping rather than meta-analysis, with descriptive vote counting to summarize technology and strategy frequencies. To make the scope transparent and reproducible, the Population, Intervention, Comparison, Outcome, Context framework was specified as follows.

**Table 1. PICOC Framework for Digital Innovation and Circular Economy in the Creative Industries**

<b>Component</b>	<b>Description</b>
<b>Population</b>	Peer-reviewed studies focusing on creative industries and related subsectors, including fashion, textile, product design, digital media, cultural production, and heritage-linked creative activities.
<b>Intervention</b>	Application or analysis of digital innovation that enables circularity, namely Artificial Intelligence, Internet of Things, Big Data analytics, and related Industry 4.0 functionalities that support reduce, reuse, recycle, repair, remanufacture, reverse logistics, or closed-loop value chains.
<b>Comparison</b>	Conventional or non-digital practices, linear production systems, or circular initiatives without substantive digital enablement; where applicable, before-after or alternative strategy contrasts reported by the study.
<b>Outcome</b>	Evidence of Circular Economy Business Model adoption, mechanisms that accelerate circular transitions, and performance outcomes such as resource efficiency, waste reduction, transparency and traceability, lifecycle extension, environmental impact mitigation, or economic and social value creation.
<b>Context</b>	Global research published primarily during 2020–2025 in English or Indonesian within peer-reviewed journals and proceedings, with selective inclusion of pre-2020 seminal works that establish enduring constructs, indicators, or frameworks relevant to digital circularity in creative sectors.

Source: Authors' elaboration based on the Systematic Literature Review framework adapted from PRISMA 2020 (Page et al., 2021) and circular economy literature.

Following the PICOC framework presented in Table 1, this study applies a structured review process aligned with PRISMA 2020 to ensure transparency and replicability. Each stage, including identification, screening, eligibility, and inclusion, was carried out systematically to refine the pool of relevant studies. Screening decisions were guided by predefined inclusion and exclusion criteria emphasizing empirical or conceptual studies addressing the intersection between digital innovation (AI, IoT, Big Data) and circular economy applications in creative industries such as fashion, design, and digital media.



**Figure 1. PRISMA 2020 Flow Diagram for Study Selection on Digital Innovation and Circular Economy in the Creative Industries**

Based on Figure 1, the identification stage yielded 332 total records across four major databases. After removing 67 duplicates, 265 unique articles proceeded to screening. Of these, 193 were excluded based on title and abstract evaluation, leaving 72 for retrieval. Four could not be accessed, and 68 full-text studies were assessed for eligibility. Following quality and relevance evaluation, 42 papers were excluded primarily due to mismatched focus, non-peer-

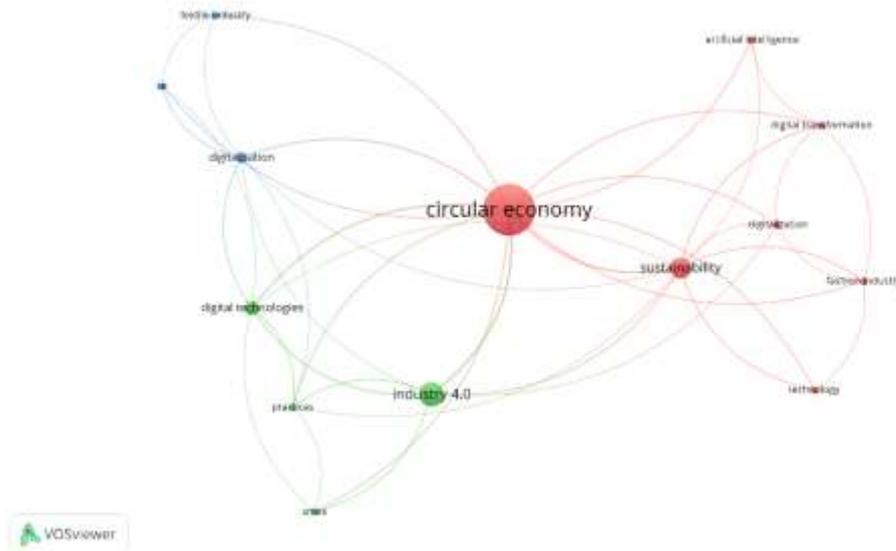
reviewed type, or language barriers, resulting in a final sample of 26 studies included in this review. These 26 studies form the empirical foundation for the synthesis, mapping how digital innovation supports circular strategies, business model transformation, and sustainable value creation within creative industries. To ensure methodological transparency and consistency in article selection, this study applied the following inclusion and exclusion criteria.

**Table 2. Inclusion and Exclusion Criteria for Study Selection**

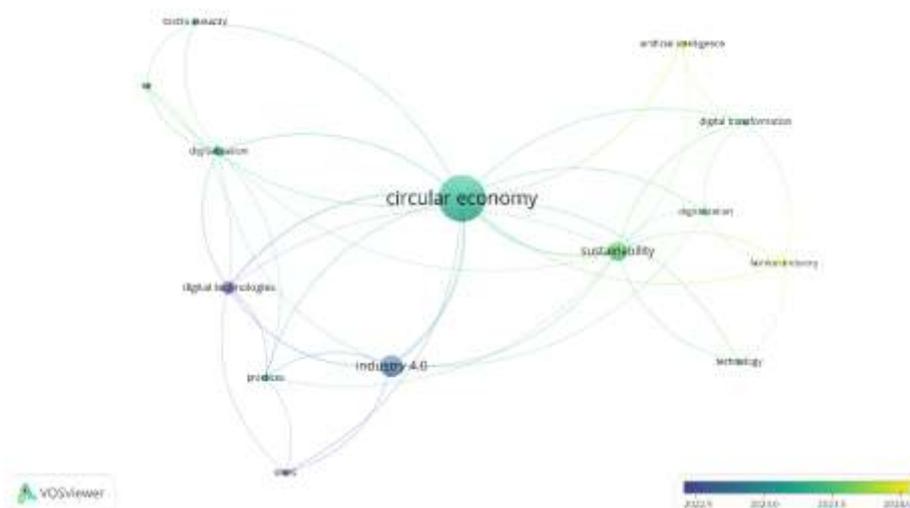
Criteria	Inclusion	Exclusion
<b>Timeline</b>	2020–2025; earlier works only if foundational.	Before 2020 without relevance.
<b>Document Type</b>	Peer-reviewed journals, conferences, book chapters, and bibliometric studies.	SLRs, literature reviews, editorials, dissertations, or non-peer-reviewed works.
<b>Publication Stage</b>	Published or “online first” with full text.	Unpublished, drafts, or no DOI.
<b>Language</b>	English, full text available.	Non-English or inaccessible.
<b>Research Focus</b>	Digital innovation (AI, IoT, Big Data) and CE in creative industries.	Studies outside digital–CE link or non-creative sectors.
<b>Relevance</b>	Examines mechanisms or models of CEBM acceleration.	No direct link between digital innovation and CE outcomes.

Source: Authors’ compilation based on PRISMA 2020 screening procedure and systematic review protocol

The criteria outlined in Table 2 were established to ensure that only studies with direct theoretical or empirical relevance to the integration of digital innovation and circular economy within creative industries were included. This approach guarantees that the selected literature provides credible, peer-reviewed, and English-language evidence focused on the mechanisms, models, and outcomes of how technologies such as AI, IoT, and Big Data accelerate Circular Economy Business Models (CEBMs). To complement the systematic identification process, a bibliometric mapping was conducted using VOSviewer to visualize the conceptual structure and keyword co-occurrence network of the selected studies. This step helps identify the dominant themes, emerging research clusters, and interconnections between digital innovation, circular economy, and creative industries.



**Figure 2. Network Visualization of Keyword Co-Occurrence in Studies on Digital Innovation and Circular Economy**



**Figure 3. Overlay Visualization of Keyword Co-Occurrence by Publication Year**

Based on Figures 2 and 3, the network visualization shows circular economy as the central and most frequent keyword, closely linked to digitalization, sustainability, industry 4.0, artificial intelligence, and digital technologies. The creative sectors most represented are the fashion and textile industries, indicating their dominance in the discourse. The overlay visualization demonstrates the temporal progression of research focus from foundational topics such as digital technologies and industry 4.0 (2022–2023) toward more specific applications like artificial intelligence and fashion industry (2024). During the mapping process, a minimum occurrence threshold of two keywords was applied to ensure conceptual clarity while retaining meaningful thematic diversity, resulting in a coherent representation of the research landscape connecting digital transformation and circular economy in creative industries.

## RESULT AND DISCUSSION

### Thematic Mapping of the Selected Studies on Digital Innovation and Circular Economy in Creative Industries

This section presents the thematic mapping of the 26 selected studies that explore the intersection between digital innovation (AI, IoT, Big Data, and related Industry 4.0 technologies) and circular economy (CE) strategies within creative industries, particularly in the fashion, textile, design, and manufacturing subsectors. The mapping aims to synthesize how different digital technologies and methodological approaches contribute to enabling or accelerating circular transitions. Each study was analyzed based on its regional context, technological orientation, CE strategy, and methodological design to identify patterns, overlaps, and unique contributions to the body of knowledge addressing Research Questions 1 and 2.

**Table 3. Thematic Mapping of the Selected Studies on Digital Innovation and Circular Economy in Creative Industries**

Author (Year)	Country / Region	Subsector	Digital Technology Focus	Circular Economy Focus / Strategy	Methodology	Key Findings / Contribution
(Almashaleh et al., 2025)	Global (Instagram data)	Textile / Fashion	Social Media Analytics, Topic Modeling (ML), Sentiment, SNA	“5R” engagement mapping for Reduce/Reuse/Recycle/Recover/Retain via CE-related hashtags	Empirical mixed-methods case (content + network analytics)	Shows that positive, benefit-framed CE content drives higher engagement, and integrates ML + SNA into a replicable framework for mobilizing consumer participation in textile circularity.
(Ali et al., 2024)	India	Textile / Apparel	Industry 4.0 (AI, Robotics, Blockchain, IoT), Big Data	Smart circularity practices; monitoring emissions/waste; greener logistics	Empirical decision-framework (Kendall’s W, Fuzzy Delphi, BWM, FUCOM, CoCoSo)	Introduces a hybrid MCDM framework showing I4.0-driven CE practices improve sustainability performance while noting market-demand/profitability gaps to close.
(Sjödén et al., 2023)	Scandinavia (multi-industry B2B)	Multi-sector (transferable to creative manufacturing/design)	AI capacities (Perceptive, Predictive, Prescriptive)	AI-enabled CBMs: augmentation (optimization) & automation (autonomous solutions) to extend cycles and reduce leakages	Multiple case study; conceptualization of dynamic capabilities	Conceptualizes AI capacities and dynamic capabilities (value discovery/realization/optimization) that enable CBMI and resource-efficiency gains in digital servitization contexts.
(Kayikci et al., 2022)	Turkey	Textile (SMEs)	Industry 4.0, IoT, Big Data	Smart Circular Supply Chain, closed-loop, regeneration	Empirical / Case Study	Developed a Smart Circular Supply Chain (SCSC) model integrating CE and Industry 4.0 to assess SMEs’ readiness and maturity, highlighting IoT and analytics as enablers of CE transition.
(Charnley et al., 2022)	UK / Europe	Fashion (Second-hand)	Digital Platforms, AI, Data Analytics	Reuse, resale, lifecycle extension	Mixed Methods (Survey & Interview)	Found digital tools (platforms, data analytics, visualization) enhance trust and convenience in second-hand fashion, overcoming consumer barriers to CE participation.
(Osterman et al., 2019)	Global (Europe, N. America, Asia)	Fashion Industry	Business Model Innovation (Digital Integration)	Product-Service System, recycling, design for circularity	Multiple Case Study	Identified key elements of Business Model Innovation for CE (BMI4CE) in fashion—emphasizing digitalization and sustainability-driven business models as drivers of systemic transformation.
(Casciani & D’Itria, 2024)	Italy / EU	Fashion & Textile	Industry 4.0, AI, IoT, Design Technologies	Sustainable production, lifecycle innovation, green-digital “twin transition”	Conceptual Framework / Case Study	Introduced a <i>Circular Fashion-Tech Lab</i> model integrating design-driven and digital innovation (I4.0/I5.0) to accelerate circularity in fashion SMEs through

						ecosystem collaboration and smart manufacturing.
(Wiegand & Wynn, 2024)	Germany	Textile Manufacturing	AI, IoT, Blockchain, Digital Twins	Resource efficiency, recycling, digital product passport, process optimisation	Empirical / Qualitative (Interviews, Process Mapping)	Developed a strategic blueprint showing how digitalisation enables narrowing, slowing, and closing resource loops in textile manufacturing, with DTs driving traceability and circular supply-chain integration.
(Oliveira Neto et al., 2023)	Brazil	Textile Industry	AI, IoT, Big Data, Robotics, Cloud, Cyber-Physical Systems	Cleaner production, waste reuse, energy efficiency	Empirical / Survey (SEM)	Found that Industry 4.0 technologies promote circular practices and micro-level CE, though weak in achieving strong sustainability; Big Data and autonomous robots are main enablers.
(J.-P. Schögl et al., 2023)	Austria	Manufacturing / Multi-sector	IoT, Big Data, AI, Blockchain	Lifecycle monitoring, predictive maintenance, product traceability	Empirical / Survey (n=132 firms)	Identified IoT as the most implemented CE enabler, followed by Big Data and AI, mainly in pilot stages; strong link between digitalization and sustainability performance.
(Kim et al., 2025)	The Netherlands / Belgium	Fashion & Textile	Digital Platforms, Data Analytics	Localized circular production, textile exchange, recycling networks	Conceptual / Case Typology	Proposed a digital platform ecosystem model for circular fashion, showing how orchestration strategies enable localized material loops and collaborative governance in urban manufacturing.
(Luoma et al., 2023)	Finland	Textile Industry	Big Data, Digitalization	Resource efficiency, data-driven CE governance	Empirical / Delphi Study	Identified paradoxical tensions (consumer behavior, transparency, and technology relevance) in leveraging data for circular textile systems, highlighting socio-technical challenges in CE transition.
(L. Liu et al., 2023)	China / Sweden	Multi-sector (Manufacturing & Design)	AI, IoT, Big Data, Blockchain, Cloud Computing	Lifecycle optimization, recycling, remanufacturing	Conceptual Framework + Case Study	Developed the CAB2IN framework linking Industry 4.0 technologies with circular supply chain management to enhance sustainable operations and resource recovery.
(Martikkala et al., 2023)	Finland	Textile / Waste Collection	IoT, Smart Sensors	Dynamic route optimization, recycling efficiency	Empirical / Case Study	Demonstrated that IoT-enabled smart bins reduce textile collection costs (-7.4%) and CO <sub>2</sub> emissions (-10.2%) through real-time monitoring and route optimization.
(Sardianou & Briana, 2025)	Greece	Fashion E-commerce	AI, AR, Digital Platforms	Reuse, resale, recycled fashion consumption	Quantitative Survey (n=1000)	Found that AI- and AR-driven e-commerce platforms increase consumer engagement with recycled fashion, fostering circular consumer behavior and platform-led sustainability.
(Ngoc et al., 2024)	Global / Conceptual	Creative Industries Governance	Digitalization & Policy Integration	Resource coordination, circular transition governance	Conceptual / Analytical	Highlighted the governance role of state-market-society collaboration in supporting digital-led circular models in cultural and creative sectors.
(Gazzola et al., 2025)	Italy, Germany, USA	Fashion Industry	AI, IoT, Blockchain	Recycling, reuse, supply chain transparency	Empirical / Case Study	Analyzed SHEIN, Ralph Lauren, and Cotopaxi to show how AI, blockchain, and IoT enhance resource efficiency, traceability, and material reuse in fashion circularity.
(Wiegand & Wynn, 2023)	Germany / EU	Textile & Clothing	IoT, Big Data, Industry 4.0	Reverse logistics, eco-design, product lifecycle extension	Mixed Methods (Survey, Corporate Analysis)	Developed an operational framework integrating digitalization with circular supply chains, showing digital tools as enablers of sustainability transitions in SMEs.

(Neri, Negri, Cagno, Kumar, et al., 2023)	Italy	Industrial SMEs / Manufacturing	IoT, AI, Big Data, Additive Manufacturing	Recycling, resource efficiency, lifecycle optimization	Empirical (Semi-Structured Interviews)	Identified how IoT, AI, and Big Data integration supports SMEs' circular transition through improved traceability, resource management, and decision-making efficiency.
(Gazzola et al., 2024)	Italy	Fashion Industry	AI, Big Data, 3D Printing, Digital Platforms	Sustainable design, on-demand production, waste reduction	Bibliometric / Conceptual	Introduced the concept of <i>digitainability</i> linking AI and 3D printing to sustainability, highlighting digital transformation as a catalyst for circular fashion innovation.
S3 – Lampertico et al. (2023)	Europe	Multi-Sector Manufacturing	Industry 4.0, IoT, Cybersecurity	Reverse logistics, closed-loop supply chains	Empirical / Case Study	Demonstrated that integrated Industry 4.0 systems and IoT-driven transparency enhance CE adoption by optimizing material recovery and inter-firm collaboration.
(Tsai & Yuan, 2025)	Taiwan	Textile / Fashion	AI, Machine Learning, Deep Learning	Automated textile sorting, recycling efficiency	Empirical / Experimental	Developed a Raman-spectroscopy-based AI system for automatic textile sorting achieving >95% precision, enabling high-purity fiber recovery and advancing closed-loop recycling in textile CE.
(Colombi & D'Itria, 2023)	Italy	Fashion Industry	AI, IoT, Big Data, Digital Platforms	Sustainable design, waste reduction, data-driven innovation	Conceptual / Empirical Framework	Highlighted how AI, IoT, and data analytics reshape value creation in fashion by enabling sustainable production, smart material management, and digital servitization toward circular business models.
(Akram et al., 2022)	India, Iraq, Nepal	Fashion Industry	IoT, AI, Blockchain, AR/VR	Smart clothing, supply-chain traceability, waste reduction, sustainable production	Empirical / Integrative Analysis	Demonstrated that integrating IoT, AI, blockchain, AR/VR enables circular practices in fashion through smart garments, real-time monitoring, and transparent supply chains supporting sustainable consumption.
(Zhang et al., 2024)	China	Fast Fashion Manufacturing	IoT, Big Data	Green Supply Chain Management (GSCM), Recycling, Closed-loop Production	Empirical / Survey (n = 342)	Demonstrated that integrating IoT and Big-Data-Driven Supply Chains enhances firm sustainability performance through green and circular practices, validating a Resource-Based View (RBV) model for CE supply chains.

Source: Authors' synthesis from 26 selected studies included in the Systematic Literature Review (2020–2025)

Based on Table 3, the selected studies collectively demonstrate how digital innovation, particularly the integration of AI, IoT, Big Data, and Industry 4.0, acts as a key enabler of circular economy transformation within creative industries such as fashion, textiles, and design. The findings reveal that these technologies drive resource efficiency, waste reduction, and transparency across production and supply chains while fostering new circular business models and consumer engagement mechanisms. Most studies employ empirical or mixed-method approaches, reflecting an applied orientation toward solving sustainability challenges through digital transformation. Conceptual and framework-based research, meanwhile, provides theoretical grounding by linking digitalization with circular economy principles, offering comprehensive insights into both strategic and operational dimensions of digital circularity.

## **Synthesis and Discussion of Digital Technologies Supporting Circular Economy (RQ1)**

Across the 26 included studies, IoT emerges as the most frequently deployed technology to operationalize circular business models in creative-industry value chains, particularly textiles and fashion. IoT is consistently used for traceability, lifecycle monitoring, and resource-efficiency control, enabling firms to narrow, slow, and close loops through real-time data capture on materials, products, and logistics (Kayikci et al., 2022; J.-P. Schögggl et al., 2023; Wiegand & Wynn, 2024). Empirical evidence shows that IoT-enabled infrastructures increase readiness for circular practices, integrate product passports, and support reverse logistics for remanufacturing and recycling (L. Liu et al., 2023; Oliveira Neto et al., 2023; Zhang et al., 2024). At the city and network levels, IoT sensors underpin waste-collection optimization and sorting pipelines, directly improving the economics of take-back schemes (Martikkala et al., 2023; Tsai & Yuan, 2025).

Big Data/analytics appears nearly as pervasively as IoT, typically co-deployed to convert streaming device data into actionable insights for demand forecasting, inventory optimization, eco-design, and closed-loop planning (Neri, Negri, Cagno, Franzò, et al., 2023; J.-P. Schögggl et al., 2023; Zhang et al., 2024). Case and survey evidence indicate Big Data is pivotal for measuring CE performance, detecting waste hotspots, and orchestrating multi-actor collaboration across the circular supply chain (Cagno et al., 2021; L. Liu et al., 2023). In platform contexts, analytics supports resale and reuse markets by reducing information asymmetries and increasing trust through product histories and quality signals (Charnley et al., 2022; Kim et al., 2025).

AI adoption is growing rapidly and is most visible in high-impact, task-specific applications that unlock circularity at bottlenecks. In upstream design and planning, AI supports predictive demand and material-use optimization, reducing overproduction and waste (Casciani & D'Itria, 2024; Colombi & D'Itria, 2023; Gazzola et al., 2025). In midstream operations, computer vision and learning models enable automated textile sorting and quality classification that raise recovery yields and purity, thereby making closed-loop recycling technically and economically viable (Tsai & Yuan, 2025). Strategically, AI capabilities (perceptive, predictive, prescriptive) are linked to digital servitization and circular business model innovation (CBMI) via dynamic capabilities that translate data into reconfigurations of value creation and capture (Neri, Negri, Cagno, Kumar, et al., 2023; Sjödin et al., 2023). Social-media AI/ML analytics also mobilize consumer participation in the 5R agenda by surfacing pro-circular narratives and engagement levers (Almashaleh et al., 2025). Complementary digital building blocks (e.g., blockchain, digital twins, AR/VR) often appear adjacent to AI–IoT–Big Data stacks, chiefly to strengthen traceability and design-for-circularity (Akram et al., 2022; Wiegand & Wynn, 2024).

Synthesizing across the corpus, IoT is the most frequently used technology, most often coupled with Big Data/analytics, while AI is a rapidly scaling enabler concentrated on forecasting, intelligent sorting, and decision support for CBMI (Kayikci et al., 2022; J.-P. Schögggl et al., 2023; Sjödin et al., 2023; Tsai & Yuan, 2025; Wiegand & Wynn, 2024; Zhang et al., 2024).

In my view, the practical center of gravity lies in IoT→Data→AI pipelines: firms first instrument processes (IoT), then institutionalize evidence (Big Data), and finally scale impact with AI for high-leverage circular tasks (forecasting, routing, sorting). Creative-industry

leaders should therefore prioritize IoT coverage and interoperable data architectures as prerequisites for AI-enabled circularity at scale.

### **Synthesis and Discussion of Digital Technologies Supporting Circular Economy (RQ1)**

The synthesis of the 26 selected studies reveals that digital innovation accelerates the transition of creative industries toward circular economy (CE) business models through three dominant mechanisms: data-driven transparency, automation and intelligent decision-making, and collaborative digital ecosystems. These mechanisms interact synergistically, enabling creative sectors, particularly fashion, textile, and design, to operationalize circular principles such as reuse, recycling, lifecycle extension, and product-as-a-service models.

The first mechanism, data-driven transparency, is primarily enabled by the Internet of Things (IoT) and Big Data technologies that generate and integrate real-time information across value chains. IoT-based monitoring systems facilitate the traceability of materials, product tracking, and environmental impact measurement, creating closed-loop visibility essential for CE adoption (Kayikci et al., 2022; Wiegand & Wynn, 2024). In textile and apparel sectors, smart sensors and connected devices support predictive maintenance, digital product passports, and waste minimization through adaptive production scheduling (Oliveira Neto et al., 2023; J.-P. Schögggl et al., 2023). Big Data analytics further strengthens this transparency by transforming raw data into insights for resource optimization and sustainable material flow management (Neri, Negri, Cagno, Franzò, et al., 2023; Zhang et al., 2024). Such transparency reduces informational asymmetries and builds accountability among producers, consumers, and recyclers, thereby fostering the behavioral and logistical foundations for circularity.

The second mechanism is automation and intelligent decision-making, primarily driven by Artificial Intelligence (AI) and machine learning (ML). AI facilitates predictive and prescriptive optimization across design, production, and end-of-life phases, enabling firms to anticipate demand and minimize overproduction (Colombi & D'Itria, 2023; Gazzola et al., 2025). In manufacturing, AI-powered computer vision supports waste classification and textile sorting, increasing recycling precision and material recovery rates (Tsai & Yuan, 2025). At the strategic level, AI enhances firms' dynamic capabilities by supporting data interpretation, scenario planning, and decision automation for circular business model innovation (Neri, Negri, Cagno, Kumar, et al., 2023; Sjödin et al., 2023). These capabilities allow creative firms to move from linear operations toward adaptive, self-learning systems that continuously optimize environmental and economic performance.

The third mechanism, digital collaboration platforms, enables ecosystem-based coordination and consumer engagement. Platforms integrating AI, augmented reality (AR), and blockchain technologies facilitate product reuse, resale, and traceable material exchanges among designers, producers, and consumers (Kim et al., 2025; Sardianou & Briana, 2025). Studies demonstrate that digital marketplaces and social media analytics mobilize consumers toward "5R" behaviors, namely reduce, reuse, recycle, recover, and rethink, by amplifying sustainability narratives and enhancing trust in circular value chains (Almashaleh et al., 2025; Charnley et al., 2022). Collaborative digital environments therefore democratize participation in CE, extending circularity beyond production systems into consumption and post-consumption networks.

Collectively, these mechanisms show that digital technologies do not merely support but actively accelerate the circular transition by embedding intelligence, visibility, and connectivity into the creative industries' ecosystems. IoT and Big Data create transparency, AI automates decision-making and adaptive production, and digital platforms expand collaboration and consumer inclusion (Gazzola et al., 2025; Kayikci et al., 2022; Tsai & Yuan, 2025; Wiegand & Wynn, 2024).

From the author's perspective, the acceleration effect arises not from individual technologies but from their integration as systemic enablers. When IoT-generated data feeds Big Data analytics and AI-driven optimization, and when these insights are disseminated through collaborative platforms, a self-reinforcing digital and circular ecosystem emerges. This convergence allows creative industries to evolve from fragmented sustainability initiatives into intelligent, networked systems capable of continuous circular innovation and long-term environmental resilience.

### CONCLUSION

This study synthesized evidence from 26 empirical and conceptual works to examine how digital innovation, particularly Artificial Intelligence (AI), Internet of Things (IoT), and Big Data, supports the transition toward circular economy (CE) business models in creative industries. The findings reveal that these technologies are not only operational enablers but also strategic catalysts that reshape production processes, resource flows, and consumer engagement. AI enhances forecasting accuracy and waste reduction through data-driven insights, IoT strengthens traceability by enabling real-time monitoring of materials and product lifecycles, while Big Data analytics optimizes logistics, material recovery, and design efficiency. Together, these technologies promote circular mechanisms such as closed-loop supply chains, product-as-a-service models, and smart manufacturing systems. However, the adoption of digital tools remains uneven across creative subsectors, with small and medium enterprises (SMEs) facing technological and financial barriers that hinder large-scale transformation. Theoretically, this research contributes to understanding digital circularity, the convergence of digital transformation and circular innovation as a foundation for sustainable creative production. It offers implications for both policy and practice, where policymakers are encouraged to strengthen digital infrastructure and cross-sector collaboration, while industry practitioners should leverage AI, IoT, and Big Data models to enhance efficiency, creativity, and sustainability. The study recognizes its limitation in geographic and temporal scope, as most evidence is concentrated in Europe and East Asia and may not fully capture dynamics in emerging markets. Future studies should extend comparative analyses across cultural and economic contexts to evaluate long-term impacts of digital circular innovation. Ultimately, digital technologies represent the next frontier of sustainability in creative industries, where technological intelligence enables regenerative growth, bridging economic viability with environmental and cultural resilience.

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