

AI as an architect: exploring the enablers of regenerative innovation ecosystems in creative industries

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Abstract

Purpose – This study explores the role of artificial intelligence (AI) in fostering sustainable and regenerative innovation ecosystems in creative industries. It investigates how AI-enhanced environmental sustainability, AI-driven resource optimization, the self-learning and adaptability of AI-enabled creative business models and stakeholder collaboration and co-creation influence the development of regenerative innovation ecosystems.

Design/methodology/approach – A quantitative research approach was adopted. Partial least squares structural equation modeling (PLS-SEM) was used to analyze survey data from 110 representatives of creative industry organizations across five European countries. The survey measured perceptions of AI's role across five latent variables, using a reflective measurement model to test the research hypotheses.

Findings – AI significantly influences the development of regenerative innovation ecosystems by enhancing environmental sustainability, promoting resource optimization and enabling self-learning business models. The self-learning and adaptability of AI-enabled creative business models and AI-driven resource optimization have mediating roles in driving the development of regenerative innovation ecosystems. However, the direct impact of stakeholder collaboration on fostering regenerative innovation ecosystems is limited, highlighting the need for complementary factors such as adaptability and resource efficiency.

Originality/value – Our novel conceptual framework links AI to regenerative innovation ecosystems, thereby bridging the gap between sustainability and creative industry innovation. The study offers empirical evidence on the mediating mechanisms that help transform sustainability practices into regenerative outcomes. The study's insights are valuable for both academics and practitioners seeking to use AI to foster sustainable and regenerative innovation in creative industries.

Keywords Regenerative artificial intelligence, Sustainability, Creative industries, Green innovation, Co-creation

Paper type Research article

1. Introduction

Artificial intelligence (AI) has rapidly penetrated a host of sectors, including creative industries. UNCTAD defines creative industries as “creation, production, and distribution

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cycles that leverage creativity and intellectual capital. These industries encompass knowledge-based activities focusing on culture and heritage, including tangible and intangible creative products with economic value” (UNCTAD, 2024, p. 111). AI integration in creative industries enables sustainable and regenerative business models that can fully address contemporary environmental challenges.

The primary types of generative AI used in creative industries are text-to-image generation, image-to-image generation, music generation, video generation, 3D modeling, and animation. Text-to-image generation refers to producing realistic images from verbal descriptions using AI techniques, specifically deep learning models. It entails deploying several methods, including on-premises and cloud-based solutions. Its applications extend to areas as broad as gaming, film and television, advertising and marketing, and music and sound production, as well as others.

The *Generative AI In Creative Industries Global Market Report 2025* (The Business Research Company, 2025) highlights how the market size of generative AI in creative industries has grown exponentially in recent years. It is projected to increase from \$3.08 billion in 2024 to \$4.09 billion in 2025, reflecting a compound annual growth rate (CAGR) of 32.8%. The market size of generative AI in creative industries is expected to continue this growth trend in the coming years. By 2029, forecasts place it at \$12.61 billion, with a CAGR of 32.5%. Growth in this period can be attributed to enhanced data efficiency and few-shot learning capabilities, the implementation of ethical and inclusive AI practices, and the development of cross-domain creative applications.

These insights align with the current academic literature. The literature highlights the potential of AI to revolutionize creative processes, enhance productivity, and offer novel solutions to complex problems. It also outlines how AI is increasingly influencing creative industries and sustainable business practices (Anantrasirichai and Bull, 2022).

As explained by Infosys (2024), regenerative AI introduces a paradigm shift in AI by powering systems that are able to self-learn, adapt, and self-repair. Inspired by biological processes such as neuroplasticity and cellular repair, regenerative AI systems operate dynamically to optimize performance and resilience. This technological advance complements the broader goals of regenerative innovation ecosystems, enabling creative industries to evolve sustainably while maintaining their operational efficiency.

In the context of sustainable business models, AI can optimize resources and improve production efficiency, thus contributing to Sustainable Development Goal (SDG) attainment (de Andreis et al., 2024). The integration of AI with circular economy (CE) principles is becoming a major research area, with AI being cited as supporting various CE activities and potentially reshaping business models (Tutore et al., 2024). As creative industries continue to adopt AI technologies, challenges such as limited data resources and multimodal data processing drive further innovation in AI development (Amato et al., 2019). Of particular relevance to the current study, Li (2020) reported that digital technologies are central to the transformation of business models in creative industries.

AI is thus progressively recognized as a transformative force within creative industries, offering innovative tools and strategies that support sustainable and regenerative practices. Erickson (2024) underscored the dualistic nature of AI’s impact on creative industries, where technological advances bring not only opportunities but also challenges.

Both generative and regenerative AI tools have shown significant potential to enhance creativity, for instance in sustainable product design. As an example, AI tools such as Vizcom have been found to increase creativity metrics such as ideation diversity and novelty, thereby promoting innovative solutions aligned with environmental goals (Kaljun and Kaljun, 2024). This integration of these AI technologies not only accelerates the ideation process but also fosters environmentally conscious design, thereby advancing education in sustainable product design.

Drupsteen and Wakkee (2024) stressed that regenerative business models represent a leap forward from traditional sustainable practices by focusing on not only mitigating harm but also

actively contributing to ecological restoration and social well-being. They explained that regenerative business models integrate CE principles with a broader, systems-based approach that encompasses interdependencies between humans, nature, and economic systems.

These insights lay the foundations for exploring how AI-driven tools can facilitate the transition toward the CE, particularly by supporting dynamic, holistic frameworks for value creation. For instance, [Konietzko et al. \(2023\)](#) argued that sustainability alone is insufficient to address the systemic challenges posed by the degradation of natural and social ecosystems. Instead, they emphasized the need for regenerative business models, which go beyond minimizing harm by actively restoring ecological health and promoting social well-being. This perspective is particularly relevant to creative industries, where embedding regenerative practices can create net-positive impacts by aligning artistic production with environmental stewardship and social equity. [Yadav and Yadav \(2024\)](#) explained that businesses face serious (*wicked*) problems, including climate change and inequality, requiring solutions that transcend traditional sustainability approaches. They proposed a shift toward regenerative innovation, which integrates resilience, sustainability, and circularity to create net-positive impacts.

AI's scope in creative industries even extends to the arts, where it can be used to imitate, combine, and extend artistic styles, transforming creative practices. Research into creative AI highlights its potential to address environmental sustainability and ethical issues such as authorship and ownership in artistic processes ([Holzapfel et al., 2022](#)). Similar studies can help us understand how AI can be used sustainably in artistic communities, while identifying potential future applications.

AI offers solutions to complex social problems such as environmental degradation and the climate crisis by facilitating environmental governance and reducing resource intensity ([Nishant et al., 2020](#)). AI's integration into organizational, technical, and processing aspects of businesses further supports sustainable development and helps meet the SDGs ([Kulkov et al., 2023](#)).

In summary, AI-driven tools and strategies are valuable for supporting sustainable and regenerative practices within creative industries. They enhance creativity, optimize eco-friendly communication, and contribute to sustainable development, thereby fostering a more sustainable future across various creative domains. However, there is limited research on how AI-driven tools specifically contribute to sustainable and eco-friendly practices in creative industries.

Despite the growing research interest in the intersections of AI, sustainability, and creative industries, literature remains fragmented. Studies have focused on either the technical potential of AI in creative production or broad sustainability transitions. However, studies have underexamined how these dimensions converge within regenerative innovation ecosystems. What is still missing is a comprehensive, empirically grounded framework that explains the AI-driven mechanisms in relation to environmental sustainability, resource optimization, the adaptability of creative business models, and stakeholder collaboration capable of regenerative outcomes. This study addresses this gap by proposing and empirically validating a conceptual model tailored to creative industries. It thereby extends theoretical debates beyond sustainability to the realm of regeneration. Moreover, it offers practical insights for stakeholders aiming to adopt AI for ecological and social restoration.

Building on these insights, the central research question of this study is as follows: How do AI-driven tools and strategies support sustainable and regenerative practices within creative industries? This study addresses this question by aiming to provide an understanding of the key factors that influence innovative and regenerative business models in creative industries.

This paper makes several important contributions to the research on AI's impact on sustainable and regenerative practices in creative industries. First, it provides a conceptual framework that integrates key constructs such as AI-enhanced environmental sustainability, AI-driven resource optimization, the self-learning and adaptability of AI-enabled creative business models, stakeholder collaboration and co-creation, and the regenerative innovation ecosystem. By linking these constructs, the paper offers a comprehensive idea of how AI

becomes a strategic enabler of innovation, sustainability, and collaboration in creative industries. Second, the study introduces an empirically validated measurement model that assesses the relationships between these constructs, bridging the gap between theoretical discussions and practical applications. Finally, the paper contributes to the broader academic and practical discourse on regenerative innovation by emphasizing the need for adaptive, sustainable, and collaborative approaches in creative industries.

The remainder of the paper is organized as follows. This introduction (Section 1) provides an overview of the relevance of AI in transforming creative industries, emphasizing its potential to enable sustainable and regenerative business practices. The theoretical background (Section 2) reviews the existing literature on key constructs such as regenerative innovation ecosystems, AI-driven resource optimization, and stakeholder collaboration. This section provides the basis for the conceptual framework. The next section (Section 3) describes the research design, data collection methods, and measurement model used for the study. The findings (Section 4) are then presented based on the results of partial least squares structural equation modeling (PLS-SEM). Thus, the relationships between the latent variables are evaluated, and the proposed hypotheses are tested. The discussion (Section 5) interprets the findings. This discussion leads to the theoretical and practical implications and provides insights into how creative industries can use AI to support sustainability and regeneration. Finally, the conclusions (Section 6) highlight the key contributions, limitations, and areas for future research. This section underscores the contribution of this study in advancing knowledge on AI-driven regenerative innovation in creative industries.

2. Theoretical background

This section reviews the existing academic research on the role of AI in fostering innovation in creative industries. The review focuses on key themes, including regenerative innovation ecosystems, AI-driven resource optimization, environmental sustainability, stakeholder collaboration and co-creation, and the self-learning and adaptability of AI-enabled creative business models.

2.1 AI in creative industries

AI has revolutionized numerous sectors, including creative industries. From music and visual arts to design and media, AI tools have reshaped workflows, enhanced creative processes, and raised important questions about the nature of creativity and authorship.

AI applications in creative industries range from content creation to workflow optimization. Anantrasirichai and Bull (2022) categorized these applications into five areas: content creation, information analysis, content enhancement, information extraction, and data compression. They explained that AI is primarily a collaborative tool that augments rather than replaces human creativity, particularly in structured tasks where machine learning models such as generative adversarial networks (GANs) and recurrent neural networks (RNNs) excel (Anantrasirichai and Bull, 2022). Anantrasirichai and Bull's main findings show that AI technologies, mainly machine learning algorithms, are being widely adopted in creative industries to assist with various tasks, including content creation, information analysis, and post-production workflows. Moreover, they concluded that, although AI has shown success as a creative tool or assistant, its scope to match human creatives as an independent creator is still limited. Finally, their study suggests that the maximum benefit from AI in creative industries will come from augmenting rather than replacing human creativity.

Li's (2020) holistic business model framework implies that AI accelerates business model innovation by supporting new ways to create, sense, and distribute value. In creative industries, AI enables content personalization streamlines resource allocation and fosters multisided market engagement.

Generative AI tools have further enhanced creative possibilities, offering novel avenues for artistic expression. O'Toole and Horvát (2024) noted the importance of designing AI systems that empower human creators, allowing for exploration and innovation while maintaining authenticity.

Amato *et al.* (2019) provided a foundational review of how AI transforms media and creative industries, highlighting its impact across various domains such as film, music, and video games. Amato *et al.* (2019) stressed that AI contributes to automation in content creation, personalizes user experiences through advanced recommendation systems, and enhances storytelling with generative models. Amato *et al.* (2019) highlighted the major challenge of ensuring ethical AI deployment, including addressing biases in training data sets and maintaining creative diversity. However, they suggested that AI faces specific technical challenges in creative industries, such as working with limited data and processing multiple data simultaneously.

Abbasi *et al.* (2017) highlighted the transformative potential of AI and related technologies in reshaping business models and creative outputs. They explained that AI technologies are integral to addressing systemic challenges such as sustainable resource management and collaborative innovation. Their roadmap underscores the potential of integrating advanced AI with emerging trends such as augmented reality (AR), virtual reality (VR), and gesture-based interfaces, which redefine how creators and consumers interact. These technologies enable immersive experiences and real-time collaboration, supporting creative industries in their transition toward dynamic, regenerative ecosystems.

Insights from Drupsteen and Wakkee (2024) reveal the growing emphasis on regenerative practices, demonstrating how AI could be pivotal in the development of regenerative business models. AI technologies are uniquely positioned to help integrate ecological and social dimensions into creative processes, enabling value creation that prioritizes restoration and holistic well-being. For instance, AI-powered design tools can employ environmental impact assessments and predictive analytics to optimize resource use, thus supporting the regenerative principles highlighted in the research.

This capability underscores the potential of AI not only to enhance creativity but also to embed sustainable and regenerative values in creative industry practices. The regenerative business model framework proposed by Konietzko *et al.* (2023) further highlights the importance of AI as a transformative enabler in creating, delivering, and capturing value. AI's ability to analyze complex data sets and drive innovative solutions supports the regenerative principles of restoring natural systems and fostering community well-being. For example, AI can support nature-inspired design, optimize resource efficiency, and enable the co-creation of products that promote both planetary health and social well-being.

Bujor and Avasilcai (2023) proposed a conceptual model for integrating open innovation into creative industries. They argued that, when combined with AI, open innovation frameworks facilitate collaboration between industry stakeholders, thus fostering creativity and accelerating innovation. Their study highlights the importance of co-creation, where AI acts as an enabler for collaborative ideation. In this regard, AI provides tools that help human creators refine and execute their ideas efficiently. More specifically, Bujor and Avasilcai's study offers three main insights. First, adopting an open sustainability innovation approach that combines sustainability, innovation, and collaboration can provide strategic advantages for companies in creative industries. Second, open innovation can help creative industries discover ways to reduce waste, use eco-friendly materials, and minimize their carbon footprints. Third, co-creating sustainable products with audiences can foster a sense of ownership and ensure that the final products meet environmental expectations.

Both Amato *et al.* (2019) and Bujor and Avasilcai (2023) thus highlight relevant emerging trends such as collaborative creativity, ethical and regulatory challenges, and open innovation ecosystems. For instance, with regard to collaborative creativity, both studies suggest that AI's primary strength lies in augmenting rather than replacing human creativity. AI-driven tools such as GANs and natural language processing (NLP) models offer a collaborative interface

where human ingenuity is amplified. Moreover, [Amato et al. \(2019\)](#) and [Bujor and Avasilcai \(2023\)](#) agree on the critical need to address ethical concerns, including intellectual property rights and the risk of the standardization of creative outputs. The tension they describe between innovation and regulation is a recurring theme that must be navigated carefully.

In the context of cultural and creative industries, AI is increasingly recognized as both a technological tool and a collaborator that shapes the user experience and cultural value creation. [Gurel \(2025\)](#) proposed a framework of how AI supports personalization, co-creation, and immersive engagement, while also raising ethical questions. The identification of innovative and regenerative drivers in creative industries stimulates entrepreneurial intention in this field ([Silesky-Gonzalez et al., 2025](#)).

AI offers vast opportunities to streamline workflows, democratize creativity, and enhance accessibility in creative domains. However, it also poses challenges. The tension between technological efficiency and the preservation of human ingenuity is an issue that arises time and again. [Amankwah-Amoah et al. \(2024\)](#) underscored the need for a balanced approach to ensure that AI supports rather than undermines the unique aspects of human creativity ([Amankwah-Amoah et al., 2024](#)). The potential for AI to either displace or complement human labor in creative industries is a recurring theme in [Erickson's \(2024\)](#) analysis. Through case studies of AI-assisted creative products, Erickson illustrated how AI reshapes the division of labor within creative teams, often requiring the addition of new skills such as data curation and algorithmic refinement. Despite the role of AI in automating routine tasks, the study concludes that AI does not replace human creativity but instead necessitates human oversight and adaptation.

The rise of AI also raises ethical dilemmas, particularly regarding intellectual property and authorship. [Lee \(2022\)](#) discussed how AI dissociates creativity from human agency, raising concerns about dehumanization and labor impacts in creative industries ([Lee, 2022](#)). In response to these issues, [Knearem et al. \(2023\)](#) encouraged future research to focus on integrating AI into creative workflows in ways that enhance rather than replace human creativity. The emphasis should be on addressing the ethical challenges around AI such as biases in AI algorithms and intellectual property disputes, while fostering human-AI collaboration.

The research discussed so far highlights some considerations that should be addressed to enrich the literature on AI in creative industries. The first relates to the relevance of cross-sector applications. Research on AI's integration into creative industries should explore interdisciplinary applications, bridging sectors such as education, healthcare, and entertainment. The second relates to the concept of AI literacy for creators. Educating creators on AI's capabilities and limitations can ensure more ethical and effective AI use, thus minimizing misuse or an over-reliance on automation. The third relates to the importance of considering the evolving definitions of creativity because the increasing collaboration between AI and humans invites a re-examination of what constitutes originality and authorship in creative outputs. Regarding these considerations, the literature seems to agree that AI serves as a catalyst for innovation in creative industries but that its successful integration demands careful attention to ethical, collaborative, and regulatory frameworks.

The integration of AI into creative industries has not only revolutionized artistic production and business processes but also laid the groundwork for addressing broader systemic challenges such as sustainability, resource efficiency, and collaborative innovation. AI's ability to analyze vast data sets, automate complex workflows, and generate novel solutions makes it a transformative tool for fostering regenerative practices. As creative industries increasingly prioritize sustainability and inclusivity, AI-driven tools offer significant opportunities to optimize resource use, reduce environmental impact, and design adaptive, future-proof business models.

2.2 The regenerative innovation ecosystem

Building on the theoretical foundations of the previous subsection, the concept of the regenerative innovation ecosystem has emerged as a holistic approach to aligning creative practices with sustainability goals. The adoption of AI in creative industries and sustainable

business models is gaining traction. AI technologies such as convolutional neural network (CNNs), GANs, and RNNs are now applied in content creation, analysis, and enhancement (Anantrasirichai and Bull, 2022). Although AI is increasingly used as a collaborative tool, its current scope as an independent creator remains limited. The concept of regeneration is relevant in the development of sustainable business models that contribute to environmental and social restoration (de Andreis *et al.*, 2024). AI facilitates the transition toward a regenerative economy by helping process complex data and drive innovation in circular design and urban development (Kadar and Kadar, 2020). Tutore *et al.*'s (2024) conceptual framework proposes four stages of AI engagement with the CE: system optimization, system redesign, business model redesign, and ecosystem innovation.

Robinson and Cole (2015) described regenerative sustainability as a net-positive paradigm that reframes human–nature relations through co-evolution and systems thinking. Their perspective underscores the idea that regenerative outcomes emerge from integrating ecological vitality with social well-being. This idea thus offers a theoretical foundation for linking AI-driven innovations to regenerative creative ecosystems.

In the context of creative industries, the regenerative innovation ecosystem refers to enhancing innovation ecosystems by making them regenerative by design. In this regard, AI can contribute by optimizing creative resources, fostering sustainability, and enabling self-learning systems that respond to the dynamic demands of creative projects. The related concept of regenerative AI expands the capabilities of traditional AI by leveraging iterative feedback loops and self-repairing mechanisms to support adaptive and sustainable ecosystems. According to Infosys (2024), these ecosystems dynamically respond to environmental and operational challenges, ensuring long-term functionality and efficiency. The regenerative innovation framework integrates resilience into creative processes and enables real-time optimization of creative workflows.

Building on sustainability research, Hahn and Tampe (2021) advocated a shift from business-case logics to regenerative strategies that co-evolve with socioecological systems. Their restore–preserve–enhance framework outlines how firms can operationalize regenerative principles through adaptive management, moving beyond harm reduction to actively strengthen system vitality. By encouraging participation in AI-driven design, content creation, and commercialization processes, creative industries can build more equitable, sustainable, and regenerative innovation ecosystems, where technological advancement and diversity reinforce each other (Rezaei *et al.*, 2024).

The framework developed by Yadav and Yadav (2024) underscores the importance of regenerative innovation as a response to socioecological challenges. Yadav and Yadav (2024) identified four archetypes of regenerative innovation that each contribute uniquely to regenerative goals: urban transformation, technological innovation, responsible innovation, and business model innovation. In creative industries, these archetypes are enabled by AI solutions, fostering resilience and adaptive capacity in processes ranging from content creation to stakeholder collaboration. The mission of creative industries has evolved from minimizing harm to actively restoring ecological and social balance. Based on the findings of Konietzko *et al.* (2023), the regenerative innovation ecosystem underlines the role of multistakeholder collaborations in addressing ecological and social challenges.

While integrating sustainability accounting and co-creative partnerships, creative industries seek business models that prioritize both human and environmental health to ensure long-term resilience and sustainability. The integration of green AI tools and strategies into the regenerative innovation ecosystem highlights the transformative potential of aligning technology with sustainability goals. Alzoubi and Mishra (2024) reported that initiatives such as carbon footprint tools and model efficiency optimizations are essential for building ecosystems that support sustainable innovation. These tools allow creative industries to adopt CE principles by reducing waste, optimizing energy consumption, and designing regenerative business models. AI is a key enabler in promoting collaboration among stakeholders in creative industries, driving innovation in art, design, media, fashion, and other creative fields.

According to [Abbasi et al. \(2017\)](#), the regenerative innovation ecosystem within creative industries involves a robust technology roadmap that emphasizes the adoption of scalable, adaptive tools. For instance, this roadmap identifies the need for AI-powered resource optimization systems, which enhance efficiency and minimize waste in creative production processes. Furthermore, it advocates the use of collaborative platforms and intelligent interfaces that enable co-creation and user-centric designs. Creative firms face pressures to redesign their business models in response to rapid technological change. Thus, creative industries must embed AI into their core business logics, aligning digital innovation with adaptive business models that support sustainability and regeneration ([Li et al., 2024](#)).

In exploring the integration of AI into regenerative innovation ecosystems, [Erickson \(2024\)](#) highlighted the importance of transparency and collaboration. The invisible side of human contributions to AI-assisted creative outputs raises concerns about authorship and recognition, potentially undermining stakeholder engagement and co-creation. Addressing these concerns requires embedding the principles of inclusivity and equitable recognition into regenerative frameworks.

[Drupsteen and Wakkee \(2024\)](#) provided valuable insights into the characteristics of regenerative business models. These characteristics are particularly relevant for conceptualizing regenerative innovation ecosystems. They explained that these models emphasize a system-thinking approach, focusing on the interconnectedness of ecological, social, and economic elements.

In creative industries, there is a need for tools and frameworks that enable businesses to co-create value across multiple dimensions, including biodiversity, community well-being, and cultural preservation. AI's capacity to analyze complex data sets and facilitate adaptive decision-making makes it a key driver in achieving these regenerative goals by allowing creative enterprises to innovate in ways that contribute positively to natural and social systems.

Moreover, [Li's \(2020\)](#) analysis of digital transformation highlights the importance of aligning technological innovations with stakeholder needs to ensure sustainable business practices. Therefore, within a regenerative innovation ecosystem, AI-driven solutions can redefine value propositions by incorporating regenerative principles into creative processes, ensuring that economic activities contribute positively to environmental and social well-being.

2.3 AI-enhanced environmental sustainability

Recent research has highlighted the potential of AI to foster sustainable and regenerative practices across various industries. AI facilitates the transition toward CE models by optimizing systems, redesigning business models, and driving ecosystem innovation ([Tutore et al., 2024](#)). AI enables sustainability efforts in sectors such as construction, transportation, healthcare, manufacturing, agriculture, and water management ([Kar et al., 2022](#)). AI applications extend to resource optimization, production efficiency improvement, and the achievement of the SDGs ([de Andreis et al., 2024](#)). The integration of AI with sustainability practices is gaining traction in business research, with studies exploring its impact on service contexts and sustainable business models ([Goel et al., 2024](#)).

Regenerative eco-innovation requires supportive regulatory frameworks and a conducive context. [Dewick et al. \(2019\)](#) reported that stringent, flexible, and enforceable regulations facilitate regenerative outcomes, enabling industries to move beyond eco-efficiency and toward restoring and revitalizing natural systems. However, although AI's potential for enhancing specific CE activities has been recognized, its strategic role in business model redesign and ecosystem innovation remains largely unexplored, presenting opportunities for research in this area ([Tutore et al., 2024](#)).

AI-enhanced environmental sustainability in the current context refers to how AI contributes to reducing the environmental impact of creative industries. From minimizing energy use in creative studios to optimizing the use of materials in product design, AI leads to significant environmental improvements that underscore regenerative principles in creative

industries. [Alzoubi and Mishra \(2024\)](#) highlighted the concept of *green AI*, which refers to minimizing the carbon footprint and energy consumption of AI systems during model training and operation. They identified key green AI initiatives such as cloud optimization tools and sustainability-focused AI development, which address the environmental challenges posed by large-scale AI adoption. For example, initiatives such as NVIDIA's green GPU platform and Google's AI for sustainability offer attempts to reduce the energy demands of AI workloads. These efforts demonstrate that integrating green AI principles into creative industries can significantly reduce their environmental impact, further optimizing resource allocation and instilling sustainable business practices.

2.4 Self-learning and adaptability of AI-enabled creative business models

AI is increasingly recognized as a transformative force in creative industries and sustainable business models. It offers tools for content creation, analysis, and enhancement ([Anantrasirichai and Bull, 2022](#)), while working toward the SDGs through resource optimization and efficiency improvements ([de Andreis et al., 2024](#)). AI-driven business models are characterized by enhanced operational efficiency, data-driven decision-making, and customer-centric approaches, although they present challenges in relation to implementation and ethical considerations ([Farayola et al., 2023](#)).

The integration of AI into sustainable business models affects the economic, social, and environmental dimensions of sustainability, with multinational companies demonstrating its practical application across various countries ([Toniolo et al., 2020](#)). Nevertheless, as AI continues to evolve, it is expected to serve as a collaborative assistant for human creativity rather than replacing it entirely, highlighting the importance of a human-centric approach to maximize AI's benefits for creative industries ([Anantrasirichai and Bull, 2022](#)).

The self-learning and adaptability construct in creative industries refers to AI's ability to autonomously improve creative processes over time. Creative businesses frequently employ AI systems that learn from previous projects, adapt to new creative challenges, and continuously enhance creative output efficiency and sustainability. Thus, we propose the first hypothesis:

- H1.* AI-enhanced environmental sustainability (AES) positively influences the self-learning and adaptability of AI-enabled creative business models (SLA).

2.5 AI-driven resource optimization

AI is recognized as a transformative force in sustainable business practices and entrepreneurship. AI-driven strategies optimize resource use, enhance production efficiency, and support the transition toward CE models ([de Andreis et al., 2024](#); [Tutore et al., 2024](#)). The integration of AI into business processes facilitates market analysis, product development, and customer engagement, leading to improved decision-making and more personalized experiences ([Usman et al., 2024](#)). AI's potential extends beyond operational improvements to strategic planning, business model redesign, and ecosystem innovation ([Tutore et al., 2024](#)).

However, the implementation of AI in sustainable business practices also presents challenges, including ethical concerns and potential job displacement ([Usman et al., 2024](#)). As research in this field continues to grow, there is a need to address gaps in the understanding of AI's role in strategic planning for sustainability and to explore its impact across various business contexts ([Goel et al., 2024](#); [Tutore et al., 2024](#)).

In creative industries, AI-driven resource optimization captures AI's capacity to optimize the use of physical and digital resources in creative processes. AI tools streamline everything from material use in design to the management of digital assets in media production by predicting maintenance needs, optimizing workflows, and minimizing waste. These features of AI are highly relevant for sustainable creativity. Thus, we propose the following hypotheses:

- H2. The self-learning and adaptability of AI-enabled creative business models (SLA) positively influences AI-driven resource optimization (ARO).
- H3. AI-driven resource optimization (ARO) positively influences the development of the regenerative innovation ecosystem (RIE).

2.6 Stakeholder collaboration and co-creation

Stakeholder collaboration and co-creation aim to foster innovation and sustainability in creative industries. Building on the findings of [Alzoubi and Mishra \(2024\)](#), collaborative efforts are important to address sustainability challenges in adoption of AI. Open-source platforms and community-driven research in AI enable stakeholders to share tools and practices, fostering a culture of collective problem-solving. Such collaborative approaches are aligned with the objectives of stakeholder collaboration and co-creation by pooling expertise to design AI systems that not only enhance productivity but also adhere to environmental sustainability goals. Ecosystems built on these approaches encourage diverse actors, including technology providers, creators, and regulators, to engage in the co-development of solutions aligned with regenerative innovation principles. The transition from traditional business models to more sustainable and regenerative models requires a focus on environmental and social dimensions alongside economic considerations ([de Andreis et al., 2024](#)). Innovation ecosystems in creative industries rely on open innovation techniques such as crowdsourcing to leverage diverse stakeholder capabilities ([Galateanu and Avasilcai, 2018](#)). Effective stakeholder engagement in co-creation processes involves coordination between internal and external participants, as well as the consideration of various antecedents and the evolution of engagement over time ([Loureiro et al., 2020](#)). The Cultural and Creative Industries Digital Business Ecosystem (CCI-DBE) model has four pillars: multistakeholder participation, co-creation mechanisms, unique consumer experiences, and co-created value outputs. This model provides a framework for enhancing cross-domain collaboration, resource sharing, and innovation within cultural and creative industries ([Hsu et al., 2023](#)).

In creative industries, stakeholder collaboration and co-creation facilitates the development of innovative, regenerative business models. AI enhances stakeholder engagement by enabling creative businesses to collaborate with clients, artists, suppliers, and other stakeholders, thereby promoting resource-sharing, content co-creation, and the development of new creative markets. Thus, we propose the following hypotheses:

- H4. AI-enhanced environmental sustainability (AES) positively influences stakeholder collaboration and co-creation (SCC).
- H5. Stakeholder collaboration and co-creation (SCC) positively influence the development of the regenerative innovation ecosystem (RIE).

AI-enhanced environmental sustainability reduces environmental impacts, for example by optimizing resource use and reducing waste through green AI tools and energy-efficient systems. The resulting improvements in sustainability directly contribute to the self-learning and adaptability of AI-enabled business models because these models evolve through iterative feedback in order to learn to integrate CE principles and adaptive processes. As regenerative AI systems autonomously refine their capabilities over time, they steadily bridge the gap between environmental sustainability and the development of regenerative innovation ecosystems. Thus, we propose the following hypothesis:

- H6. The self-learning and adaptability of AI-enabled creative business models (SLA) mediates the relationship between AI-enhanced environmental sustainability (AES) and the development of the regenerative innovation ecosystem (RIE).

AI enhances collaboration among stakeholders by enabling resource-sharing, co-creation, and collective problem-solving to address sustainability challenges. AI-enhanced environmental

sustainability initiatives such as cloud optimization tools and AI-driven sustainable design systems facilitate the active engagement of diverse stakeholders to collectively address environmental objectives. Such collaborative engagement leads to the creation of innovative, regenerative business models that not only mitigate ecological harm but also actively restore ecosystems. Thus, we propose the following hypothesis:

- H7.* Stakeholder collaboration and co-creation (SCC) mediates the relationship between AI-enhanced environmental sustainability (AES) and the development of the regenerative innovation ecosystem (RIE).

AI-driven resource optimization relates to AI's scope to enhance efficiency in creative industries, for example by minimizing material waste, optimizing supply chains, and predicting maintenance needs. Self-learning and adaptable systems directly support AI-driven resource optimization by tailoring AI-driven tools to maximize operational efficiency over time and respond to the requirements of regenerative innovation ecosystems. Thus, we propose the following hypothesis:

- H8.* AI-driven resource optimization (ARO) mediates the relationship between the self-learning and adaptability of AI-enabled creative business models (SLA) and the development of the regenerative innovation ecosystem (RIE).

Recently, scholars have distinguished regeneration from sustainability by its orientation toward vitality, co-evolution, and the cultivation of a regenerative mindset. [Yunibandhu and Hallinger \(2025\)](#) showed that regeneration expands sustainability's foundations by emphasizing holism, reflexivity, and mutualism, thus enabling systemic transformation.

3. Method

We employed partial least squares structural equation modeling (PLS-SEM) to gain a deeper understanding of how innovation, collaboration, and sustainability factors influence the development of AI-powered regenerative practices in creative industries. PLS-SEM enables the examination of causal relationships and the testing of conceptual models using empirical data. In the current research context, it can provide valuable insights into the interconnected dynamics of creative industry stakeholders to uncover how these elements collectively foster innovation ecosystems and sustainable practices.

PLS-SEM is particularly well-suited to analyses with complex models that include multiple constructs and indicators, making it an appropriate methodological choice for our study. Creative industries operate in dynamic environments where internal organizational features, external environmental conditions, technological advancements, and market dynamics interact to shape innovative and sustainable outcomes. Given that our model integrates interdependent variables such as AI-enhanced environmental sustainability, the self-learning and adaptability of AI-enabled business models, resource optimization, and stakeholder collaboration, PLS-SEM was a suitable methodological choice in that it allowed us to simultaneously assess both direct and mediating effects.

3.1 Data collection and measurement model

We developed an online questionnaire-based survey (<https://forms.gle/JDAc588o6WcSAWuE7>) to collect data on the perceptions of creative industry company representatives regarding specific items distributed over five latent variables: the self-learning and adaptability of AI-enabled creative business models (SLA), AI-driven resource optimization (ARO), AI-enhanced environmental sustainability (AES), stakeholder collaboration and co-creation (SCC), and the regenerative innovation ecosystem (RIE).

Responses were assessed on a 5-point Likert scale, with participants indicating their agreement with statements on a scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Responses were collected from October 2024 to December 2024.

Given the limited availability of established measurement scales tailored to creative industries, we developed an original measurement framework by adapting items from the existing literature and incorporating insights from expert practitioners within the sector. These experts provided feedback during an iterative review process, ensuring the relevance and clarity of the newly developed scale.

To validate the measurement instrument, we conducted a pretest involving a focus group of creative industry experts. This pretest assessed the clarity of the questionnaire items, the appropriateness of the Likert scale, and the overall structure. Based on participants' feedback, adjustments were made, including rephrasing ambiguous items, ensuring contextual relevance to creative industries, and refining the Likert scale to better align with the study's objectives. The pilot study, conducted with five managers from creative industry companies, confirmed the reliability and consistency of the revised instrument, supporting its application in the broader survey. Their feedback helped refine the wording of items, confirm their contextual relevance, and improve the clarity of the Likert-scale options. Minor adjustments were made based on their suggestions, which were included in the questionnaire before its broader distribution.

The sampling strategy in this study consisted of contacting managers of companies in creative industries across five European countries: France, Germany, Italy, Romania, and Spain. These countries were chosen because they are partners in the *Fostering Resilience and Innovation in Europe through Networking Development of Clusters in the Cultural and Creative Industry Ecosystem* (FRIEND CCI) project. As its name suggests, this project aims to strengthen resilience and innovation in the European cultural and creative industry ecosystem by fostering cross-border collaboration and developing strong networks. Managers from these companies were invited to participate in an online questionnaire. This questionnaire was developed based on the items outlined in Table 1 to ensure its relevance to the FRIEND CCI objectives. This targeted approach ensured that insights from managers in these countries were directly related to the overarching aim of advancing innovation and resilience in cultural and creative industries. We directly contacted managers from creative industries to ensure a high participation rate in the study.

The sample included representatives from various areas within creative industries. This diverse representation ensured that the findings were comprehensive and applicable across multiple subdomains of creative industries. The inclusion criterion was to be a manager of a European creative industry company involved in the FRIEND CCI initiative. This selection criterion ensured that participants had relevant experience and insights into the unique challenges and opportunities in their industries. By targeting a wide range of creative industries, including advertising, design, fashion, film, and video games, our study captured different profiles of creative companies.

Table 2 shows the demographics of the convenience sample. Most respondents reported that trend maturity enables a balanced approach to technological and market skills, along with a business model that supports communication of innovation.

3.2 Conceptual framework

In the research on creative industries, latent variables often reflect the dynamics of innovation, sustainability, and collaboration. PLS-SEM is particularly well-suited to handling these latent constructs, enabling the modeling and analysis of complex relationships between them. Furthermore, studies in this field frequently involve multidimensional models. PLS-SEM's flexibility is again suitable for managing such complexities.

We first assessed the measurement model using construct reliability and validity. We then assessed the conceptual model (Figure 1). We analyzed the online questionnaire data using SmartPLS software v. 4.1.0.9.

The conceptual framework (Figure 1) posits that AI acts as a systemic enabler of regenerative innovation ecosystems in creative industries. Specifically, the framework

Table 1. Items included in the measurement model (questionnaire)

Items included in the questionnaire	Source(s)
<i>Regenerative innovation ecosystem (RIE)</i>	
AI improves cross-disciplinary collaboration in our creative projects	Yadav and Yadav (2024), Konietzko <i>et al.</i> (2023), Drupsteen and Wakkee (2024)
AI-driven tools have led to sustainability-focused redesigns in our business processes	
AI enables us to identify and access new market opportunities in creative industries	
AI supports the seamless integration of sustainable practices into our creative workflows	
<i>AI-driven resource optimization (ARO)</i>	
AI optimizes material and resource use in our creative projects	Tutore <i>et al.</i> (2024), Kar <i>et al.</i> (2022), Kulkov <i>et al.</i> (2023)
AI-driven predictive maintenance reduces unplanned downtime and enhances creative operational efficiency	
Our supply chains for creative production have become more efficient through AI-powered optimization	
AI-based systems actively contribute to waste minimization in our creative processes	
<i>AI-enhanced environmental sustainability (AES)</i>	
AI systems help reduce energy consumption in our creative production processes	Alzoubi and Mishra (2024), de Andreis <i>et al.</i> (2024)
AI has improved water management efficiency in our creative operations	
Our AI systems are fundamental in minimizing environmental waste across our creative projects	
Having real-time data from AI helps lower our creative projects' environmental footprint	
<i>Self-learning and adaptability of AI-enabled creative business models (SLA)</i>	
Our AI systems autonomously adapt to new challenges in creative projects	Anantrasirichai and Bull (2022), Drupsteen and Wakkee (2024)
AI tools are designed for self-learning and continuous improvement based on feedback from creative projects	
Our AI-driven creative business models evolve independently without manual intervention	
AI technologies in our organization self-adjust and repair in response to unforeseen creative workflow issues	
<i>Stakeholder collaboration and co-creation (SCC)</i>	
AI tools strengthen collaboration with stakeholders across creative industries	Bujor and Avasilcai (2023), Hsu <i>et al.</i> (2023)
We use AI tools to co-create innovative products and services with external partners	
AI improves resource and data sharing with our creative collaborators	
AI enhances stakeholder engagement quality throughout all stages of our creative projects	
Source(s): Authors' own work	

describes the links of four interdependent constructs (AI-enhanced environmental sustainability, the self-learning and adaptability of AI-enabled business models, AI-driven resource optimization, and stakeholder collaboration and co-creation) with the regenerative innovation ecosystem. In this model, AI-enhanced environmental sustainability establishes solid foundations by reducing environmental footprints and embedding sustainable practices.

Table 2. Study sample demographics

Characteristic	Sample (n = 110)
<i>Area within the creative industry</i>	
Advertising and marketing	20
Architecture	10
Arts and theater	5
Crafts (handmade and artisanal goods)	8
Design (graphic design, product design, industrial design, interior design, etc.)	12
Fashion	8
Film, TV, video, radio, and photography	13
Museums, galleries, and libraries	2
Publishing	4
Software development	21
Video games	5
Other	2
<i>Market experience in creative industries</i>	
Less than 1 year	11
Between 1 and 5 years	53
More than 5 years	46
<i>Country of head office</i>	
France	22
Germany	18
Italy	21
Romania	30
Spain	19

Note(s): Data retrieved from the online survey

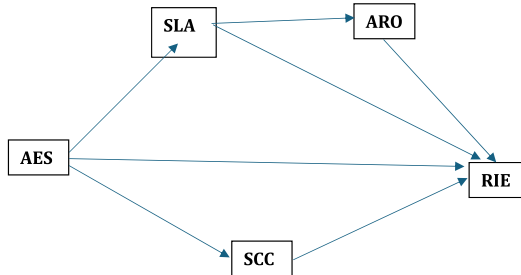


Figure 1. Structural model. SLA – self-learning and adaptability of AI-enabled creative business models; ARO – AI-driven resource optimization; AES – AI-enhanced environmental sustainability; SCC – stakeholder collaboration and co-creation; RIE – regenerative innovation ecosystem. *Source.* Authors’ own work

These foundations foster the self-learning and adaptability of AI-enabled business models, enabling business models to evolve and adapt dynamically. The self-learning and adaptability of AI-enabled business models then drives AI-driven resource optimization, ensuring that creative processes minimize waste and maximize efficiency and that adaptability translates into tangible ecological and economic outcomes. Stakeholder collaboration and co-creation further complements these mechanisms by leveraging collective intelligence and co-creation to extend regenerative impacts across networks of stakeholders.

The reflective measurement model was assessed using Cronbach’s alpha, composite reliability (CR), average variance extracted (AVE), the Fornell–Larcker criterion, and the

heterotrait-monotrait (HTMT) ratio of correlations (Sarstedt et al., 2021). The structural model was assessed using the *p* values and *t*-statistics from bootstrap analysis with 5,000 subsamples.

4. Findings

4.1 Assessment of the reflective measurement model

The reliability and validity measurements of the reflective latent variables included in the structural model were in line with the requirements outlined in the literature. Most of the Cronbach’s alpha and composite reliability (CR) values exceeded the recommended minimum threshold of 0.70. Most item loadings were above the 0.70 threshold. Most average variance extracted (AVE) values were above the recommended minimum threshold of 0.50 (Table 3). However, exceptions were noted for a few items where the outer loadings were slightly below 0.70 (ARO4, AES3, AES4, SLA1, SCC2). These values reflected potential areas for refinement and reassessment to improve the measurement model.

Table 3. Description of the reflective measurement model

Construct reliability, convergent validity, and descriptions of items	Items’ outer loadings
<i>RIE: Regenerative innovation ecosystem (α = 0.725, CR = 0.829, AVE = 0.548)</i>	
RIE1: AI improves cross-disciplinary collaboration in our creative projects	0.774
RIE2: AI-driven tools have led to sustainability-focused redesigns in our business processes	0.702
RIE3: AI enables us to identify and access new market opportunities in creative industries	0.775
RIE4: AI supports the seamless integration of sustainable practices into our creative workflows	0.707
<i>ARO: AI-driven resource optimization (α = 0.795, CR = 0.867, AVE = 0.621)</i>	
ARO1: AI optimizes material and resource use in our creative projects	0.806
ARO2: AI-driven predictive maintenance reduces unplanned downtime and enhances creative operational efficiency	0.797
ARO3: Our supply chains for creative production have become more efficient through AI-powered optimization	0.856
ARO4: AI-based systems actively contribute to waste minimization in our creative processes	0.683
<i>AES: AI-enhanced environmental sustainability (α = 0.691, CR = 0.766, AVE = 0.452)</i>	
AES1: AI systems help reduce energy consumption in our creative production processes	0.717
AES2: AI has improved water management efficiency in our creative operations	0.707
AES3: Our AI systems are fundamental in minimizing environmental waste across our creative projects	0.561
AES4: Having real-time data from AI helps lower our creative projects’ environmental footprint	0.691
<i>SLA: Self-learning and adaptability of AI-enabled creative business models (α = 0.700, CR = 0.819, AVE = 0.537)</i>	
SLA1: Our AI systems autonomously adapt to new challenges in creative projects	0.527
SLA2: AI tools are designed for self-learning and continuous improvement based on feedback from creative projects	0.779
SLA3: Our AI-driven creative business models evolve independently without manual intervention	0.767
SLA4: AI technologies in our organization self-adjust and repair in response to unforeseen creative workflow issues	0.821
<i>SCC: Stakeholder collaboration and co-creation (α = 0.727, CR = 0.832, AVE = 0.560)</i>	
SCC1: AI tools strengthen collaboration with stakeholders across creative industries	0.772
SCC2: We use AI platforms to co-create innovative products and services with external partners	0.542
SCC3: AI improves resource and data sharing with our creative collaborators	0.833
SCC4: AI enhances stakeholder engagement quality throughout all stages of our creative projects	0.810
Note(s): α = Cronbach’s alpha, CR = composite reliability, AVE = average variance extracted. Outer loadings are taken from Figure 2	

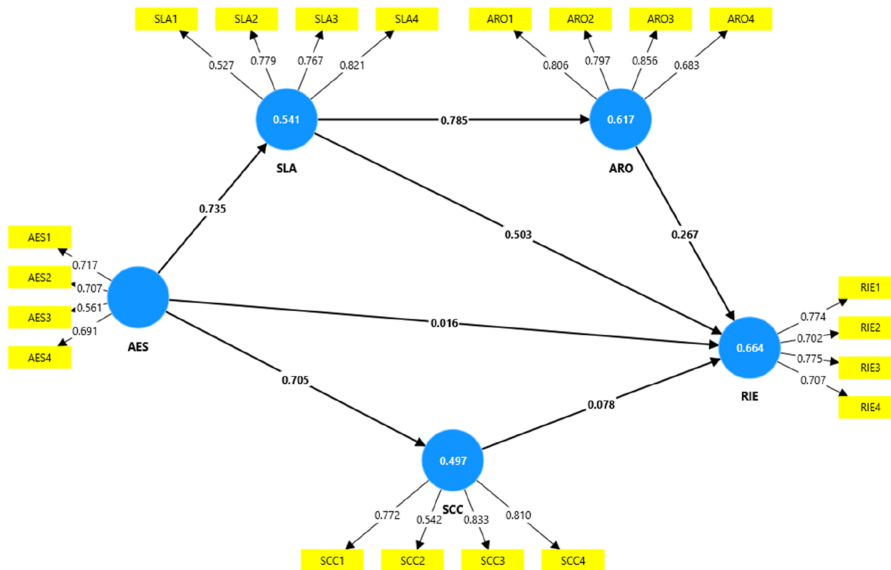


Figure 2. Path coefficients in the structural model. Note. SmartPLS software output

Moreover, the AVE value for AI-enhanced environmental sustainability was 0.452, which was slightly below the recommended minimum value of 0.50. According to the methodological literature (Hair *et al.*, 2021), in exploratory studies, indicators with loadings above 0.40 may be retained if they are theoretically important and their removal does not meaningfully improve the model’s explanatory power. Because AI-enhanced environmental sustainability was a core construct in our framework and because the slightly lower AVE resulted from one indicator with a moderate loading (0.561), we retained all items to preserve content validity and theoretical coverage.

The outer loading for each indicator represents the regression weight or coefficient that measures the strength of the association between the indicator and its corresponding reflective latent construct. The deployment of AI systems that help reduce energy consumption in creative production processes (AES1: outer loading = 0.717) had the highest impact on AI-enhanced environmental sustainability (AES). The efficiency improvement of supply chains for creative production through AI-powered optimization (ARO3: outer loading = 0.856) had the highest impact on AI-driven resource optimization (ARO). The improvement in resource and data sharing with creative collaborators facilitated by AI (SCC3: outer loading = 0.833) had the highest impact on stakeholder collaboration and co-creation (SCC). The ability of AI technologies in organizations to self-adjust and repair in response to unforeseen creative workflow issues (SLA4: outer loading = 0.821) had the highest impact on the self-learning and adaptability of AI-enabled creative business models (SLA). The capability of AI to identify and access new market opportunities in creative industries (RIE3: outer loading = 0.775) had the highest impact on the regenerative innovation ecosystem (RIE), highlighting AI’s role in expanding market potential and fostering innovation in creative industries.

The results for the structural model demonstrated that the self-learning and adaptability of AI-enabled creative business models had the strongest impact on AI-driven resource optimization, with a path coefficient of 0.785. This effect was followed by AI-enhanced environmental sustainability, which significantly influenced self-learning and adaptability, with a path coefficient of 0.735. The lowest impact on the regenerative innovation ecosystem

corresponded to AI-enhanced environmental sustainability, with a path coefficient of 0.016. This impact was minimal compared to the effects of other constructs, underscoring the need for complementary factors such as adaptability and collaboration to drive regenerative innovation ecosystems in creative industries.

The AI-enhanced environmental sustainability variable explained 54.1% of the variation in the self-learning and adaptability of AI-enabled creative business models (R -square = 0.541), as well as 49.7% of the variation in stakeholder collaboration and co-creation (R -square = 0.497). Self-learning and adaptability of AI-enabled creative business models explained 61.7% of the variation in AI-driven resource optimization (R -square = 0.617). In turn, AI-driven resource optimization, the self-learning and adaptability of AI-enabled creative business models, AI-enhanced environmental sustainability, and stakeholder collaboration and co-creation explained 66.4% of the variation in regenerative innovation ecosystem development (R -square = 0.664).

The square root of the AVE for each construct exceeded its highest correlation with any other construct (shown under the main diagonal) in almost all cases. The one exception is found in the first column of Table 4, at the intersection between AI-enhanced environmental sustainability and the self-learning and adaptability of AI-enabled creative business models. This result confirms the discriminant validity of the latent variables, according to the Fornell–Larcker criterion (Table 4).

Discriminant validity in the reflective measurement model was also confirmed by the heterotrait-monotrait ratio of correlations (HTMT) because most of the pairs of latent variables were below the maximum threshold of 0.85 (Table 5).

Although most HTMT values remained below the maximum recommended value of 0.85, the self-learning and adaptability of AI-enabled creative business models exceeded this threshold in its relationship with AI-enhanced environmental sustainability. This result indicates potential conceptual overlap between these two constructs because the self-learning

Table 4. Discriminant validity of the structural model (Fornell-Larcker criterion)

	AES	ARO	RIE	SCC	SLA
AES	0.672				
ARO	0.637	0.788			
RIE	0.626	0.732	0.740		
SCC	0.605	0.766	0.715	0.748	
SLA	0.735	0.785	0.735	0.718	0.733

Note(s): SmartPLS software output. SLA – self-learning and adaptability of AI-enabled creative business models; ARO – AI-driven resource optimization; AES – AI-enhanced environmental sustainability; SCC – stakeholder collaboration and co-creation; RIE – regenerative innovation ecosystem

Table 5. Discriminant validity of the model (HTMT)

	AES	ARO	RIE	SCC	SLA
AES					
ARO	0.824				
RIE	0.853	0.844			
SCC	0.836	0.821	0.825		
SLA	1.147	0.838	0.813	0.795	

Note(s): SmartPLS software output. SLA – self-learning and adaptability of AI-enabled creative business models; ARO – AI-driven resource optimization; AES – AI-enhanced environmental sustainability; SCC – stakeholder collaboration and co-creation; RIE – regenerative innovation ecosystem

and adaptability of AI-enabled creative business models may inherently include aspects of environmental adaptability captured by AI-enhanced environmental sustainability.

4.2 Hypothesis testing

PLS-SEM employs a nonparametric bootstrap method to assess the significance of path coefficients within the structural model. During the bootstrapping process, 5,000 subsamples were randomly drawn from the original data set with replacements. Table 6 summarizes the hypothesis testing process, focusing on the *p* values and *t*-statistics associated with the relationships among all latent variables in the structural model.

The results support H1, as indicated by the high *t*-statistic (15.109) and the *p* value of 0.001. Thus, adopting AI to enhance environmental sustainability has a significant positive impact on the adaptability and self-learning capabilities of AI-enabled creative business models.

H2 is also supported, with a *t*-statistic of 20.837 and a *p* value close to 0.000. This result underscores the importance of self-learning and adaptability of AI-enabled creative business models in minimizing waste and maximizing resource efficiency in creative industries.

H3 is also supported, with a *t*-statistic of 2.552 and a *p* value of 0.011. Although the strength of the relationship is moderate compared to the results for H1 and H2, it still confirms the role of resource optimization in developing regenerative ecosystems that prioritize sustainability and collaboration in creative industries.

H4 is supported, as reflected by the *t*-statistic of 13.222 and the *p* value of 0.001. AI's contributions to environmental sustainability significantly improve collaboration and co-creation among stakeholders, probably through shared goals around sustainable and innovative practices.

The results do not support H5, given its low path coefficient (0.078), small *t*-statistic (0.472), and nonsignificant *p* value (0.637). Even though stakeholder collaboration and co-creation may be important, it may not directly drive the development of regenerative ecosystems without the influence of other variables such as the self-learning and adaptability of AI-enabled creative business models or AI-driven resource optimization.

H6 is supported, with a *t*-statistic of 2.681 and a *p* value of 0.007. This result highlights the mediating role of the self-learning and adaptability of AI-enabled creative business models, indicating that environmental sustainability efforts rely on adaptable AI systems to effectively drive regenerative innovation ecosystems in creative industries.

H7 is not supported, as indicated by the *t*-statistic of 0.464 and the nonsignificant *p* value (0.642). Thus, stakeholder collaboration and co-creation does not appear to mediate the relationship between AI-enhanced environmental sustainability and the regenerative

Table 6. Hypothesis testing results

Hypothesis path	Path coefficient	Sample mean	SD	<i>t</i> -statistic	<i>p</i> -value
H1: AES → SLA	0.735	0.740	0.049	15.109	0.001*
H2: SLA → ARO	0.785	0.790	0.038	20.837	0.000*
H3: ARO → RIE	0.267	0.262	0.105	2.552	0.011*
H4: AES → SCC	0.705	0.710	0.053	13.222	0.001*
H5: SCC → RIE	0.078	0.085	0.165	0.472	0.637
H6: AES → SLA → RIE	0.370	0.366	0.138	2.681	0.007*
H7: AES → SCC → RIE	0.055	0.060	0.118	0.464	0.642
H8: SLA → ARO → RIE	0.210	0.207	0.084	2.497	0.013*

Note(s): SmartPLS software output. *Statistically significant relationship. SLA – self-learning and adaptability of AI-enabled creative business models; ARO – AI-driven resource optimization; AES – AI-enhanced environmental sustainability; SCC – stakeholder collaboration and co-creation; RIE – regenerative innovation ecosystem

innovation ecosystem. One explanation for this result is that sustainability initiatives in creative industries are often incremental, focusing on efficiency or compliance rather than systemic regeneration.

Finally, H8 is supported, with a t -statistic of 2.497 and a p value of 0.013. This result further highlights the idea that resource optimization serves as a powerful mechanism to enable adaptive and self-learning AI systems to contribute to regenerative innovation ecosystems. This result underscores the interconnections among the self-learning and adaptability of AI-enabled creative business models, AI-driven resource optimization, and the development of the regenerative innovation ecosystem.

5. Discussion

Our paper highlights AI's capacity to drive regenerative innovation ecosystem development through environmental sustainability, resource optimization, and adaptive AI-enabled business models. Along these lines, [Alzoubi and Mishra \(2024\)](#) reported the role of green AI initiatives, focusing on reducing the carbon footprint of AI systems and promoting sustainable energy use.

Our findings emphasize the impact of AI on optimizing resource use and integrating adaptive business models tailored to sustainability. Our findings are in line with those of [Anantrasirichai and Bull \(2022\)](#), who reported AI's capacity to improve productivity and support creative processes through machine learning techniques applied across content creation, content enhancement, and post-production workflows.

Our findings are aligned with those of [Drupsteen and Wakkee \(2024\)](#), who reported that regenerative business models entail comprehensive approaches, encompassing not only environmental restoration but also social and stakeholder well-being. However, the scope of the two studies differs. Our research focuses specifically on regenerative innovation ecosystems in creative industries, emphasizing co-creation, adaptive business models, and industry-specific applications. In contrast, [Drupsteen and Wakkee \(2024\)](#) adopted a broader, conceptual exploration of regenerative business models across various sectors, aiming to establish a holistic theoretical framework.

Our paper emphasizes AI's contribution to uncovering the pillars of regenerative ecosystems and the factors driving sustainable innovation in creative industries. Similarly, [Erickson \(2024\)](#) highlighted how AI enables new creative expressions and enhances ideation, while emphasizing the labor-intensive nature of AI-assisted production. However, there are key differences in the framing and focus of the two studies. Our research focuses on the systemic integration of AI in creative industries, emphasizing its regenerative potential. In contrast, [Erickson \(2024\)](#) focused on the socioeconomic and labor implications of AI adoption. In particular, Erickson centered on AI-assisted production and the risks of deskilling and displacement in certain creative tasks but did not consider the regenerative potential of AI.

Whereas our study focuses specifically on the role of regenerative ecosystems in creative industries, [Konietzko et al. \(2023\)](#) provided a broader, cross-sector framework for regenerative business models, differentiating them from sustainable and circular models. Furthermore, [Yadav and Yadav \(2024\)](#) also adopted a cross-sector perspective, presenting four archetypes of regenerative innovation: urban transformation, technological innovation, responsible innovation, and business model innovation. They thus offered a macro-level analysis of regenerative practices, which differs from our study goals and findings.

Our research builds on and expands the work of [de Andreis et al. \(2024\)](#) by also exploring sustainable business models and the adoption of AI to promote sustainability. Whereas [de Andreis et al. \(2024\)](#) highlighted AI's potential to optimize resource use and enhance sustainable practices, our study further explores the antecedents of regenerative innovation ecosystems in creative industries, empirically validating a conceptual model that considers the combined use of co-creation, adaptive business strategies, and ecosystem-wide collaboration to achieve sustainability goals.

The lack of support for H5 (stakeholder collaboration and co-creation → development of regenerative innovation ecosystems) suggests that collaboration, while valuable, may not directly drive regenerative ecosystems unless it is embedded in complementary mechanisms such as adaptive business models and resource optimization. This finding is in line with those of Hahn and Tampe (2021), who reported that regenerative strategies require the systemic integration of capabilities rather than isolated efforts. Similarly, Dewick *et al.* (2019) noted that regulatory and contextual conditions often mediate whether collaborative practices can scale into regenerative eco-innovations.

The nonsignificance of H7 (AES → SCC → RIE) also underscores unresolved tensions in how environmental sustainability efforts translate into regenerative outcomes through collaboration. Although sustainability initiatives encourage cooperation, they often remain incremental and compliance driven, falling short of the systemic transformations needed for regeneration (Yunibandhu and Hallinger, 2025). Prior studies of cultural and creative industries likewise caution that AI-enabled innovations must be combined with organizational change to deliver meaningful outcomes (Gurel, 2025; Li *et al.*, 2024). Taken together, these findings suggest that the pathway from sustainability and collaboration to regeneration is not straightforward but instead requires reinforcing mechanisms such as business model reconfiguration and long-term capability building based on regenerative AI.

5.1 Theoretical implications

AI is heralded as a transformative enabler of sustainability, capable of addressing systemic environmental challenges by driving predictive analytics, resource optimization, and energy efficiency. Resilience theory emphasizes the need for adaptive, systems-based approaches to cope with such transformations. This study corroborates the notion that regenerative innovation requires interconnected constructs such as AI-enhanced environmental sustainability, the self-learning and adaptability of AI-enabled creative business models, and AI-driven resource optimization to build systems that are both adaptive and resilient. The mediating roles of the self-learning and adaptability of AI-enabled creative business models and AI-driven resource optimization underscore the importance of systemic interdependencies in achieving regenerative goals.

The regenerative innovation ecosystem concept integrates sustainability principles with systems-thinking approaches. The study's results demonstrate that AI technologies, particularly when applied to resource optimization and environmental sustainability, significantly contribute to meeting regenerative goals.

Self-learning AI models, inspired by the concepts of neuroplasticity and cellular repair, adapt dynamically to new challenges and continuously improve performance. The results confirm the mediating role of the self-learning and adaptability of AI-enabled creative business models in the relationship between AI-enhanced environmental sustainability and regenerative innovation ecosystem development. This finding implies that adaptability and learning in AI systems enhance their ability to introduce sustainable practices and support regenerative ecosystems.

The findings on the regenerative innovation ecosystem can be metaphorically illustrated by drawing parallels with Archimedes' principle. The dynamics of buoyancy are analogous to the way that innovation ecosystems interact with sustainability, adaptability, and collaboration. Building on Archimedes' principle, an organization immersed in a regenerative innovation ecosystem displaces resources and efforts that then provide upward support (e.g., innovation, sustainability, and collaboration). The volume displaced corresponds to the organization's contributions to regenerative practices such as resource optimization and sustainable innovation. In the regenerative innovation ecosystem, the buoyant force is the regenerative capacity of the ecosystem. Organizations with heavy (large) environmental footprints may sink in a regenerative ecosystem as they fail to align themselves with sustainability principles. Conversely, adaptive, innovative, and sustainable organizations will float thanks to their alignment with the ecosystem's regenerative capabilities.

5.2 Practical implications

The findings of this study have practical implications for creative industry organizations, particularly in relation to using AI technologies to drive sustainability, adaptability, and collaboration within regenerative innovation ecosystems. These implications are especially relevant for policymakers, business leaders, and creative professionals who aim to leverage innovation with regenerative principles.

The study outlines the importance of AI-enhanced environmental sustainability as a key driver of regenerative innovation ecosystems. Applications of AI technologies such as predictive analytics, resource optimization, and energy-efficient systems enable creative organizations to reduce their environmental footprint.

The findings highlight the importance of self-learning and adaptability in creating AI-enabled business models that evolve autonomously to meet dynamic creative industry demands. Organizations are advised to invest in AI systems capable of iterative learning and self-repair, enabling them to continuously enhance their creative processes, innovate efficiently, and remain competitive.

The study demonstrates the role of stakeholder collaboration and co-creation in fostering innovation and shared value creation. Creative organizations should harness AI-driven collaborative tools to build robust ecosystems where diverse actors contribute to regenerative innovation.

The mediating role of AI-driven resource optimization in the relationship between adaptability and regenerative ecosystems highlights the importance of building resilient operational models. Businesses managers should capture the opportunities created by AI to predict maintenance needs, optimize supply chains, and ensure operational continuity, even in volatile environments.

6. Conclusions

This study contributes meaningfully to the understanding of how AI can drive sustainable and regenerative practices in creative industries. The study offers a comprehensive framework for aligning innovation with sustainability and adaptability. This framework is based on the integration of key constructs such as AI-enhanced environmental sustainability, AI-driven resource optimization, the self-learning and adaptability of AI-enabled creative business models, stakeholder collaboration and co-creation, and the regenerative innovation ecosystem. The findings empirically validate the relationships among these constructs, highlighting the enabling role of AI as a driver of regenerative innovation.

This research advances the existing knowledge in several ways. First, it introduces a novel conceptual framework linking AI-driven technologies to regenerative innovation ecosystems. It thus bridges the gap between theoretical discussions on sustainability and practical applications in creative industries. Second, it provides empirical evidence on the mediating roles of the self-learning and adaptability of AI-enabled creative business models and AI-driven resource optimization, emphasizing their importance in translating AI's potential into tangible innovation and regeneration outcomes. Third, the study underscores the importance of stakeholder collaboration. It demonstrates how AI platforms facilitate co-creation and resource-sharing, while highlighting the need for complementary factors to maximize their impact on regenerative ecosystems.

Ultimately, the study emphasizes the transformative potential of AI as a catalyst for transitioning creative industries from sustainability-focused models to fully regenerative ecosystems. Creative industry stakeholders are invited to explore these insights by adopting strategies that integrate AI into their business models to foster sustainability and regeneration. Creative enterprises are encouraged to implement AI-driven resource optimization tools to reduce material and energy consumption, adopt self-learning systems that allow business models to adapt dynamically to environmental and market changes, and use collaborative AI platforms to enhance co-creation with stakeholders across the value chain.

At the policy level, the findings of this study highlight the importance of creating supportive frameworks that enable the integration of AI into regenerative practices across creative industries. Policymakers should co-create solutions to foster cross-sector participation by providing incentives for the adoption of sustainable AI solutions and establishing guidelines on how to leverage technological innovation to meet ecological and social objectives.

Despite its contributions, the study has several limitations. The primary limitation lies in the reliance on self-reported data, which may introduce certain biases. Additionally, the sample is geographically restricted to five European countries, which may limit the generalizability of the findings to other cultural contexts. The study also focuses somewhat narrowly on creative industries. Although its insights may have broader applicability, further research is needed to test the framework in other sectors.

This study opens several avenues for future research. First, longitudinal studies are needed to explore the dynamic relationships among the constructs over time, particularly as AI technologies evolve and new sustainability challenges emerge. Second, future research could expand the geographical scope to include diverse cultural and industrial settings, enabling a global understanding of how AI influences regenerative innovation ecosystems. Third, qualitative studies are needed to complement these quantitative findings. Such studies could provide deeper insights into how organizations implement AI-driven practices and cope with the challenges involved. Our framework focused on four main constructs. Future research could extend it by adding variables such as regulatory frameworks, ethical AI adoption, and cultural dynamics, which recent scholarship has shown to be critical for systemic regeneration.

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