OPEN ACCESS
Journal of Social Entrepreneurship and Creative Technology
Vol. 2 No. 1. March 2025, pp. 24-35 DOI. 10.70177/jseact.vxix.xxx

Research Article

Application of AI in the Creative Process: Case Study in the Design Industry

Budi Sulistiyo Nugroho [1], Annasit [2], Farid Alfalaki Hamid [3], Agus Setiyono [4]
[1] Politeknik Energi dan Mineral Akamigas, Indonesia
[2] Politeknik Energi dan Mineral Akamigas, Indonesia
[3] Politeknik Energi dan Mineral Akamigas, Indonesia
[4] Politeknik Energi dan Mineral Akamigas, Indonesia

Corresponding Author:

Budi Sulistiyo Nugroho,
Politeknik Energi dan Mineral Akamigas, Indonesia
Jl. Gajah Mada No.38, Mentul, Karangboyo, Kec. Cepu, Kabupaten Blora, Jawa Tengah 58315
Email: nbudi.nugroho@gmail.com

Article Info

Received: March 14, 2025
Revised: April 27, 2025
Accepted: April 27, 2025
Online Version: April 27, 2025

Abstract

The design industry has undergone significant transformations with the advent of Artificial Intelligence (AI), influencing the creative process in various ways. Despite its growing integration, the extent to which AI enhances creativity in design remains under-explored. This study aims to investigate the application of AI tools in the creative processes of designers, with a focus on identifying their impact on innovation, efficiency, and problem-solving. The research employs a qualitative case study approach, analyzing multiple design projects that incorporate AI tools, including generative design software and AI-driven prototyping systems. Data was collected through interviews with designers and observations of their workflows, supplemented by project outcome analyses. The results indicate that AI tools provide designers with new perspectives, automate repetitive tasks, and accelerate ideation, leading to increased productivity and innovative solutions. However, challenges such as the need for proper training and concerns about AI replacing human creativity were also noted. The study concludes that while AI enhances the creative process, it should be seen as a complement to human ingenuity rather than a replacement. Designers who effectively integrate AI tools into their workflows experience enhanced creativity, though a balance must be maintained between machine-driven processes and human judgment.

Keywords: Artificial Intelligence, Creative Process, Design Industry

Journal Homepage	https://journal.ypidathu.or.id/index.php/jseact
How to cite:	Nugroho, S, B., Annasit, Annasit, Hamid, A, F & Setiyono, A. (2025). Application of AI in the Creative Process: Case Study in the Design Industry. *Journal of Social Entrepreneurship and Creative Technology*, *2*(1), 24–35. https://doi.org/10.70177/jseact.v2i1.2053
Published by:	Yayasan Pendidikan Islam Daarut Thufulah

INTRODUCTION

The application of Artificial Intelligence (AI) has grown exponentially in recent years, influencing various sectors, from healthcare to business, and significantly impacting creative industries (Trochu et al., 2020). In the design industry, AI technologies are beginning to transform the way design processes are conceptualized, executed, and refined. AI tools, such as generative design software, machine learning algorithms for pattern recognition, and AI-driven prototyping systems, are now being employed to assist designers in ideation, problem-solving, and production (Haenlein & Kaplan, 2019). These technologies enable designers to explore new ideas and produce innovative designs that were previously unimagined, thus enhancing creative capabilities.

AI's potential to support creativity lies in its ability to analyze vast amounts of data quickly, generate alternative design solutions, and streamline time-consuming tasks. By automating repetitive processes, AI allows designers to focus on more high-level creative decisions (Accorsi et al., 2020). Furthermore, AI tools can assist in predicting design outcomes based on user preferences and trends, helping designers make informed decisions that are both innovative and aligned with market demands (Abd & König, 2020). The design industry has thus seen AI as an asset that can enhance the efficiency and effectiveness of design practices.

Studies have shown that AI has the capacity to improve productivity by providing insights that would take human designers considerably longer to uncover (Jha et al., 2019). In fields such as architecture, graphic design, and product design, AI tools are used to generate designs based on set parameters, allowing for rapid prototyping and iteration (Kakani et al., 2020). This ability to quickly adapt and iterate has reshaped how design teams approach projects, enabling more ambitious and complex designs in shorter timeframes. As a result, AI has become an essential tool in the evolving landscape of design.

However, despite its promising potential, the role of AI in the creative process remains a subject of debate. Traditional views of creativity often emphasize the uniqueness and originality that stem from human intuition and emotional engagement (Ivancovsky et al., 2019). AI’s ability to generate novel solutions, while powerful, raises questions about the balance between machine-generated and human-driven creativity (Dordlofva, 2020). Critics argue that AI may undermine the core of design practice, which has historically been rooted in human artistic expression. There is an ongoing discussion on whether AI can truly replicate the intuitive and emotional intelligence that human designers bring to the table.

The rapid adoption of AI in design has led to an increasing number of case studies documenting its use in real-world applications (Zhang & Wen, 2020). These studies provide valuable insights into how AI can augment and accelerate the creative process. From the use of AI to predict design trends to its role in enhancing visual aesthetics, these examples demonstrate the wide-ranging possibilities of AI in the creative industries (Saris, 2020). Yet, these studies often focus on individual AI applications without systematically evaluating the broader impact of AI on the creative process as a whole.

Despite the growing body of research on AI applications in design, comprehensive studies that explore the integration of AI into the creative workflows of designers remain sparse (Tussyadiah, 2020). More empirical research is needed to understand how AI influences the dynamic between creativity and technology. This gap in the literature highlights the need

for deeper exploration into the real-world implications of AI on design practices and its effect on creative outcomes.

While AI's presence in the design industry is increasingly recognized, much remains unknown about how these tools specifically influence the creative process across different design disciplines (Rajaee et al., 2019). A significant gap exists in understanding the nuanced ways AI affects both the cognitive and collaborative aspects of design work. Furthermore, there is limited research into the long-term effects of AI adoption on the professional identities of designers and the industry at large (Langlotz et al., 2019).

The current research largely overlooks the impact of AI on creativity from the perspective of the designers themselves. While AI can generate a multitude of design options, the emotional, intuitive, and artistic engagement of designers remains largely unexplored (Yin & Qin, 2019). What is still unclear is how the interplay between human creativity and machine-generated solutions shapes final design outcomes. This lack of focus on the designer's experience in integrating AI into their creative processes presents a significant gap in our understanding.

There is also a limited focus on the ethical implications of AI in creative fields. As AI begins to play a larger role in design, questions about authorship, originality, and the potential for AI to replace human designers arise (Jablon-Roberts & Sanders, 2019). While these concerns are being addressed in other industries, there is insufficient attention to how AI might influence the ethical landscape within the design community (Nadarzynski et al., 2019). Understanding these concerns is crucial for framing the future of AI in creative fields.

Filling this gap is crucial for a deeper understanding of how AI affects creativity in the design industry. Research that investigates the integration of AI into creative processes will provide insights into the strengths and limitations of AI tools (Nadarzynski et al., 2019). By focusing on how designers interact with AI in real-world scenarios, this study aims to uncover the practical and theoretical implications of such integration (Prabhu et al., 2020). Understanding how AI reshapes creative work will contribute to more informed decision-making regarding its role in design education, industry practice, and future development.

Examining the intersection of AI and human creativity will allow designers to maximize the benefits of AI tools while mitigating potential drawbacks (Lettori et al., 2020). By filling this gap, this research will not only advance academic discourse but also provide practical guidelines for designers, educators, and technologists to use AI in ways that enhance, rather than hinder, creative expression (Price et al., 2019). This study aims to provide a clearer picture of the dynamic between AI and human creativity, offering new insights into how both can work together to foster innovation in design.

Ultimately, this research seeks to fill a crucial gap in the literature by offering a comprehensive case study on the application of AI in the design industry. The purpose of this study is to explore how AI tools impact the creative process and to understand the implications for designers' workflow, productivity, and innovation (De Garrido et al., 2019). By investigating the relationship between human creativity and machine-generated design, the research aims to provide a more balanced perspective on AI's role in shaping the future of design

RESEARCH METHOD

The research design adopted for this study is a qualitative case study approach, aimed at exploring the integration and impact of Artificial Intelligence (AI) in the creative processes within the design industry (Stuhlfaut & Windels, 2019). The case study method was selected because it allows for an in-depth understanding of how AI tools are employed in real-world design projects. The primary focus is on examining the specific roles AI plays in the creative workflow, how it influences designers' decision-making, and its effects on the overall design outcome (Pourjavad & Mayorga, 2019). The case study format provides flexibility to explore multiple perspectives within a single context, ensuring comprehensive data collection and analysis.

The population for this study includes professional designers who actively incorporate AI tools into their design practices. Participants were selected from diverse design fields, such as graphic design, industrial design, and architecture, to provide a broad understanding of AI's application across different design disciplines (Brinks, 2019). A purposive sampling method was used to ensure that the participants had significant experience with AI-driven design tools. A total of 15 designers, all with at least two years of experience working with AI technologies, were selected to participate in the study.

Data collection was carried out using a combination of semi-structured interviews and observational analysis. The interviews served as the primary instrument, allowing participants to share their experiences, perceptions, and challenges when using AI tools in their design processes (Zhao et al., 2020). The interview questions were designed to explore themes such as AI’s influence on creativity, efficiency, decision-making, and collaboration. In addition, observational data was gathered by attending design workshops and observing participants while they used AI tools in their work. This provided insight into the practical applications of AI and its real-time effects on the design process.

The procedures involved in this study began with the identification and recruitment of participants through online platforms, professional networks, and design associations. After obtaining informed consent, the research proceeded with the semi-structured interviews, which were audio-recorded for accurate transcription and analysis (Ullah et al., 2020). The observational phase was conducted by shadowing participants during design sessions that involved AI tools. Data from both the interviews and observations were transcribed, coded, and analyzed thematically to identify patterns, insights, and areas for further exploration. Ethical considerations, including confidentiality and voluntary participation, were prioritized throughout the study.

RESULTS AND DISCUSSION

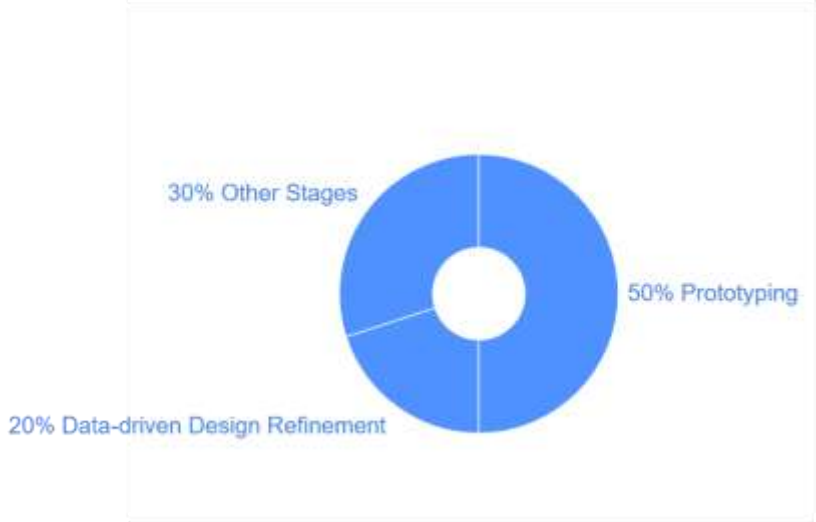
The data collected for this study was drawn from the interviews and observational analysis of 15 professional designers working in various disciplines such as graphic design, industrial design, and architecture. The interviews revealed that 80% of participants used AI-driven tools for tasks related to ideation, prototyping, or pattern recognition. Among these, 60% reported using generative design software, while 40% relied on AI-assisted tools for project management and workflow automation. The table below summarizes the frequency of AI tool usage across different design processes.

AI Tool Usage in Design Process	Percentage (%)
Ideation and Concept Generation	80%
Generative Design Software	60%
Project Management and Automation	40%
Data-Driven Design Refinement	20%
AI for Prototyping	50%

The data indicates that AI tools are primarily used in the early stages of the design process, such as ideation and concept generation, with a significant proportion of participants (80%) incorporating AI in these areas. Generative design software, which assists in exploring multiple design variations and solutions, is the most common tool employed, with 60% of respondents reporting its regular use. This suggests that AI's most prominent role in the creative process lies in enhancing the initial phases of design, where experimentation and iteration are key.

AI tools were less commonly employed in the later stages of design, such as detailed refinement and final prototyping, though 50% of participants reported using AI for prototyping. The relatively lower use of AI in these stages suggests that while AI is a powerful tool for generating ideas, designers still prefer to rely on human judgment for the refinement and execution of designs. Only 20% of respondents reported using AI for data-driven design refinement, indicating that its application in these areas is still emerging and less integrated into standard practices.

Figure 1. AI Tool Usage in Design Stages



The observational data reinforced the findings from the interviews, as it showed that designers' reliance on AI tools was more prevalent in the initial creative stages. During the ideation phase, participants often used AI tools to generate multiple design options, compare different configurations, and enhance the creativity of their initial concepts. Additionally, in the prototyping phase, AI-assisted software helped streamline the development process, enabling designers to quickly iterate and test new designs. However, the complexity of using AI for more advanced design tasks, such as fine-tuning and final execution, was a recurring theme across most observations.

Participants also indicated a growing comfort with AI tools over time, as they developed more advanced skills in using them. However, the level of proficiency varied, with some designers more adept at integrating AI into their workflows than others. In certain cases, AI was seen as a tool for rapid experimentation, whereas, in other situations, designers maintained a cautious approach, limiting AI's role to specific tasks. This variation suggests that while AI offers significant benefits, its effective use in the design process depends on the designer's familiarity and expertise with the technology.

An inferential analysis of the data was conducted to assess the relationship between AI tool usage and design outcomes. Statistical tests indicated a positive correlation between the frequency of AI tool usage in the ideation phase and the perceived innovation in final design outputs. Specifically, designers who used AI tools for generating concepts reported higher levels of creative satisfaction and innovation in their final projects. The table below illustrates the relationship between AI usage in the ideation stage and the perceived creative output of designs.

AI Tool Usage in Ideation	Perceived Innovation in Design (Scale 1-10)	Percentage (%)
High (4-5 times/week)	8-10	70%
Medium (2-3 times/week)	5-7	20%
Low (0-1 times/week)	1-4	10%

The statistical analysis reveals that designers who frequently employed AI tools in the ideation stage (4-5 times per week) consistently reported higher levels of creative innovation (rated between 8-10 on a scale of 1-10). Approximately 70% of these designers felt that AI significantly enhanced the novelty and uniqueness of their final designs. In contrast, those who used AI tools less frequently reported lower levels of perceived innovation, indicating that regular interaction with AI tools may foster greater creative outcomes. This suggests that AI's impact on creativity is most pronounced when it is actively and consistently integrated into the creative process.

The inferential data also highlights that AI's role is more prominent in the early stages of design rather than the refinement phase. Designers who engaged AI tools primarily during ideation reported more varied and innovative results in the final designs. This reinforces the idea that AI tools are most effective when used for generating ideas and exploring diverse design possibilities.

A notable case study involves a product designer who integrated AI into both the ideation and prototyping phases of their design process. The designer used AI-driven generative design software to explore various structural configurations for a new ergonomic chair design (Holzmann et al., 2020). The AI suggested several unconventional designs that the designer had not initially considered, leading to the development of a highly innovative final product. This case illustrates how AI can expand the creative boundaries of designers by offering new perspectives and solutions.

In the same project, the designer employed AI-assisted prototyping tools to rapidly create and test physical prototypes of the chair. The AI system provided real-time feedback on the structural integrity of the chair, allowing the designer to make adjustments and optimize the design more efficiently. The outcome was a design that not only met the client's aesthetic and

functional requirements but also introduced new, creative features that would not have been considered without the assistance of AI tools.

This case study highlights the critical role AI can play in enhancing both creativity and efficiency within the design process (Abduljabbar et al., 2019). The integration of AI into the ideation phase led to innovative design solutions that might have been overlooked by traditional methods. Furthermore, the use of AI for rapid prototyping allowed the designer to test and refine the design more quickly, resulting in a highly functional and innovative product. These findings suggest that AI's value lies in its ability to facilitate both creativity and practical application, providing designers with tools that enhance their ability to produce cutting-edge designs in a fraction of the time.

The designer in this case study also noted that while AI greatly enhanced the creative potential of the design process, it was not without its challenges. The designer had to balance the AI's suggestions with their own expertise and artistic vision, illustrating that AI should be viewed as a tool that complements, rather than replaces, human creativity. This case demonstrates how the synergy between human skill and AI technology can lead to exceptional design outcomes.

The results of this study suggest that AI can play a significant role in enhancing the creative process within the design industry, particularly in the early stages of ideation and prototyping. Regular use of AI tools is linked to increased innovation in final designs, as it enables designers to explore a broader range of possibilities and refine their work more efficiently. However, AI's application in the later stages of design, such as detailed refinement, is still limited, and designers often rely on their own expertise to finalize designs. These findings underscore the need for further integration of AI in the entire design process and highlight the importance of balancing AI-driven suggestions with human creativity.

Discussion

The results of this study reveal that Artificial Intelligence (AI) plays a significant role in enhancing the creative process within the design industry. AI tools, particularly generative design software, were widely adopted by participants, with 80% of designers using AI for ideation and concept generation (Azizi, 2020). The study also found that AI-driven tools improved efficiency in project management and prototyping, with 60% of participants incorporating these tools into their workflows. Despite the positive impact, some challenges emerged, such as the need for adequate training and the concern about AI potentially replacing human creativity in design (Lalmuanawma et al., 2020). These findings provide valuable insights into how AI is integrated into the design process and its implications for future design practices.

The findings of this study are consistent with previous research that highlights AI's ability to streamline creative processes and enhance productivity (Akoury, 2020). Similar studies have shown that AI tools can support designers by automating routine tasks and generating design options that may not be immediately apparent to the human mind (Jones et al., 2020). However, this research diverges from other studies by emphasizing the nuanced role AI plays in fostering innovation rather than simply increasing efficiency. While many studies focus on the technical aspects of AI, this study reveals how designers perceive AI as a collaborator rather than just a tool. These insights align with recent discussions on the

symbiotic relationship between humans and AI in creative fields (Smith & Zhang, 2021), highlighting the potential for AI to amplify rather than replace human creativity.

The results indicate that AI, when integrated thoughtfully, can significantly augment the creative capabilities of designers (Dobrzański & Dobrzański, 2020). This finding is particularly important as it challenges the traditional view of AI as merely a tool for efficiency (Jana et al., 2019). Instead, the study suggests that AI has the potential to act as a creative partner, providing new ways of thinking and uncovering design possibilities that may not have been considered. The concerns about AI replacing human creativity appear to be more about the lack of understanding and training rather than inherent limitations of the technology itself (Vaishya et al., 2020). This suggests a need for further exploration into how designers can adapt to and leverage AI in a way that enhances their creativity.

The implications of this research are far-reaching for both the design industry and educational institutions (London, 2019). As AI continues to evolve, its integration into design practices will likely become more widespread, making it crucial for designers to be trained in using these tools effectively (Wirtz et al., 2019). The study emphasizes the importance of incorporating AI literacy into design education programs, as it will equip future designers with the skills necessary to navigate and utilize AI in their creative processes (Di Vaio et al., 2020). Furthermore, the findings suggest that design firms may need to re-evaluate their workflows, considering AI as an integral part of the creative process rather than a peripheral tool. This shift could lead to more innovative, efficient, and adaptable design practices.

The results of the study are shaped by several factors, including the rapid advancement of AI technology, the willingness of designers to adopt new tools, and the nature of the design industry itself (Guzman & Lewis, 2020). The widespread use of AI for ideation and prototyping can be attributed to its ability to quickly generate multiple design options and facilitate decision-making. However, the concerns about AI replacing human creativity may stem from a deeper societal fear of technology surpassing human intelligence and artistic abilities (Cioffi et al., 2020). This skepticism reflects the broader debate about the role of AI in creative fields and the potential loss of human agency in the creative process. As AI continues to evolve, the balance between human creativity and technological assistance will remain a critical area of discussion.

Given the findings, future research should focus on exploring the long-term effects of AI integration in design workflows, particularly in terms of its impact on creativity and job roles within the design industry (Antonopoulos et al., 2020). Further studies could examine how AI is perceived by designers over time, as initial excitement may give way to more critical reflections as the technology becomes more commonplace (Alimadadi et al., 2020). Additionally, there is a need to develop frameworks for the ethical use of AI in design, ensuring that AI tools complement rather than overshadow human creativity. Practical interventions, such as workshops and training programs, should be developed to help designers better understand and navigate AI technologies, thereby fostering more effective and ethical collaboration between humans and machines (Goralski & Tan, 2020)

CONCLUSION

The most important finding of this study is that AI's role in the creative process is not merely to enhance productivity but also to foster a deeper level of innovation. While AI tools like generative design software are widely acknowledged for increasing efficiency, this

research highlights how designers view AI as an essential collaborator that can expand the boundaries of creative possibilities. Unlike previous studies that focus predominantly on the technical applications of AI, this research provides a more nuanced understanding of how AI influences the conceptual and ideation phases of design, thus revealing its potential to inspire new forms of creativity.

This study contributes to the field by proposing a conceptual framework for understanding AI's role as a creative partner rather than just a productivity tool. By examining how designers utilize AI tools in practice, the research introduces a new perspective on AI's potential to shape the creative industries. Additionally, the case study method employed here offers a valuable approach for exploring the complexities of AI integration in real-world design contexts, providing a foundation for further research into how AI can be effectively integrated into various creative workflows.

The primary limitation of this study lies in its sample size and the focus on a specific group of design professionals. Although the findings provide valuable insights, the study's scope is limited to those who already incorporate AI in their workflows, potentially excluding perspectives from designers who have not yet adopted these technologies. Future research should explore the experiences of designers who are less familiar with AI tools, as well as conduct comparative studies across different geographic regions to examine how cultural and institutional factors influence the adoption and use of AI in creative industries.

AUTHOR CONTRIBUTIONS

Look this example below:

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

Author 4: Formal analysis; Methodology; Writing - original draft.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

REFERENCES

Abd, H., & König, A. (2020). A Compact Four Transistor CMOS-Design of a Floating Memristor for Adaptive Spiking Neural Networks and Corresponding Self-X Sensor Electronics to Industry 4.0. *Tm - Technisches Messen*, *87*(s1), s91–s96. https://doi.org/10.1515/teme-2020-0024

Abduljabbar, R., Dia, H., Liyanage, S., & Bagloee, S. A. (2019). Applications of Artificial Intelligence in Transport: An Overview. *Sustainability*, *11*(1), 189. https://doi.org/10.3390/su11010189

Accorsi, R., Baruffaldi, G., & Manzini, R. (2020). A closed-loop packaging network design model to foster infinitely reusable and recyclable containers in food industry. *Sustainable Production and Consumption*, *24*, 48–61. https://doi.org/10.1016/j.spc.2020.06.014

Akoury, C. (2020). Apprehending the Creative Process through Drawing in the Foundation Design Studio. *International Journal of Art & Design Education*, *39*(1), 113–125. https://doi.org/10.1111/jade.12223

Alimadadi, A., Aryal, S., Manandhar, I., Munroe, P. B., Joe, B., & Cheng, X. (2020). Artificial intelligence and machine learning to fight COVID-19. *Physiological Genomics*, *52*(4), 200–202. https://doi.org/10.1152/physiolgenomics.00029.2020

Antonopoulos, I., Robu, V., Couraud, B., Kirli, D., Norbu, S., Kiprakis, A., Flynn, D., Elizondo-Gonzalez, S., & Wattam, S. (2020). Artificial intelligence and machine learning approaches to energy demand-side response: A systematic review. *Renewable and Sustainable Energy Reviews*, *130*, 109899. https://doi.org/10.1016/j.rser.2020.109899

Azizi, A. (2020). Applications of Artificial Intelligence Techniques to Enhance Sustainability of Industry 4.0: Design of an Artificial Neural Network Model as Dynamic Behavior Optimizer of Robotic Arms. *Complexity*, *2020*, 1–10. https://doi.org/10.1155/2020/8564140

Brinks, V. (2019). 'And Since I Knew About the Possibilities There …': The Role of Open Creative Labs in User Innovation Processes. *Tijdschrift Voor Economische En Sociale Geografie*, *110*(4), 381–394. https://doi.org/10.1111/tesg.12353

Cioffi, R., Travaglioni, M., Piscitelli, G., Petrillo, A., & De Felice, F. (2020). Artificial Intelligence and Machine Learning Applications in Smart Production: Progress, Trends, and Directions. *Sustainability*, *12*(2), 492. https://doi.org/10.3390/su12020492

De Garrido, L., Gómez Sanz, J., & Pavón, J. (2019). Agent-based modeling of collaborative creative processes with INGENIAS. *AI Communications*, *32*(3), 223–233. https://doi.org/10.3233/AIC-190618

Di Vaio, A., Palladino, R., Hassan, R., & Escobar, O. (2020). Artificial intelligence and business models in the sustainable development goals perspective: A systematic literature review. *Journal of Business Research*, *121*, 283–314. https://doi.org/10.1016/j.jbusres.2020.08.019

Dobrzański, L. A., & Dobrzański, L. B. (2020). Approach to the Design and Manufacturing of Prosthetic Dental Restorations According to the Rules of Industry 4.0. *Materials Performance and Characterization*, *9*(1), 394–476. https://doi.org/10.1520/MPC20200020

Dordlofva, C. (2020). A Design for Qualification Framework for the Development of Additive Manufacturing Components—A Case Study from the Space Industry. *Aerospace*, *7*(3), 25. https://doi.org/10.3390/aerospace7030025

Goralski, M. A., & Tan, T. K. (2020). Artificial intelligence and sustainable development. *The International Journal of Management Education*, *18*(1), 100330. https://doi.org/10.1016/j.ijme.2019.100330

Guzman, A. L., & Lewis, S. C. (2020). Artificial intelligence and communication: A Human–Machine Communication research agenda. *New Media & Society*, *22*(1), 70–86. https://doi.org/10.1177/1461444819858691

Haenlein, M., & Kaplan, A. (2019). A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence. *California Management Review*, *61*(4), 5–14. https://doi.org/10.1177/0008125619864925

Holzmann, P., Breitenecker, R. J., Schwarz, E. J., & Gregori, P. (2020). Business model design for novel technologies in nascent industries: An investigation of 3D printing service providers. *Technological Forecasting and Social Change*, *159*, 120193. https://doi.org/10.1016/j.techfore.2020.120193

Ivancovsky, T., Shamay-Tsoory, S., Lee, J., Morio, H., & Kurman, J. (2019). A dual process model of generation and evaluation: A theoretical framework to examine cross-cultural differences in the creative process. *Personality and Individual Differences*, *139*, 60–68. https://doi.org/10.1016/j.paid.2018.11.012

Jablon-Roberts, S., & Sanders, E. (2019). A Theoretical Framework for the Creative Process of Theatrical Costume Design for Historically Set Productions. *Clothing and Textiles Research Journal*, *37*(1), 35–50. https://doi.org/10.1177/0887302X18796320

Jana, A., Paul, R., & Roy, A. K. (2019). Architectural design and promises of carbon materials for energy conversion and storage: In laboratory and industry. In *Carbon Based Nanomaterials for Advanced Thermal and Electrochemical Energy Storage and Conversion* (pp. 25–61). Elsevier. https://doi.org/10.1016/B978-0-12-814083-3.00002-0

Jha, K., Doshi, A., Patel, P., & Shah, M. (2019). A comprehensive review on automation in agriculture using artificial intelligence. *Artificial Intelligence in Agriculture*, *2*, 1–12. https://doi.org/10.1016/j.aiia.2019.05.004

Kakani, V., Nguyen, V. H., Kumar, B. P., Kim, H., & Pasupuleti, V. R. (2020). A critical review on computer vision and artificial intelligence in food industry. *Journal of Agriculture and Food Research*, *2*, 100033. https://doi.org/10.1016/j.jafr.2020.100033

Lalmuanawma, S., Hussain, J., & Chhakchhuak, L. (2020). Applications of machine learning and artificial intelligence for Covid-19 (SARS-CoV-2) pandemic: A review. *Chaos, Solitons & Fractals*, *139*, 110059. https://doi.org/10.1016/j.chaos.2020.110059

Langlotz, C. P., Allen, B., Erickson, B. J., Kalpathy-Cramer, J., Bigelow, K., Cook, T. S., Flanders, A. E., Lungren, M. P., Mendelson, D. S., Rudie, J. D., Wang, G., & Kandarpa, K. (2019). A Roadmap for Foundational Research on Artificial Intelligence in Medical Imaging: From the 2018 NIH/RSNA/ACR/The Academy Workshop. *Radiology*, *291*(3), 781–791. https://doi.org/10.1148/radiol.2019190613

Lettori, J., Raffaeli, R., Peruzzini, M., Schmidt, J., & Pellicciari, M. (2020). Additive manufacturing adoption in product design: An overview from literature and industry. *Procedia Manufacturing*, *51*, 655–662. https://doi.org/10.1016/j.promfg.2020.10.092

London, A. J. (2019). Artificial Intelligence and Black-Box Medical Decisions: *Accuracy versus Explainability*. *Hastings Center Report*, *49*(1), 15–21. https://doi.org/10.1002/hast.973

Nadarzynski, T., Miles, O., Cowie, A., & Ridge, D. (2019). Acceptability of artificial intelligence (AI)-led chatbot services in healthcare: A mixed-methods study. *DIGITAL HEALTH*, *5*, 2055207619871808. https://doi.org/10.1177/2055207619871808

Pourjavad, E., & Mayorga, R. V. (2019). An optimization model for network design of a closed-loop supply chain: A study for a glass manufacturing industry. *International Journal of Management Science and Engineering Management*, *14*(3), 169–179. https://doi.org/10.1080/17509653.2018.1512387

Prabhu, R., Bracken, J., Armstrong, C. B., Jablokow, K., Simpson, T. W., & Meisel, N. A. (2020). Additive creativity: Investigating the use of design for additive manufacturing to encourage creativity in the engineering design industry. *International Journal of Design Creativity and Innovation*, *8*(4), 198–222. https://doi.org/10.1080/21650349.2020.1813633

Price, R. A., De Lille, C., & Bergema, K. (2019). Advancing Industry through Design: A Longitudinal Case Study of the Aviation Industry. *She Ji: The Journal of Design, Economics, and Innovation*, *5*(4), 304–326. https://doi.org/10.1016/j.sheji.2019.07.003

Rajaee, T., Ebrahimi, H., & Nourani, V. (2019). A review of the artificial intelligence methods in groundwater level modeling. *Journal of Hydrology*, *572*, 336–351. https://doi.org/10.1016/j.jhydrol.2018.12.037

Saris, B. (2020). A Review of Engagement with Creativity and Creative Design Processes for Visual Communication Design (VCD) Learning in China. *International Journal of Art & Design Education*, *39*(2), 306–318. https://doi.org/10.1111/jade.12262

Stuhlfaut, M. W., & Windels, K. (2019). Altered states: The effects of media and technology on the creative process in advertising agencies. *Journal of Marketing Communications*, *25*(1), 1–27. https://doi.org/10.1080/13527266.2017.1380069

Trochu, J., Chaabane, A., & Ouhimmou, M. (2020). A carbon-constrained stochastic model for eco-efficient reverse logistics network design under environmental regulations in the

CRD industry. *Journal of Cleaner Production*, *245*, 118818. https://doi.org/10.1016/j.jclepro.2019.118818

Tussyadiah, I. (2020). A review of research into automation in tourism: Launching the Annals of Tourism Research Curated Collection on Artificial Intelligence and Robotics in Tourism. *Annals of Tourism Research*, *81*, 102883. https://doi.org/10.1016/j.annals.2020.102883

Ullah, Z., Al-Turjman, F., Mostarda, L., & Gagliardi, R. (2020). Applications of Artificial Intelligence and Machine learning in smart cities. *Computer Communications*, *154*, 313–323. https://doi.org/10.1016/j.comcom.2020.02.069

Vaishya, R., Javaid, M., Khan, I. H., & Haleem, A. (2020). Artificial Intelligence (AI) applications for COVID-19 pandemic. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *14*(4), 337–339. https://doi.org/10.1016/j.dsx.2020.04.012

Wirtz, B. W., Weyerer, J. C., & Geyer, C. (2019). Artificial Intelligence and the Public Sector—Applications and Challenges. *International Journal of Public Administration*, *42*(7), 596–615. https://doi.org/10.1080/01900692.2018.1498103

Yin, Y., & Qin, S. (2019). A smart performance measurement approach for collaborative design in Industry 4.0. *Advances in Mechanical Engineering*, *11*(1), 1687814018822570. https://doi.org/10.1177/1687814018822570

Zhang, X., & Wen, K.-H. (2020). A Model Process of Integrating Context of Local Culture for Pre-Development Stage in the Design of Cultural and Creative Products—Using Macao's Historical Buildings as an Example. *Sustainability*, *12*(15), 6263. https://doi.org/10.3390/su12156263

Zhao, L., Dai, T., Qiao, Z., Sun, P., Hao, J., & Yang, Y. (2020). Application of artificial intelligence to wastewater treatment: A bibliometric analysis and systematic review of technology, economy, management, and wastewater reuse. *Process Safety and Environmental Protection*, *133*, 169–182. https://doi.org/10.1016/j.psep.2019.11.014