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APPLICATION STRATEGY ANALYSIS AND PRACTICAL SUGGESTIONS OF GENERATIVE AI IN SERVICE DESIGN

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ABSTRACT
A systematic literature review reveals that the role of AI tools in service design has been widely studied. Generative AI can significantly improve design efficiency in multiple stages of service design, specifically in service context, service demand insight, service design, and design execution. However, given the limitations of AI in emotional expression and complex decision-making, human participation in service design is still indispensable. In this context, the possible ways of AI-designer collaboration in each stage of service design are herein proposed, and future directions of research are put forward at the same time. It is asserted that a balance needs to be struck between efficiency and empathy and AI should serve as a complement instead of a replacement.

Keywords: Service Design, Service Demand Insight, Human-machine Collaboration, Design Innovation, Application Strategy

1 INTRODUCTION

Service design involves emotional needs and humanistic care and the globally wide development of artificial intelligence (AI) is significantly changing the way of service design and user experiences. Whether in health, retail, transportation or culture, AI technology has become the core driving force for innovation and optimization of services. Especially in the post-epidemic era, enterprises and institutions face tremendous digital transformation pressure. How to improve service quality, efficiency and user satisfaction through AI has become a key issue that needs to be urgently addressed. Based on this wide range of social needs, this study aims to explore how AI-driven service design can play a role in different stages of service design through systematic literature analysis and theoretical model construction, and put forward corresponding design strategies and application suggestions. To achieve the research objectives, this study has the following three specific objectives:

1. Analyze the specific stages in which generative artificial intelligence plays a role in the service design process. Clarify the specific application scenarios and action mechanisms of generative artificial intelligence in each stage.
2. Explore the advantages and limitations of artificial intelligence in different stages of service design. Analyze the advantages of generative artificial intelligence in a service context, demand insight, design generation and execution and at the same time explore its limitations in data accuracy, user experience, and design innovation.
3. Provide suggestions for service designers to integrate generative artificial intelligence into the design process. Based on literature analysis and practical cases, provide practical suggestions on effective application of generative artificial intelligence tools in the service design process so as to improve design efficiency and user experience.

2 LITERATURE SEARCH AND SCREENING

2.1 Research background and significance accessibility

The keywords ‘Generative AI’, ‘Service Design’, and ‘Human-AI Collaboration’ were combined with the help of Boolean operators to comprehensively cover relevant aspects of AI applications in service design. Databases include Web of Science, Google Scholar, IEEE Xplore, Springer, Scopus, etc., as

well as industry reports and white papers, with a special focus on the application of generative AI in service design.

2.2 Search strategy

Boolean logic (AND, OR, NOT) is used to combine keywords and expand the search scope. Specifically, 'Generative AI' AND 'Service Design' were used to focus on AI applications in design contexts while 'Human-AI Collaboration' was included to ensure the coverage of collaborative design.

2.3 Literature screening and inclusion criteria

The screening process for the literature review was conducted in two stages to ensure the selection of high-quality and relevant studies.

In the first stage, a preliminary screening was performed based on titles and abstracts to identify studies in accordance with the following criteria: (1) published within the last five years, (2) peer-reviewed, and (3) focused on the application of AI within the service design process. This initial stage resulted in the identification of 66 potential documents.

In the second stage, a more detailed review of the full texts was conducted to further refine the selection based on relevance and quality. Articles were excluded if they were found to be (1) retracted, (2) not directly related to design fields, or (3) mentioned AI only in general terms as a prospective tool or approach without any specific applications within service design contexts. This second round screening ultimately led to a final set of 56 papers that are in line with our research objectives.

3 THEORETICAL AND MODEL BASIS OF LITERATURE ANALYSIS

3.1 Characteristics and principles of service design

Service design is a systematic, interdisciplinary approach that spans the entire process from understanding user needs to delivering final services, focusing on optimizing touchpoints and processes to enhance user experience [1]. It emphasizes being people-oriented, co-creative, holistic, visualized, and evidencing. These principles advocate for user-centeredness, stakeholder collaboration, a focus on the entire service journey, and the use of visual tools to simplify complex processes and convey service value. When combined with generative AI, these principles provide a framework where technology serves as a means to achieve design goals rather than overshadowing the human-centered approach.

3.2 Human-AI co-creation

The Human-AI Co-creation model points AI as a collaborative partner in the design process with its data processing and generative capabilities to support designers in creative generation and decision-making. [2] This collaboration works at different stages. The Human-AI Co-creation Model proposed by Wu et al. [3] categorizes the collaboration between AI and human designers into three stages: assistance, enhancement, and collaboration. In the assistance stage, AI supports decision-making while designers maintain full control over the outcomes. In the enhancement stage, AI actively contributes ideas and solutions to augment the design process. Finally, the collaboration stage represents a synergistic relationship where AI adapts based on designer preferences, enabling continuous co-creation and iterative refinement [3]. The collaborative effect between human creativity and AI's analytical power allows designers to generate and refine design solutions timely with higher efficiency and greater innovation. In light of these theories, this study aims to investigate the integration of generative AI at different stages of service design and explore its practical applications and impact on the design process.

3.3 General strategic process model of service design

The model proposed by Zhang and Hu [4] is a foundational framework that outlines the strategic process of service design through four stages: service context, service demand insight, service design, and design execution (Figure 1). The model not only structures the service design process in a clear, user-centered progression but also emphasizes cross-disciplinary collaboration and continuous optimization to enhance user value. Its representation of the service design process—from initial market analysis to final execution—offers a comprehensive view that helps designers systematically address user needs at each stage. Additionally, by examining service design across time and type dimensions, the model provides both an analytical and organizational approach and enables designers to deconstruct and reconstruct

service processes for innovation and management improvement. In this sense, this structured multidimensional approach may be conducive to the integration of AI into each phase.

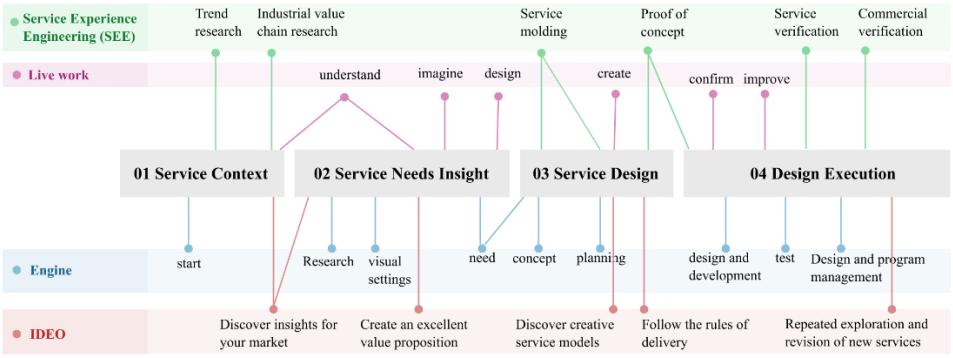

Figure 1. General strategic process of service design. From [4] with translation by the author.

4 MODEL-BASED LITERATURE CLASSIFICATION AND ANALYSIS

The above-mentioned model is used herein as a framework to classify literature and explore the application and intervention of artificial intelligence (AI) in various stages of service design. Specifically, the literature searched by keywords are divided into four stages in the model and then the way that AI promotes the service design process at each stage will be further analyzed.

4.1 Literature classification

As far as how AI supports the design process, the literature is classified as follows with the help of keywords in Table 1.

Table 1. Keywords to determine the stag

Service Context	Service Needs Insight	Service Design	Design Execution
• User profiling tools • Industry and market research tools (such as industry report analysis) • Trend analysis methods (such as market insight)	• User research methods (such as interview analysis) • Qualitative and quantitative analysis tools (such as demand matrix) • Data analysis tools	• Prototyping tools (such as Sketch, Figma) • Rapid iteration and generation tools • Concept verification tools (such as design simulator)	• Delivery optimization tools • Product testing and implementation tools • Final delivery methods (such as AI-assisted product deployment)

The four main stages of service design are service context analysis, service demand insight, service design, and design execution. With the support of AI, each stage can be greatly optimized especially in data processing, generating design plans, prediction and analysis. The following will analyze the specific role of AI in each stage.

4.2 Service context

Among the above-mentioned 56 papers, six are related to service context. Through data processing and predictive models, AI assists designers in understanding the complex macro environment, audience profiles and emerging trends by analyzing user data, behavior patterns, market dynamics, and socioeconomic factors. This capability allows for more efficient identification of key trends and potential opportunities in intricate service settings. For instance, Meesad and Mingkhwan (2024) discussed how AI integration in smart digital libraries enhances service personalization and automation,

allowing libraries to better adapt to evolving user expectations [5]. Similarly, Chun and Elkins (2023) introduced a framework for diachronic sentiment analysis using AI, demonstrating its potential to predict user needs while highlighting the risk that such AI-driven insights may overlook subtle user intentions [6]. Additionally, a study by Martin et al. (2021) explored the application of AI in analyzing consumer behavior across various industries, revealing that AI-driven analytics can uncover hidden patterns and preferences, thereby informing more targeted and effective service design strategies [7].

Beyond urban contexts, AI also shows potential in broader applications, such as rural public service systems. For instance, a study by the Alan Turing Institute explores the automation of resource allocation across various public sector domains, including healthcare and social welfare, highlighting AI's potential to optimize resource distribution in rural areas [8]. Additionally, research by Rahman et al. (2023) examines AI's role in optimizing resource allocation in agriculture through IoT integration, demonstrating its applicability in rural settings to improve efficiency and productivity [9]. Besides, AI's failure to capture the complex social and cultural dynamics has also drawn scholarly attention. A study by Prabhakaran et al. (2022) highlights that AI technologies often embed the cultural values and practices of the countries where they are developed, leading to incongruencies when applied in diverse cultural contexts. This misalignment can result in homogenized solutions that fail to address unique, context-specific needs, thereby hindering the personalization of services [10]. Similarly, a study by Ananthram et al. (2024) investigates the Western cultural bias of large vision-language models, revealing that such biases can affect image understanding and interpretation, which is crucial for culturally sensitive AI applications [11].

In this stage, the collaboration aligns with the Embedding Mode, where AI functions as a supportive tool integrated into background research, allowing designers to focus on strategy and synthesis. Through leveraging the power of artificial intelligence in data analysis and pattern recognition, designers can effectively collect, filter, and analyze large amounts of relevant information, saving time while improving the accuracy and depth of insights. This process facilitates a more comprehensive grasp of the service environment, encompassing an in-depth examination of the research context, prevailing market trends, and user behavior, thereby establishing a robust foundation for formulating scientific and efficacious design strategies. Nevertheless, artificial intelligence frequently falls short in deciphering the intricate cultural and social subtleties that are paramount to attaining a holistic comprehension of the service environment. By integrating artificial intelligence with qualitative research techniques, such as anthropological studies, this shortcoming can be effectively mitigated.

4.3 Service demand insights

Thirteen papers center on service demand insights. Service demand insights are the process of identifying users' core needs and pain points. At this stage, AI supports designers in digging deeper into user needs and classifying information through natural language processing, sentiment analysis, and big data analysis.

Bang Nguyen et al. (2021) used machine learning models to process a large number of user reviews in their sentiment analysis study of online food ordering services to identify user needs and emotional responses, thereby providing a basis for improving service design [12]. Similarly, Majid et al. (2024) explored the use of generative AI chatbots in understanding and guiding tourists' sustainable travel behaviors [13]. Tools such as Uizard and Visily can process complex data flows to generate design specifications and problem definitions. By identifying hidden factors or potential conflicts, AI reduces human bias and enhances the logical consistency of problem definition.

In this stage, the collaborative mode is more inclined to the co-pilot mode. AI can provide designers with creative suggestions and insights into user needs, but the final decision and implementation remain in the hands of the designer. While AI can help reduce individual biases, qualitative methods, such as reflective subject analysis, show that subjectivity has unique value in revealing deep and subtle differences in human experience. Finding a balance between AI's objectivity and human judgment can generate richer, more meaningful, and highly context-relevant design insights.

4.4 Service design

Twenty-nine papers are about service design which involves innovative service solutions. The literature about this stage mainly discusses how to provide multiple options through AI to help designers quickly generate creative output and iterative optimization through algorithms and create links beyond human logic.

For instance, Huang et al. (2021) proposed a model that leverages the Semantic Web to facilitate creative service software development. This model is applied in two phases: requirement specification and service design. By employing semantic and visual cues, the model aids in bridging the knowledge gap between domain experts and software engineers, thereby improving the traceability of specifications and supporting machine processing [14]. This collaboration aligns with a co-pilot model, where AI generates multiple design options based on users' historical data, while designers refine and review the final output to ensure quality. This model is particularly valuable in the design generation stage, especially when speed and diversity are critical.

4.5 Design execution

The other eight papers are on design execution, where AI plays a crucial role in monitoring service delivery, assessing performance metrics, and providing optimization recommendations through predictive analytics and monitoring systems. Designers oversee these operations and intervene only when necessary. For example, the intelligent heart health monitoring platform proposed by Faust et al. (2020) monitors the heart rate and health status of patients through IoT and AI technology [15]. Similarly, Yu et al. (2024) showed that AI could optimize service integration through the service competition model and improve service quality in a competitive environment [16]. Maqtari et al. (2022) explored the role of IT governance in facilitating the integration of AI into accounting and auditing processes, emphasizing that robust governance frameworks enhance AI adoption, thereby improving transparency and accountability in service delivery [17]. Furthermore, Labadze et al. (2023) conducted a systematic literature review on the role of AI chatbots in education, demonstrating how these tools can transform support services, improve accessibility, and contribute to more efficient and effective learning environments [18].

At this stage, AI operates autonomously in an Agent Mode, optimizing the service delivery process through continuous observation and data analysis to maintain service effectiveness. This approach proves highly effective in dynamic environments such as medical monitoring or logistics optimization. AI-driven systems facilitate real-time adjustments, ensuring that services remain consistently aligned with evolving user needs throughout the delivery process.

4.6 Comments

A systematic literature review and case study reveal that the role of AI tools in service design has been widely studied and generative AI can significantly improve design efficiency in multiple stages of service design, especially in service context analysis, creative generation, and service optimization. It accelerates data processing, generates diverse design options, and refines outputs, thereby improving design quality and user experience. Meanwhile, it can be seen that although generative AI performs well in technical processing and logical analysis, its ability to deal with complex emotional needs and humanistic care is relatively limited.

Given the limitations of AI in emotional expression and complex decision-making, human participation in service design is still indispensable. Therefore, how AI and human design can collaborate in practice needs to be further discussed and explored.

5 POSSIBLE AI-DESIGNER COLLABORATION IN EACH STAGE

It is no doubt that AI can play a key role in technical and logical tasks, but in terms of humanistic expression and moral judgment, the dominance of service designers is irreplaceable. Song et al. (2024) emphasize that while AI excels in processing large datasets and generating solutions, the integration of human oversight is critical for ensuring ethical and contextually relevant outcomes [19]. Similarly, Milind et al. (2023) identify that AI tools are most effective in specific stages of engineering and design processes, such as generation and execution, while human involvement is indispensable for ensuring cultural and emotional resonance in design [20]

The current application landscape shows that the collaborative model of human-machine co-creation is highly feasible. Wu et al. (2021) categorize AI-human collaboration into three primary modes: Embedding Mode, where AI acts as a supportive tool integrated into workflows; Copilot Mode, where AI provides suggestions and assists in decision-making while humans retain control; and Agent Mode, where AI operates autonomously with human oversight only when necessary [3]. AI tools are most concentrated in the design generation and execution stages, where efficiency gains are critical, while human involvement remains strongest in context analysis and demand insights, emphasizing the need

for a holistic and balanced collaboration. Designers must leverage the speed and precision of AI to manage tasks while ensuring the comprehensiveness of design results and user satisfaction through the control of emotions and ethics. In this context, tailored collaboration strategies are proposed to address the specific needs of designers at each stage of the service design process (Figure 2).

5.1 Context analysis

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5.2 Service design

In the stage of idea generation and prototyping, generative AI tools (e.g., Framer, Creatie) and user interaction simulation platforms enable the rapid generation of diverse design options and behavioral predictions, which is conducive to iterative prototype development. Designers should take full advantage of AI which can generate a large number of creative ideas in a short time and on this basis explore multiple possible design directions in the early stage and verify the feasibility of the solutions through rapid prototyping tests. Considering that it is difficult for AI to fully capture these multidimensional factors like emotions, intuition, and cultural background, it is necessary to combine AI with real user testing to validate AI-driven outputs against real-world user feedback, ensuring that the results are both contextually relevant and emotionally resonant. In the latter stage, participation and feedback from real users are needed to optimize and verify whether the AI-generated design meets the actual user needs and emotional experience.

5.3 Service demand insight

In this stage, with sentiment analysis platforms (such as Bang NLP), clustering algorithms and data visualization tools, AI can deeply explore user needs, pain points and behavior patterns. The initial insights generated by AI provide data support for designers, who then use their expertise to evaluate and contextualize these insights and balance data-driven objectivity with deep insights from human judgment. At this stage, designers need to collect and preprocess structured and unstructured data from questionnaires, user comments, and logs to ensure the reliability of AI output.

5.4 Service execution

Finally, in the process of service execution, designers should use AI tools to ensure the optimized implementation of design solutions and ensure the consistency and efficient delivery of multi-platform designs. Here, AI primarily operates in an autonomous mode and optimizes service processes while designers oversee the system to handle complex decisions and address ethical considerations. Meanwhile, designers continue to track the feedback data generated by AI after the project is delivered and make some necessary adjustments to ensure the consistency and effectiveness of the design solution in different application scenarios.

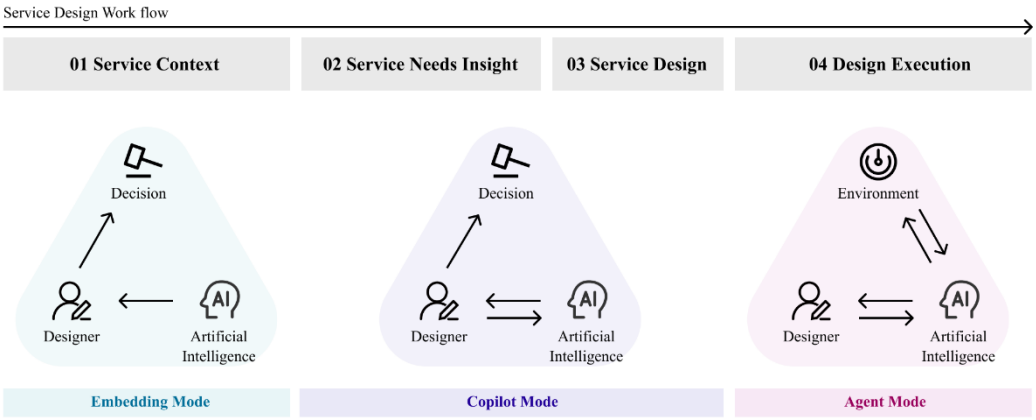

Figure 2. Three modes of AI-designer collaboration in the service design process. Drawn by the author.

6 FUTURE DIRECTIONS OF RESEARCH

The general strategic process of service design provides a clear framework for designers, but in actual applications, the differences in service objects and service contexts require designers to flexibly adjust the process so as to accurately respond to specific needs. A general tendency is that service design will not only be confined to the commercial field but also play a broader role in public services and social value creation. It is indisputable that AI-based service design research will further promote the continuous development of service design and provide designers with more intelligent design tools and strategies. Future research may be conducted in the following directions.

6.1 In-depth research on the co-creation model of AI and service design

Future research should further explore the collaboration between AI and designers in the service design process, especially the differentiated application in different service scenarios. The innovative application of service design requires the development of more sophisticated AI tools for specific industries and service needs. In addition, future research should continue to focus on how to balance the efficiency of AI and the limitations in creative tasks and explore the best collaborative model between AI and human designers in service design.

6.2 The role of AI in user feedback and emotional design

Future research should also pay more attention to the potential and challenges of AI in emotional design and user experience optimization. Although existing technologies can provide assistance in relatively simple emotion recognition and feedback processing, the application of AI still needs to be improved when it comes to more complex emotional expression and interpersonal interaction. How to effectively integrate AI into emotional design and make it complement the designer's intuition and creativity will be a direction worthy of in-depth exploration.

6.3 Cross-domain expansion and long-term impact

The rapid advancement of AI technology is reshaping the practice of service design. Future research should focus more on the long-term impact of these technological changes on the service design process and explore how AI technology can adapt to and reshape the process model of service design. In addition, service design projects in different fields may have different needs and characteristics. How to flexibly apply AI technology in different scenarios and formulate corresponding strategic processes are also important directions for future research.

7 CONCLUDING REMARKS

It is noteworthy that a balance needs to be struck between efficiency and empathy. For one thing, AI can play a leading role in such tasks as data processing, pattern recognition, and option generation with its high speed and precision. For another, designers need to take an active part in activities that require emotional intelligence, deep user understanding, and human-centered decision-making. AI can handle

the mechanics while designers must bring empathy and cultural awareness to ensure the outcomes resonate with users.

It is asserted that AI should serve as a complement instead of a replacement. It is significant to view AI as a tool to augment human creativity and decision-making. With a human-centered, AI-driven collaboration, designers can focus on more strategic and nuanced tasks and make sure that the design process remains ethical, inclusive, and innovative. Although AI is in a position to enhance productivity, the human designer can never be replaced with its role in shaping the vision, addressing ethical concerns, and ensuring inclusivity. AI and human designers together can make design services both technically sound and emotionally impactful.

REFERENCES

[1] Stickdorn M. and Schneider J. *This is service design thinking: Basics, tools, cases*, 2012 (John Wiley & Sons, Chichester).

[2] Dellermann, D., Ebel, P., Söllner, M., Leimeister, J. Hybrid Intelligence. *Bus Inf Syst Eng*, 61, 2019, pp.637–643.

[3] Wu Z., Ji D., Yu K., Zeng X., Wu D., and Shidujaman M. AI Creativity and the Human-AI Co-creation Model. *Human-Computer Interaction. Theory, Methods and Tools*. *HCI 2021,* Virtual Event, July 24–29, 2021, Proceedings, Part I 23, pp. 171-190 (Springer International Publishing, 2021).

[4] Zhang X. and Hu F. A Study on General Strategic Processes in Service Design. *Packaging Engineering*, 2018, 39(2), 42-47.

[5] Meesad P. and Mingkhwan A. AI-Powered Smart Digital Libraries. In *Libraries in Transformation: Navigating to AI-Powered Libraries*, 2024, pp. 391-428. (Springer Nature Switzerland, Cham).

[6] Chun J. and Elkins K. Explainable AI with GPT4 for story analysis and generation: A novel framework for diachronic sentiment analysis. *International Journal of Digital Humanities*, 2023, 5(2), pp. 507-532.

[7] G. Martín, A., Fernández-Isabel, A., Martín de Diego, I., & Beltrán, M. A survey for user behavior analysis based on machine learning techniques: current models and applications. *Applied Intelligence*, 2021, 51(8), 6029–6055.

[8] Esnaashari, S., Bright, J., Francis, J., Hashem, Y., Straub, V., & Morgan, D. Approaches to the Algorithmic Allocation of Public Resources: A Cross-disciplinary Review. *arXiv preprint arXiv:2310.06475*, 2023.

[9] Rahman M. et al. Optimizing Resource Allocation in Agriculture through IoT and AI. In *2023 7th International Conference on Electronics, Communication and Aerospace Technology*, *ICECA,* November 2023, pp. 573-1578.

[10] Ananthram, A., Stengel-Eskin, E., Vondrick, C., Bansal, M., & McKeown, K. See It from My Perspective: Diagnosing the Western Cultural Bias of Large Vision-Language Models in Image Understanding. *arXiv preprint arXiv:2406.11665*, 2024.

[11] Prabhakaran V., Qadri R. and Hutchinson B. Cultural incongruencies in artificial intelligence. *arXiv preprint arXiv:2211.13069*, 2022.

[12] Nguyen B., Nguyen V. H. and Ho T. Sentiment analysis of customer feedbacks in online food ordering services. *Business Systems Research: International journal of the Society for Advancing Innovation and Research in Economy*, 2021, 12(2), 46-59.

[13] Majid G.M., Tussyadiah I. and Kim, Y.R. Exploring the Potential of Chatbots in Extending Tourists' Sustainable Travel Practices. *Journal of Travel Research*, 2024.

[14] Huang P.S., Fahmi F. and Wang F.J. A model to helping the construction of creative service-based software. In *2021 IEEE 45th Annual Computers, Software, and Applications Conference*, *COMPSAC*, July 2021, pp. 1235-1242.

[15] Faust, O., Lei, N., Chew, E., Ciaccio, E. J., & Acharya, U. R. A Smart Service Platform for Cost Efficient Cardiac Health Monitoring. *International journal of environmental research and public health*, 2020, 17(17), 6313.

[16] Yu S. and Guo C. Service design under asymmetric service provider competition: Applications of AI services. *Transportation Research Part E: Logistics and Transportation Review*, 2024

[17] Almaqtari F.A. The Role of IT Governance in the Integration of AI in Accounting and Auditing Operations. *Economies*, 2024, 12(8), 199.

[18] Labadze L., Grigolia M. and Machaidze L. Role of AI chatbots in education: systematic literature review. *International Journal of Educational Technology in Higher Education*, 2023, 20(1), 56.
[19] Song B, Zhu Q, Luo J. Human-AI collaboration by design. *Proceedings of the Design Society. Volume 4:DESIGN 2024*, May 2024, pp. 2247-2256.
[20] Khanolkar P.M., Vrolijk A. and Olechowski A. Mapping artificial intelligence-based methods to engineering design stages: a focused literature review. *AI EDAM*, 2023, *37*, e25.