Proceedings of the 2023 Winter Simulation Conference
C. G. Corlu, S. R. Hunter, H. Lam, B. S. Onggo, J. Shortle, and B. Biller, eds.

SUSTAINABILITY-INTEGRATED DIGITAL FRAMEWORK FOR DECISION MAKING IN INTERIOR CONSTRUCTION DESIGN

Rongxu Liu

Exeter Digital Enterprise Systems Laboratory
Department of Engineering Faculty of Environment, Science and Economy
University of Exeter
Streatham Campus, North Park Rd
Exeter, Devon, EX4 4QF, UK

ABSTRACT

The present study presents a novel digital tool that is seamlessly integrated with cutting-edge Industry 4.0 technologies. The primary objective of this tool is to effectively cater to the diverse requirements of stakeholders involved in interior construction projects. This research endeavor explores the various challenges faced by stakeholders, examines the significance of digital tools in facilitating the integration of cutting-edge technologies, and assesses the effectiveness of the proposed application in improving project results. The anticipated outcomes hold the potential to fundamentally transform the landscape of construction project management in the future. This transformation will be achieved through the integration of stakeholder requirements and the utilization of cutting-edge technological advancements.

1 INTRODUCTION

Construction project management requires stakeholder alignment for success. Industry 4.0 has shifted architectural design toward novel technologies like generative design, promising transformative effects. This study examines sustainable construction techniques and how digital frameworks improve decision-making, particularly in interior construction.

2 LITERATURE REVIEW

Construction and architectural design technology literature research shows gaps in stakeholder involvement, sustainability, construction management, and digital framework development. Despite extensive study on stakeholder engagement, project management lacks integration of stakeholder involvement with sustainability. (Silvius and Schipper 2014; Stanitsas et al. 2021). Several frameworks that have been suggested exhibit a deficiency in practical validation (Martens and Carvalho 2016), and there is a dearth of research on the examination of stakeholders' perspectives in relation to interior building projects (Chinyio and Olomolaiye 2009; Rajablu et al. 2015). The impact of emerging technologies, including artificial intelligence (AI), machine learning (ML), and virtual reality (VR), on stakeholder management within the field of construction management has received limited attention in existing literature (Prebanić and Vukomanović 2021). Insufficient research has been conducted on the proficient utilization of these technologies and their influence on project results (Wang 2019; Levitt and Kunz 1987), and the consequences of implementing a data-driven approach have received limited scrutiny (Kerzner 2017). The building of a digital framework lacks a thorough plan for managing stakeholders (Aapaoja and Haapasalo 2014). Despite the existing limitations of current operational frameworks, there is a growing imperative to explore the evolving dynamics

of stakeholder significance through time (Gan and Guo 2014; Demirel et al. 2023). Furthermore, the comprehensive investigation of the impact of incorporating user-centered design methodologies on project performance remains an area that requires further exploration, as indicated by recent studies conducted by Muñoz-La Rivera et al. (2021) and Zhang et al. (2023).

3 RESEARCH METHOD

The research adopts a three-stage framework: 1) Research Design and Factor Development, involving a literature review on stakeholder management challenges in interior construction and decision-making for sustainability; 2) Framework Development, using qualitative interviews and quantitative surveys analyzed via SPSS and thematic methods; 3) Framework Evaluation and Validation. This methodology aims to create a conceptual framework addressing identified issues and improving stakeholder collaboration and sustainability decisions.

4 EXPECTED RESULTS AND IMPACT

This study explores stakeholders' interior design preferences across backgrounds and project involvement-satisfaction. The goal is to adapt generative design to varied needs and study sustainability and decision-making. Include stakeholder feedback Interior building sustainability and personalization are emphasised in generative design for optimal solutions.

REFERENCES

Aapaoja, A., and H. Haapasalo. 2014. "A Framework for Stakeholder Identification and Classification in Construction Projects". *Open Journal of Business and Management* 2014.

Chinyio, E., and P. Olomolaiye. 2009. *Construction Stakeholder Management*. John Wiley & Sons.

Demirel, H. O., M. H. Goldstein, X. Li, and Z. Sha. 2023. "Human-Centered Generative Design Framework: An Early Design Framework to Support Concept Creation and Evaluation". *International Journal of Human–Computer Interaction*:1–12.

Gan, X., and L. Guo. 2014, 04. "A Framework for Sakeholder Analysis in Construction Projects". Volume 61, 1869–1876.

Kerzner, H. 2017. *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*. John Wiley & Sons.

Levitt, R. E., and J. C. Kunz. 1987. "Using Artificial Intelligence Techniques to Support Project Management". *AI EDAM* 1(1):3–24.

Martens, M. L., and M. M. Carvalho. 2016. "The Challenge of Introducing Sustainability into Project Management Function: Multiple-Case Studies". *Journal of Cleaner Production* 117:29–40.

Muñoz-La Rivera, F., J. Mora-Serrano, I. Valero, and E. Oñate. 2021. "Methodological-Technological Framework for Construction 4.0". *Archives of Computational Methods in Engineering* 28:689–711.

Prebanić, K. R., and M. Vukomanović. 2021. "Realizing the Need for Digital Transformation of Stakeholder Management: A Systematic Review in The Construction Industry". *Sustainability* 13(22):12690.

Rajablu, M., G. Marthandan, and W. F. W. Yusoff. 2015. "Managing for Stakeholders: The Role of Stakeholder-Based Management in Project Success". *Asian Social Science* 11(3):111.

Silvius, A., and R. P. Schipper. 2014. "Sustainability in Project Management: A Literature Review and Impact Analysis". *Social Business* 4(1):63–96.

Stanitsas, M., K. Kirytopoulos, and V. Leopoulos. 2021. "Integrating Sustainability Indicators Into Project Management: The Case of Construction Industry". *Journal of Cleaner Production* 279:123774.

Wang, Q. 2019. "How to Apply AI Technology in Project Management1, 2". *PM World Journal* Vol. VIII, Issue III – April 2019.

Zhang, Y., Y. Chen, and X. Li. 2023. "Integrated Framework of Knowledge-Based Decision Support System for User-centered Residential Design". *Expert Systems with Applications* 216:119412.