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A Design Science Research Approach to Supporting Operational Management in Early-Stage MSMEs

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Abstract

Early-stage micro, small, and medium-sized enterprises (MSMEs) face persistent difficulties in incorporating operational management practices due to limited resources, low process formalization, the concentration of functions among a few actors, and the limited availability of tools adapted to their actual conditions. In this context, the purpose of this study was to design and validate a modular digital tool to facilitate operational management in Early-stage MSMEs. The study was developed through an agile Design Science Research (DSR) approach, in which the findings of a systematic literature review were used as input to build macro-clusters, logical chains, design mechanisms, and the functional and technical requirements of the artifact. The literature synthesis made it possible to translate recurrent barriers faced by MSMEs, such as low formalization, limited resources, insufficient training, resistance to change, and difficulties in adopting management methodologies, into design criteria focused on ease of use, gradual adoption, modularity, low operational burden, accessible language, and traceability between diagnosis, recommendation, and action. Based on these criteria, a digital prototype was developed, composed of modules for business structuring, indicators, basic finance, continuous improvement, quality, risk management, compliance, sustainability, and operational initiatives. The artifact was evaluated through expert validation, considering its relevance, coherence, perceived usefulness, usability, and feasibility of adoption. The study contributes a methodological pathway for transforming scientific evidence into a practical solution to support operational management in Early-stage MSMEs operating in resource-constrained contexts.

Keywords
Design Science Research, Early-stage MSMEs, operational management, digital artifact.

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Biographies

Julián David González Zapata is an Industrial Engineer and a Master's candidate in Industrial Engineering at the National University of Colombia. He serves as an Operations advisor at the Entrepreneurship and Innovation Unit and as an Organizational Improvement Consultant at the School of Dentistry at the National University of Colombia. In these roles, he has worked closely with micro, small, and medium-sized enterprises (MSMEs), providing guidance on process optimization and operational efficiency. His main topics of interest are related to productivity, quality management, operations management and logistics.

Bertha Viviana Ruales Guzmán is an Agroindustrial Engineer, with Master's degree in Food Science and Technology and a PhD in Engineering: Industry and Organizations of Universidad Nacional de Colombia. She is an Assistant Professor at Universidad Nacional de Colombia, has professional experience of eighteen years in the food industry and teaching on topics of quality management and operations management at all levels of education. Her main topics of interest are related to productivity, quality management and the food industry.

Angelo Cavallo is an Associate Professor at Politecnico di Milano and holds a Ph.D. in Management Economics and Industrial Engineering from the same institution. Since 2019, he has been a core faculty member at POLIMI Graduate School of Management, where he serves as Director of the International Master in Innovation and Entrepreneurship. His main research areas include entrepreneurship, innovation strategy, digital entrepreneurship, corporate entrepreneurship, digitally enabled business models, and entrepreneurial ecosystems. He is co-founder and Scientific Director of the Space Economy Observatory, and also serves as an external advisor for startups and large organizations.

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