

# 142<sup>a</sup> DEFESA DE TESE EM ENGENHARIA INDUSTRIAL

PROGRAMA DE PÓS-GRADUAÇÃO EM ENGENHARIA INDUSTRIAL - PEI



## ANDRÉ DE MENDONÇA SANTOS



[pei@ufba.br](mailto:pei@ufba.br)



[www.pei.ufba.br](http://www.pei.ufba.br)



@peiufba



@peiufba



PEI TV

### Orientadores:

- Prof. Dr. Ângelo Márcio Oliveira Sant'Anna (PEI-UFBA);
- Prof. Dr. Néstor Fabián Ayala (UFRGS).

### Banca Examinadora:

- Prof. Dr. Ângelo Márcio Oliveira Sant'Anna (PEI-UFBA);
- Prof. Dr. Néstor Fabián Ayala (UFRGS);
- Prof. Dr. Diego de Castro Fettermann (UFSC);
- Prof. Dr. Eduardo Alves Portela Santos (UFPR);
- Prof. Dr. Glauco Henrique de Sousa Mendes (UFSCAR);
- Profa. Dra. Maria Silene Alexandre Leite (UFPB).

**Título:** “*INDUSTRY 4.0 DIGITAL TECHNOLOGIES AS ENABLERS OF SUSTAINABILITY FOR SMALL AND MEDIUM ENTERPRISES*”.

**Data:** 04 de dezembro de 2024      **Horário:** 14h

**Local:** [https://conferenciaweb.rnp.br/webconf/pei\\_epufba](https://conferenciaweb.rnp.br/webconf/pei_epufba)

### Resumo:

The primary aim of this study is to explore how Industry 4.0 (I4.0) digital technologies can be implemented and applied to achieve sustainability in Small and Medium Enterprises (SMEs) in developing countries. The research followed a two-stage Systematic Literature Review (SLR), analyzing 42 academic articles from the Web of Science and Scopus databases. In the first stage, R<sup>®</sup> software was used to analyze journal trends, publication countries and articles' growth over time. The second stage involved a qualitative analysis, identifying 17 sustainability functions that I4.0 contributes to in sustainable manufacturing for SMEs. After the SLR, a quantitative study was conducted to identify which sustainability functions should be prioritized. The Fuzzy DEMATEL method was used, gathering questionnaires from experts to highlight the most prominent and influential functions. Further qualitative research was conducted through semistructured interviews with SME leaders to identify specific challenges in achieving sustainability and addressing the pillars of Industry 5.0 (I5.0), focusing on sustainability, human-centric, and resilience aspects. Additionally, interviews with technology providers were conducted to evaluate existing solutions available to SMEs. The interview findings were analyzed, and technological solutions were proposed during a focus group session involving four I4.0 experts. A subsequent round of meetings was held to gather feedback from the SMEs. The results demonstrated that digital technologies can indeed support SMEs in achieving sustainability and I5.0 objectives. The study also proposed frameworks for accomplishing these goals, such as creating safer work environments, improving environmental sustainability, and strengthening resilience through increased integration between companies. Moreover, the findings suggest that priority should be given to functions like organizing production processes and employee skill development to reduce the complexity of I4.0 implementation. Lastly, the study highlighted the need for technologies to align with SMEs' requirements, which include ease of implementation, compatibility, and low costs to ensure broader adoption. This paper offers practical guidance to help SME managers in their digitization efforts and contributes to the academic understanding of appropriate digital technologies for SMEs in emerging countries to become more human-centric, sustainable, and resilient.

**Palavras chave:** Manufacturing Industry; SME; Entrepreneurship; Sustainable Development; Technology Adoption; MCDM.