Developing a Digital Maturity Model for Indian Post-Consumer Textile Recycling MSMEs: A Digital Transformation Perspective

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Abstract

The transition towards circular textile production has increased the importance of post-consumer textile recycling as a strategy for reducing textile waste and extending material lifecycles. In India, recycling activities are largely undertaken by micro, small, and medium enterprises (MSMEs), which operate within fragmented, resource-constrained supply chains and often rely on labour-intensive processes. Digital technologies, artificial intelligence, and automation can improve material identification, sorting, traceability, process monitoring, and resource-efficient production; however, the ability of these enterprises to effectively adopt and integrate such technologies remains largely unexplored. Existing Digital Maturity Models (DMMs) have predominantly been developed for conventional manufacturing, Industry 4.0, and generic SME contexts, limiting their applicability to post-consumer textile recycling.
This study develops a conceptual DMM tailored to Indian post-consumer textile recycling MSMEs. A systematic literature review was conducted using Scopus and Web of Science, followed by thematic synthesis to identify and contextualize digital maturity dimensions, sub-dimensions, and maturity levels. The synthesis resulted in five dimensions: People, Digital Strategy, Smart Recycling Processes, Smart Recycled Products and Services, and Digital Technology and Infrastructure. These dimensions incorporate sector-specific capabilities including digital collection and feedstock tracking, AI-enabled textile identification and sorting, feedstock quality monitoring, material traceability, recycled-material provenance, Digital Product Passport readiness, and digitally enabled recycling services. A five-level maturity progression: Initial, Emerging, Defined, Integrated, and Optimized, was identified as the basis for assessing progressive digital capability development.
The proposed framework provides a structured pathway for assessing digital readiness and identifying capability gaps across post-consumer textile recycling operations. It contributes to the advancement of digitalization and circular textile production by linking organizational capabilities with AI, automation, traceability, and resource-efficient recycling processes. The framework further provides a foundation for future empirical validation and the development of a practical maturity assessment tool for accelerating digital transformation in textile recycling MSMEs.

Keywords: Post consumer textile recycling, Digital maturity model, Circular textile production, Textile recycling MSMEs

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