

ENABLING DIGITAL BUSINESS MODEL TRANSFORMATION FOR SUSTAINABLE MANUFACTURING THROUGH SERVITIZATION

Anand R. Moorthy

DII, University of Pisa, Italy, a.moorthy@studenti.unipi.it

ABSTRACT

Introduction: The manufacturing sector stands at a critical juncture, facing dual pressures of environmental sustainability and digital transformation. As a significant contributor to global carbon emissions and resource consumption, the industry is under increasing scrutiny to adopt more sustainable practices. Simultaneously, the rapid advancement of digital technologies is reshaping production processes and business models. This research explores the intersection of these trends, examining how digital technologies can enable manufacturers to transition towards more sustainable practices through servitization strategies, with a particular focus on circular economy principles.

Background: Manufacturing firms face mounting pressure to adopt sustainable practices while maintaining competitiveness in an increasingly digitalized world. Servitization, the shift from product-centric to service-oriented business models, offers a promising pathway to address these challenges. However, the complex dynamics of how digital technologies enable this transition, particularly in fostering circular economy principles, remain underexplored.

Research Question: "How do digital technologies facilitate the transition of manufacturers towards circular economy principles through servitization strategies?"

Theoretical Framework: This study employs the Multi-Level Perspective (MLP) from sustainability transition theory to analyze the socio-technical transitions involved in digitally enabled servitization. The MLP framework allows for a nuanced examination of interactions between macro-level landscape pressures (e.g., environmental regulations, technological trends), meso-level industry regimes (established manufacturing practices), and micro-level niche innovations (digital servitization initiatives).

Methodology: We conducted a qualitative, multiple case study analysis of three manufacturing firms that have successfully implemented digitally enabled servitization strategies. Data collection involved analysis of academic literature, industry reports and company documents. We employ an abductive analytical approach, iterating between empirical findings and theoretical concepts to develop our insights.

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Findings:

Digital technologies serve as fundamental enablers of servitization, facilitating:

- Enhanced product monitoring and predictive maintenance
- Resource optimization and performance improvement
- Development of innovative service-based business models

Servitization strategies, when enabled by digital technologies, can strongly align with and promote circular economy principles.

The success of sustainability transitions through servitization is significantly influenced by the alignment between technological capabilities, service strategies, and circular economy practices.

Theoretical Contribution: This study extends sustainability transition theory by integrating digital technology, servitization, and circular economy perspectives within the MLP framework. We propose a novel conceptual model, the "Digital Servitization Transition Pathway," which outlines the multi-level dynamics involved in sustainable manufacturing transitions.

Practical Implications: Our findings provide strategic guidance for manufacturers on leveraging digital technologies for sustainable servitization. We offer insights into how various digital technologies can enable different servitization strategies and promote circular practices. Additionally, we provide recommendations for policymakers to create supportive environments for these transitions.

Limitations and Future Research: While our study provides rich insights from three cases, future research could benefit from quantitative analyses across larger samples to validate our findings. Longitudinal studies could track transition pathways over time, and cross-cultural studies could explore variations in the adoption and impact of digital servitization strategies.

Conclusion: This research advances our understanding of how digital technologies enable the transition towards sustainable manufacturing through servitization. By adopting a multi-level perspective, we provide a comprehensive view of the complex interactions involved in these socio-technical transitions, offering both theoretical advancements and practical insights for shaping the future of sustainable manufacturing.

Keywords: Servitization, Digital Technologies, Circular Economy, Sustainability Transition, Manufacturing, Multi-Level Perspective, Industry 4.0