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Quadruple Business Model Canvas for Twin Green and Digital Transitions: Integrating Environmental, Social, Digital, and Economic Value in Food & Beverage Sector

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Abstract

Small and medium-sized enterprises (SMEs) in the food and beverage (F&B) sector are simultaneously confronted with the demands of the European Union's Twin Green and Digital Transition (TT), which refers to the parallel push toward sustainability and digitalization. While existing business model (BM) frameworks address these dimensions in isolation, no integrated tool exists that systematically combines environmental, social, digital, and economic value creation in a single canvas. This paper addresses that gap by developing and empirically grounding the Quadruple Business Model Canvas (QBMC). The QBMC extends the logic of Osterwalder and Pigneur's (2010) Business Model Canvas and Joyce and Paquin's (2016) Triple Layered Business Model Canvas (TLBMC) by adding an explicit digital layer and repositioning economic viability as a dedicated assessment layer rather than an assumed baseline. The framework comprises four integrated canvases: sustainable, social, digital, and economic. Each canvas is structured around the nine standard building blocks while focusing on a distinct value domain. Placing the economic layer last reflects a purpose-first, profit-supported sequencing: SMEs are encouraged to first define environmental and social value propositions and identify digital enablers before evaluating financial viability and scalability. The study is grounded in practice-based research with Dutch F&B SMEs. Data were collected through seven semi-structured interviews conducted in March 2025 and an interactive online workshop with five SME representatives in April 2025. Participants represented diverse value chain roles, including food production, logistics, network orchestration, and technology provision. A hybrid qualitative analysis approach combined thematic coding with AI-supported structuring tools, with all interpretations validated by the research team. Findings reveal that F&B SMEs actively engage in sustainability and digitalization, yet frequently treat these as compliance obligations or internal efficiency measures rather than as customer-facing value propositions. The QBMC makes cross-dimensional interdependencies visible and actionable: digital traceability tools can simultaneously reduce waste (environmental), increase transparency and stakeholder trust (social), enable new product propositions (digital), and lower operational costs (economic). The empirical cases further demonstrate that digitalization, particularly automation, route optimization, and e-commerce, creates economic value while directly supporting environmental and social objectives when deliberately designed into the BM logic. The QBMC contributes to multi-dimensional BM theory by integrating the digital dimension into sustainability-oriented BM design, and by treating the four layers as mutually

reinforcing rather than parallel. Practically, it provides SMEs with a structured design and reflection tool to align purpose, technology, planet, and profit, helping to prioritize TT initiatives that simultaneously advance multiple objectives while remaining financially feasible. Future research should test QBMC application across larger and more diverse samples, develop measurement guidance per layer, and examine quantitative performance outcomes following QBMC-guided BM interventions.

Keywords: Twin Green and Digital Transition, Quadruple Business Model Canvas, Digital Sustainable Business Models, Food and Beverage SMEs, Sustainability

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