Cooperatives and SMEs in the Twin Transition: A Comparative Analysis

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The twin transition (TT), addressing both environmental and digital transformation, has emerged as a main challenge for contemporary businesses. Governments, international organizations, and the private sector increasingly recognize the need for firms to adapt to new environmental practices and regulations while leveraging digital technologies to remain competitive. However, the extent to which different business models facilitate or hinder these transitions remains an open question. Cooperatives, characterized by democratic governance and a social orientation, are often assumed to be more committed to sustainability compared to small and medium enterprises (SMEs). Yet, empirical evidence on their actual performance in advancing the TT remains limited. This paper seeks to bridge this knowledge gap by exploring whether a cooperative business model provides an advantage in fostering both the green and the digital transition, compared to SMEs.

Research Objectives and Contribution

The main aim of this study is to examine the role of cooperatives in fostering the TT relative to SMEs. While cooperatives are theoretically expected to prioritize long-term sustainability goals, due to their guiding principles, their operational constraints, resource limitations, and competitive pressures might align them more closely with SMEs in terms of environmental and technological innovations adoption (ICA, 2022). By empirically analyzing whether cooperatives differ in their approach to the TT and identifying the factors influencing their strategic choices, this paper provides valuable insights into the role of governance structures in shaping firms' innovation processes.

The study makes several key contributions to the literature on sustainable business models and the TT. First, it offers one of the first empirical investigations comparing cooperatives and SMEs in their TT efforts using firm-level data. Second, it addresses methodological challenges associated with comparing cross-sectional survey data collected at different time points. Third, it provides policy-relevant findings by identifying potential barriers and facilitators of sustainability and digital adoption among different firm types. Moreover, this research contributes to the broader discourse on how organizational structures impact sustainability transitions, offering comparative insights that can inform both theory and practice.

Additionally, one of the key aspects of our analysis is the regional variation in firm behaviour. The dataset allows us to examine whether geographic location, specifically the division of Italy into North, Center, and South, influences firms' engagement in the TT. Prior studies suggest that firms in Northern Italy, which traditionally exhibit higher levels of industrialization and innovation, might be more inclined to adopt green and digital innovations compared to those in the Center and South, where economic and infrastructural challenges persist (Iammarino & McCann, 2013). By

incorporating these geographic determinants, we aim to understand whether regional disparities play a significant role in shaping firms' sustainability and digitalization efforts.

Data and Methodology

The analysis relies on an original dataset constructed by merging two independently conducted surveys. The first dataset consists of 300 observations from a survey on cooperative enterprises conducted in 2025 focusing on the time frame 2021-2023, while the second dataset contains 4000 observations from a survey on SMEs conducted in 2021, focusing on the time frame 2019-2020. Although collected at different times, both surveys provide highly comparable information on firms' environmental strategies, in particular on the adoption of circular economy strategies (CES), eco-innovations (EIs) and technological innovations (TIs), besides organizational characteristics, enabling a robust comparative analysis.

One of the primary methodological challenges in this study is ensuring that differences in survey timing do not bias the results. To address this issue, we introduce a dummy variable for the survey year to account for potential time effects. Additionally, we include an interaction term between firm type and survey year to test whether the differences between SMEs and cooperatives vary across the two distinct periods. By implementing these controls, we aim to isolate the effect of firm type from broader macroeconomic and policy-driven shifts that may have occurred between 2019 and 2023 (Wooldridge, 2010; Stock & Watson, 2019).

The empirical strategy consists of a regression framework to examine the determinants of the interconnections between the adoption of CES, EIs and TIs. We pursue three parallel analytical approaches:

1. **Conduct separate regressions for cooperatives and SMEs**: With these models we want to identify the determinants influencing adoption behaviour within each firm type, uncovering potential differences.
2. **Conduct a unified model that includes interaction terms**: By including interaction effects between firm type and key explanatory variables, we assess whether the cooperative business model systematically influences firms' responses to CES, EIs and TIs adoption.
3. **Conduct a spatial analysis:** Conducting a spatial analysis help us explore potential geographical heterogeneity in firms' approaches to the TT, distinguishing between Northern, Central, and Southern Italy. This allows us to assess whether regional disparities affect the adoption of CES, EI and TIs differently for cooperatives and SMEs.

Beyond these regression analyses, we will conduct robustness checks, including sensitivity analyses to account for potential omitted variable biases and alternative model specifications. Additionally, we will explore potential heterogeneity in firm responses based on sectoral classifications, firm size, and regional variations.

Theoretical Framework and Hypotheses

Why cooperative enterprises?

The cooperative enterprise plays a significant role in the global economic system today (Cori et al., 2021) and represents an alternative to the traditional entrepreneurial model of private corporations, whose primary objective is profit maximization (Bernardi & Monni, 2019).

The link between these enterprises and sustainability, was given by different scholars as Annesi et al. (2021) and Bernardi et al. (2022). Given that EI has gained increasing significance over time, as it is

closely linked to the attainment of the Sustainable Development Goals outlined in the United Nations' Agenda 2030, the implementation of these innovations should leverage three fundamental characteristics: leadership, cooperation and transparency. In this context, cooperative business models may appear better positioned to promote sustainability and accelerate the ecological transition compared to private enterprise models. The rationale behind this lies in the distinctive governance and business model of cooperatives, which effectively harmonizes the economic objectives of a business with the principle of mutuality. These enterprises, by their intrinsic nature, work towards the sustainable development of the community, based on principles of self-help, individual responsibility, democracy, equality, and solidarity. It is therefore easy to perceive that cooperatives are inherently predisposed to achieve sustainability that encompasses not only economic but also social and environmental aspects.

In this context, the study by Guerreschi & Zecca (2025) highlights that cooperatives, while addressing social gaps left by other stakeholders like the government, still face barriers to innovation. Their research emphasizes the role of cooperation in implementing CEIS and identifies key factors such as participation in production chains, R&D, and future investments. R&D and export activities influence product design and water consumption reduction, while future investments are crucial for emission reduction. Additionally, R&D supports recycling, re-use, and refurbishing innovations, whereas export appears to hinder innovation adoption.

Why the TT?

The green and digital transitions are occurring simultaneously and are at the core of national and international policy strategies. It is due to their interconnection and simultaneous occurrence that they are referred to as the TT. This term highlights the recognition that both transitions are interdependent and must be addressed in a coordinated and integrated manner to achieve desired outcomes and goals (Ortega-Gras, et al., 2021). In fact, the transition towards a greener economy, and in particular towards a circular economy (CE) necessitates structural changes that should capitalize on the opportunities presented by technological progress and innovation, and the Industry 4.0 (I4.0) has the potential to bring about significant transformation. I4.0, in fact, is characterized as a new paradigm that enhances process and business performance and that can also drive the transition towards a CE by optimizing resource utilization, minimizing waste, and reducing emissions (Laskurain-Iturbe, et al., 2021).

The works concerning the TT and the link with businesses are still few, and most focus on SMEs and on how companies must implement EIs using latest generation technologies to remain competitive in the market identifying which may be the drivers and barriers to this change (Bossle et al., 2016; Horváth & Szabó, 2019; Ghisetti & Montresor, 2020; Ardito et al., 2021; Díaz-Chao et al., 2021; Feng et al., 2022). Less has been said about how cooperatives and their peculiar business model fit into these transitions. It is in this research gap in which the present study aims to fit.

Based on what has been reported, the hypotheses we want to test are the following:

H1: Cooperatives exhibit a higher likelihood of adopting CES and EIs compared to SMEs. This hypothesis builds on the assumption that cooperative enterprises have a stronger commitment to sustainability due to their governance structure and social mission.

H2: The adoption of TIs is positively correlated with environmental sustainability efforts in both cooperatives and SMEs. This hypothesis examines whether firms pursuing green strategies are also more likely to embrace digital tools to improve operational efficiency and compliance.

H3: The cooperative advantage in CES and EIs adoption diminishes when controlling for financial constraints and external market pressures. This hypothesis evaluates whether the perceived superiority of cooperatives in environmental performance holds after accounting for economic and competitive factors.

H4: SMEs, despite their profit-driven nature, demonstrate increasing levels of sustainability adoption in response to regulatory and competitive pressures. This hypothesis explores the extent to which external forces shape SME behaviour in sustainability initiatives.

H5: Differences in TIs adoption between cooperatives and SMEs are moderated by firm size and sector. This hypothesis examines whether the impact of business model type is conditional on other firm characteristics.

H6: Firm location (North, Center, South) significantly affects the likelihood of digital and green innovation adoption. This hypothesis evaluates whether regional disparities play a role in determining firms' engagement with the TT.

Conclusion and expected results

This study aims to fill an important gap in the empirical literature on sustainable business models by systematically comparing cooperatives and SMEs in their response to the TT. By integrating regional analysis, we further explore whether geographic disparities influence firms' ability to transition toward greener and more technological operations. Our findings will help inform best practices for businesses balancing sustainability goals with economic imperatives in a rapidly evolving global market.

Beyond contributing to academic discourse, this research holds practical implications for policymakers, industry stakeholders, and business leaders. Understanding how different governance structures influence the adoption of CES, EIs, and TIs can inform targeted policies that enhance firms' capacity to navigate the TT effectively. Additionally, by identifying potential barriers, such as financial constraints or regional disparities, this study provides insights into how institutional support mechanisms and regulatory frameworks might be tailored to facilitate a smoother and more inclusive transition.

Ultimately, the findings will offer a comparative perspective that sheds light on whether cooperatives truly hold a structural advantage in fostering sustainable and digital innovation, or whether market dynamics and external pressures create convergence with SMEs. This distinction is crucial for shaping future discussions on the role of cooperative enterprises in the green and digital economy, as well as for designing policy interventions that leverage the strengths of both business models to drive a more sustainable economic transformation.

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