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Dynamic Capabilities and Performance in Low-Tech Manufacturing Industries: Examining the Roles of Innovative, Absorptive, and Adaptive Capabilities

Capacidades Dinâmicas e Desempenho em Indústrias Manufatureiras de Baixa Tecnologia: O Papel das Capacidades Inovadora, Absortiva e Adaptativa

Capacidades Dinámicas y Desempeño en Industrias Manufactureras de Baja Tecnología: El Papel de las Capacidades Innovadora, Absortiva y Adaptativa

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ABSTRACT

Purpose: This study examines the distinct effects of innovative, absorptive, and adaptive capabilities on organizational and innovative performance in low-tech manufacturing industries. While dynamic capabilities are generally associated with superior firm performance, less is known about how different dynamic capabilities contribute to performance outcomes in low-technology contexts. **Design/ methodology:** A survey was conducted with 41 Brazilian firms operating in the wood and furniture industries. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). **Findings**: The results reveal a heterogeneous pattern of effects among dynamic capabilities. Innovative capability positively influenced market, financial, and innovative performance, emerging as the most influential capability across all performance dimensions. Absorptive capability positively affected market and financial performance but did not significantly influence innovative performance. Contrary to theoretical expectations, adaptive capability did not positively affect performance and exhibited negative relationships with market and financial performance. **Theoretical contributions**: Innovative, absorptive, and adaptive capabilities do not contribute equally to organizational outcomes in low-tech manufacturing industries. The findings suggest that the effectiveness of dynamic capabilities is context-dependent and that innovative capability represents the most strategically relevant capability in mature industrial environments characterized by lower technological intensity. **Managerial implications:** Managers of low-tech manufacturing firms should prioritize investments in innovative capability and, to a lesser extent, absorptive capability, as these capabilities generate the strongest organizational benefits. Also, adaptive initiatives should be carefully aligned with environmental demands, as adaptation alone may not necessarily translate into superior performance.

Keywords: Dynamic Capabilities; Low-Tech Manufacturing Industries; Innovative Capability; Absorptive Capability; Adaptive Capability; Organizational Performance.

RESUMO

Objetivo: Este estudo examina os efeitos distintos das capacidades inovadora, absortiva e adaptativa sobre o desempenho organizacional e inovador em indústrias manufatureiras de baixa tecnologia. Embora as capacidades dinâmicas sejam geralmente associadas ao desempenho superior das empresas, ainda existem evidências limitadas sobre como diferentes dimensões das capacidades dinâmicas contribuem para os resultados organizacionais em contextos de baixa intensidade tecnológica. **Metodologia:** A pesquisa foi conduzida por meio de uma *survey* com 41 empresas brasileiras dos setores madeireiro e moveleiro. Os dados foram analisados por meio da Modelagem de Equações Estruturais por Mínimos Quadrados Parciais (PLS-SEM). **Resultados:** Os resultados revelam um padrão heterogêneo de efeitos entre as capacidades dinâmicas. A capacidade inovadora influenciou positivamente os desempenhos de mercado, financeiro e inovador, destacando-se como a capacidade mais influente em todas as dimensões analisadas. A capacidade absortiva apresentou efeitos positivos sobre os desempenhos de mercado e financeiro, mas não influenciou significativamente o desempenho inovador. Em contraste com as expectativas teóricas, a capacidade adaptativa não apresentou efeitos positivos sobre o desempenho e exibiu relações negativas com os desempenhos de mercado e financeiro. **Contribuições teóricas:** Os resultados demonstram que as capacidades inovadora, absortiva e adaptativa não contribuem igualmente para os resultados organizacionais em indústrias manufatureiras de baixa tecnologia. Os achados sugerem que a efetividade das capacidades dinâmicas depende do contexto e indicam que a capacidade inovadora representa a capacidade mais estrategicamente relevante em ambientes industriais maduros caracterizados por menor intensidade tecnológica. Ao ampliar a pesquisa em capacidades dinâmicas para indústrias de baixa tecnologia, este estudo contribui para uma compreensão mais refinada das implicações heterogêneas das diferentes capacidades dinâmicas sobre o desempenho organizacional. **Contribuições para a gestão:** Os resultados indicam que gestores de empresas manufatureiras de baixa tecnologia devem priorizar investimentos no fortalecimento da capacidade inovadora e, em menor medida, da capacidade absortiva, uma vez que essas capacidades geram os maiores benefícios organizacionais. Os achados também sugerem que iniciativas de adaptação devem estar cuidadosamente alinhadas às demandas ambientais, pois a adaptação, por si só, pode não resultar em desempenho superior.

Palavras-chave: Capacidades Dinâmicas; Indústrias Manufatureiras de Baixa Tecnologia; Capacidade Inovadora; Capacidade Absortiva; Capacidade Adaptativa; Desempenho Organizacional.

RESUMEN

Objetivo: Este estudio examina los efectos diferenciados de las capacidades innovadora, absortiva y adaptativa sobre el desempeño organizacional e innovador en industrias manufactureras de baja tecnología. Aunque las capacidades dinámicas suelen asociarse con un desempeño empresarial superior, todavía existe evidencia limitada sobre cómo diferentes dimensiones de las capacidades dinámicas contribuyen a los resultados organizacionales en contextos de baja intensidad tecnológica. **Metodología:** La investigación se realizó mediante una encuesta aplicada a 41 empresas brasileñas de los sectores de la madera y del mueble. Los datos fueron analizados mediante Modelado de Ecuaciones Estructurales por Mínimos Cuadrados Parciales (PLS-SEM). **Resultados:** Los resultados revelan un patrón heterogéneo de efectos entre las capacidades dinámicas. La capacidad innovadora influyó positivamente en los desempeños de mercado, financiero e innovador, destacándose como la capacidad más influyente en todas las dimensiones analizadas. La capacidad absortiva presentó efectos positivos sobre los desempeños de mercado y financiero, pero no influyó significativamente en el desempeño innovador. En contraste con las expectativas teóricas, la capacidad adaptativa no presentó efectos positivos sobre el desempeño y exhibió relaciones negativas con los desempeños de mercado y financiero. **Contribuciones teóricas:** Los resultados demuestran que las capacidades innovadora, absortiva y adaptativa no contribuyen de manera equivalente a los resultados organizacionales en industrias manufactureras de baja tecnología. Los hallazgos sugieren que la efectividad de las capacidades dinámicas depende del contexto y muestran que la capacidad innovadora representa la capacidad estratégicamente más relevante en entornos industriales maduros caracterizados por una menor intensidad tecnológica. Al ampliar la investigación sobre capacidades dinámicas hacia industrias de baja tecnología, este estudio contribuye a una comprensión más refinada de las implicaciones heterogéneas de las diferentes capacidades dinámicas sobre el desempeño organizacional. **Contribuciones para la gestión:** Los resultados sugieren que los gestores de empresas manufactureras de baja tecnología deben priorizar inversiones dirigidas al fortalecimiento de la capacidad innovadora y, en menor medida, de la capacidad absortiva, ya que estas capacidades generan los mayores beneficios organizacionales. Los hallazgos también indican que las iniciativas de adaptación deben estar cuidadosamente alineadas con las demandas del entorno, dado que la adaptación por sí sola puede no traducirse en un desempeño superior.

Palabras clave: Capacidades Dinámicas; Industrias Manufactureras de Baja Tecnología; Capacidad Innovadora; Capacidad Absortiva; Capacidad Adaptativa; Desempeño Organizacional.

INTRODUCTION

Dynamic capabilities have become one of the most influential perspectives in strategic management for explaining how firms sustain competitiveness under conditions of environmental change (Karagouni & Protogerou, 2015; Liu & Xin, 2026). Since the seminal work of Teece et al. (1997) dynamic capabilities have been conceptualized as the organizational ability to integrate, build, and reconfigure internal and external resources to address changing market conditions and technological opportunities. Subsequent research has consistently associated dynamic capabilities with strategic renewal, innovation, adaptability, and superior organizational performance (Fainshmidt et al., 2016; Kurtmollaiev, 2020; Scheuer & Thaler, 2023; D. J. Teece, 2007, 2018).

Despite the maturity of the field, important questions remain regarding the specific mechanisms through which dynamic capabilities contribute to firm performance. Although the literature generally supports a positive relationship between dynamic capabilities and organizational outcomes, recent studies suggest that such effects are neither uniform nor automatic (Chen et al., 2025; Fainshmidt et al., 2016; Fan & Liu, 2025; Schilke et al., 2018). Dynamic capabilities do not directly generate competitive advantage; rather, they enable firms to sense opportunities, mobilize resources, and reconfigure organizational structures in ways that may (or may not) translate into superior performance depending on contextual conditions (Brock & Hitt, 2024; Fan & Liu, 2025). As a result, increasing attention has been devoted to understanding which dynamic capabilities matter most and under what circumstances they contribute to organizational success.

However, most empirical evidence on dynamic capabilities originates from high-technology industries, digitally intensive sectors, knowledge-based firms, and highly dynamic competitive environments. Recent investigations have examined the role of dynamic capabilities in digital transformation, artificial intelligence adoption, Industry 4.0 implementation, sustainable innovation, and technology-driven business model innovation (Chen et al., 2025; Liu & Xin, 2026; Uyanik & Koc, 2025). While these studies have significantly advanced theory, they have also contributed to a context-specific understanding of dynamic capabilities that may not fully reflect the realities of firms operating in more mature and less technology-intensive industries.

This limitation is particularly relevant because low-technology industries continue to represent a substantial share of employment, industrial production, and economic activity worldwide. According to OECD classifications, low-tech sectors are characterized by relatively low levels of R&D intensity, mature technologies, incremental innovation trajectories, and Hirsch limited technological sophistication in final products (Galindo-Rueda & Verger, 2016; OECD, 2015). Yet, contrary to traditional assumptions, these industries are not static or innovation-free. Prior studies have shown that firms operating in low-tech sectors continuously adapt through organizational learning, process improvements, market knowledge, collaborative relationships, and non-R&D-based innovation mechanisms (Evers, 2011; Hirsch-Kreinsen, 2008).

Nevertheless, our understanding of dynamic capabilities in low-tech contexts remains fragmented. Existing studies primarily focus on how low-tech firms innovate or internationalize, while considerably less attention has been devoted to examining how specific dynamic capabilities influence organizational and innovative performance within these environments. This gap is theoretically important because low-tech firms face competitive conditions that differ substantially from those typically investigated in dynamic capability research. Compared with technology-intensive firms, low-tech organizations often operate in more stable technological trajectories, rely less on formal R&D activities, and derive competitive advantage from operational excellence, market responsiveness, accumulated experience, and relational resources. Consequently, there is no reason to assume that all dynamic capabilities contribute equally to performance in these settings.

Recent research has increasingly emphasized the contingent and heterogeneous nature of dynamic capabilities. Studies suggest that different capabilities may generate distinct outcomes depending on environmental conditions, organizational characteristics, and strategic objectives (Brock & Hitt, 2024; Scheuer & Thaler, 2023). Similarly, evidence from emerging economies indicates that firms develop and mobilize dynamic capabilities through different mechanisms according to institutional conditions and resource constraints (Fan & Liu, 2025). These arguments raise an important but insufficiently explored question: **which dynamic capabilities effectively generate performance in low-tech industries?**

To address this gap, this study investigates the effects of three dimensions of dynamic capabilities — innovative capacity, adaptive capacity, and absorptive capacity — on organizational and innovative performance in low-tech manufacturing firms. Drawing upon the framework proposed by (Wang & Ahmed, 2004, 2007), we examine firms operating in the Brazilian wood and furniture industries, two sectors traditionally classified as low-technology manufacturing. Specifically, we investigate whether these capabilities contribute equally to financial, market, and innovative performance, or whether certain dynamic capabilities become more strategically relevant than others in low-tech environments.

This study contributes to the dynamic capabilities literature in three ways. First, it extends dynamic capabilities research to a context that remains underrepresented in the strategic management literature: low-tech manufacturing industries. Second, it advances understanding of the heterogeneous effects of dynamic capabilities by examining whether innovative, adaptive, and absorptive capacities generate distinct performance outcomes. Third, it contributes to ongoing discussions regarding the contextual nature of dynamic capabilities by demonstrating how the performance implications of these capabilities may differ from those commonly reported in technology-intensive environments. By shifting the focus from whether dynamic capabilities influence performance to which dynamic capabilities effectively generate performance in low-tech contexts, this study offers a more nuanced understanding of strategic adaptation in mature manufacturing industries.

CONCEPTUAL RESEARCH MODEL AND HYPOTHESES

Dynamic capabilities are not guaranteed sources of superior performance; their development represents potential for performance improvement (Eisenhardt & Martin, 2000). The initial theoretical-empirical studies on the relationship between dynamic capabilities (DCs) and performance by (Wu, 2007) highlight the implications of DCs for the performance of high-tech startups, corroborating the assertions by Eisenhardt and Martin (2000) and (D. J. Teece, 2007) that complementary structures are necessary for DCs to enhance performance.

Dynamic capabilities refer to a firm's ability to integrate, build, and reconfigure internal and external resources and competencies to address rapidly changing environments, which are essential in determining firm performance (Eisenhardt & Martin, 2000; David. J. Teece et al., 1997). Without dynamic capabilities to convert resources into advantages, entrepreneurial resources do not translate into performance, and companies can quickly deplete their assets and be eliminated (Arend, 2014; Arndt et al., 2022; Kurtmollaiev, 2020; Pezeshkan et al., 2016; Schilke & Helfat, 2025; Zollo & Winter, 2002).

Empirical evidence shows a positive relationship between dynamic capabilities and performance (Fainshmidt et al., 2016; Kurtmollaiev, 2020; Scheuer & Thaler, 2023). Although prior studies generally support a positive relationship between dynamic capabilities and organizational outcomes, recent research suggests that these effects are neither uniform nor automatic. The value generated by dynamic capabilities depends on contextual conditions, environmental characteristics, and the specific capability being mobilized (Scheuer & Thaler, 2023). Emerging evidence indicates that different dynamic capabilities may contribute to distinct organizational outcomes and that their performance implications vary across industries and institutional environments (Fan & Liu, 2025; Kortus & Gutmann, 2023). This argument is particularly relevant in low-technology industries, where innovation trajectories, technological turbulence, and resource configurations differ substantially from the high-technology contexts that dominate the dynamic capabilities literature. Hence, the central hypothesis (H1) of this research is:

> ***H1 (central hypothesis 1)*** *- Dynamic capabilities positively influence the perception of organizational performance in low-tech manufacturing industries.*

Innovation helps organizations navigate turbulent environments and is a key driver of long-term success (Audretsch & Belitski, 2026; Jiménez-Jiménez & Sanz-Valle, 2011). Recent studies suggest that innovative capability functions as a strategic mechanism through which firms transform existing resources and knowledge into new value-creation opportunities, particularly under conditions of environmental uncertainty and market transformation (Chen et al., 2025). In low-technology industries, where formal R&D investments tend to be lower than in high-tech sectors, innovative capability often manifests through incremental innovation, process improvements, product adaptation, and continuous operational renewal.

Such capabilities may be particularly relevant in mature manufacturing sectors, where firms frequently compete through efficiency gains,

customer responsiveness, and incremental improvements rather than through radical technological breakthroughs (Evers, 2011). These assertions support the following hypothesis:

> ***H1a*** *- The greater the innovative capacity of low-tech manufacturing industries, the better the perception of market performance.*

The positive influence of innovative performance on financial performance is well-documented, indicating a strong relationship between innovation and financial outcomes (Chouaibi, 2021; Du et al., 2014; Quelhas, 2021; Saliba de Oliveira et al., 2018). Additionally, innovation is crucial for company survival in uncertain environments (David. J. Teece, 2007). Therefore:

> ***H1b*** *- The greater the innovative capacity of low-tech manufacturing industries, the better the perception of financial performance.*

A company's adaptability reflects its strategic flexibility and ability to adopt necessary organizational changes in response to emerging trends (Gibson & Birkinshaw, 2004; Raisch et al., 2009). Wang and Ahmed (2007) suggest that "the more dynamic the market environment, the stronger the drive for companies to exhibit dynamic capabilities due to external changes". Historically, organizations have always needed to adapt to constant changes in their business environment (Duncan, 1976; Lawrence & Lorsch, 1969; Miles et al., 1978). Adaptive capacity enables organizations to seek new markets and technologies, process new information, adjust and reconfigure organizational structures and management quickly, and explore new knowledge (David. J. Teece, 2007; David. J. Teece et al., 1997).

More recent studies have reinforced the importance of adaptive capacity as a mechanism through which firms respond to institutional change, evolving market conditions, and shifting competitive environments (Fan & Liu, 2025). Through adaptive capability, firms are able to realign resources and strategic priorities in response to external pressures, thereby increasing organizational resilience and strategic flexibility.

Although adaptive capability is generally expected to contribute positively to organizational outcomes, recent literature also suggests that its effectiveness may vary according to environmental dynamism and industry characteristics (Scheuer & Thaler, 2023), making its role in low-technology industries an important empirical question. These statements support the following hypotheses:

> ***H1c*** *- The greater the adaptive capacity of low-tech manufacturing industries, the better the perception of market performance.*

> ***H1d*** *- The greater the adaptive capacity of low-tech manufacturing industries, the better the perception of financial performance.*

Absorptive capacity, initially discussed by (W. M. Cohen & Levinthal, 1990), is the ability of a company to recognize the value of new external information, assimilate it, and apply it for commercial purposes. Absorptive capacity is characterized by three components: acquisition, assimilation, and exploitation, with transformation being later added as a fourth component

(Zahra & George, 2002). (Kale et al., 2019) observed that acquisition does not directly affect financial performance, whereas the use of assimilation, transformation, and exploitation components does. Empirical tests confirm a positive and significant effect of absorptive capacity on financial performance (Kostopoulos et al., 2011; Wales et al., 2013). Studies also demonstrate a relationship between absorptive capacity and organizational performance in various business contexts (Cardozo et al., 2019; Miranda et al., 2021; Najafi-Tavani et al., 2018).

Recent evidence further highlights absorptive capacity as a strategic management capability that enables firms to identify, assimilate, and exploit external knowledge through interorganizational relationships, customer interactions, social capital, and prior knowledge accumulation (Cunha Filho et al., 2025). In this perspective, absorptive capacity constitutes a critical mechanism through which firms operating under resource constraints access and leverage external knowledge to improve competitiveness and organizational performance – supporting the following hypotheses:

> ***H1e*** *- The greater the absorptive capacity of low-tech manufacturing industries, the better the perception of market performance.*
>
> ***H1f*** *- The greater the absorptive capacity of low-tech manufacturing industries, the better the perception of financial performance.*

Regarding innovative performance, innovation entails the exploration and transformation of knowledge within and outside organizations by employees, particularly when shared (Jiménez-Jiménez & Sanz-Valle, 2011; McKelvie et al., 2018). Kianto et al. (2017) state that innovation involves production, adoption, assimilation, and application of new ideas with added value in social and economic areas, as well as improvements in services, products, and management methods. Some studies consider innovative performance as an output of the firm's innovative capacity (Gunday et al., 2011; Lazzarotti et al., 2014). Teece and Pisano (2003) describe dynamic innovation capacity as the subset of competencies and capabilities enabling a firm to generate new products and processes in response to market changes. Innovative organizations tend to respond more quickly to environmental pressures and, as a result, develop competitive advantages (Arend, 2014; Piening & Salge, 2015; Robertson et al., 2023). Research indicates that engaging in innovation activities can lead to superior performance (Piening & Salge, 2015).

Nevertheless, recent research suggests that the relationship between dynamic capabilities and innovation outcomes is contingent upon contextual conditions and organizational characteristics. Different dynamic capabilities may contribute unevenly to innovation performance, depending on how firms mobilize resources, access knowledge, and respond to environmental changes (Robertson et al., 2023; Scheuer & Thaler, 2023). Consequently, investigating this relationship in low-technology industries offers an opportunity to better understand whether capabilities traditionally associated

with innovation-intensive environments generate similar outcomes in mature manufacturing sectors. This supports our second central hypothesis:

> ***H2 (central hypothesis 2)*** *- Dynamic capabilities positively influence the perception of innovative performance in low-tech manufacturing industries.*

Innovation drives the transformation of resources into capabilities, enhancing performance in innovation (Julienti et al., 2010). Studies argue that the ability to innovate positively impacts product innovation performance (Manthey et al., 2017). Wang and Ahmed (2007) explain that superior performance is achieved as innovation capabilities align organizational resources with customer expectations. Therefore, the more an organization demonstrates innovation capabilities, the greater its performance (Wang & Ahmed, 2007). Recent studies have reinforced this argument by demonstrating that innovative capability enables firms to recombine existing knowledge and resources into new products, services, and processes, thereby enhancing innovation outcomes and organizational renewal (Chen et al., 2025; Robertson et al., 2023). This supports the following hypothesis:

> ***H2a*** *- The greater the innovative capacity of low-tech manufacturing industries, the greater the perception of innovative performance.*

Absorptive capacity has been identified as a factor that provides a competitive advantage (Zahra & George, 2002) due to its relationship with innovation (Xie et al., 2018). Achieving and renewing sustainable competitive advantages increasingly requires rapid adaptation to external changes, necessitating continuous learning of new capabilities (Bergh et al., 2011; Reeves, 2016). This implies that companies must develop and constantly renew their adaptive capacity.

Adaptive capability may also contribute to innovation by enabling organizations to continuously interpret environmental changes, identify emerging opportunities, and reconfigure resources to support innovation initiatives (Fan & Liu, 2025). Through these mechanisms, adaptive firms may become better positioned to introduce incremental innovations and adjust innovation activities to evolving market conditions. These statements support the following hypothesis:

> ***H2b*** *- The greater the adaptive capacity of low-tech manufacturing industries, the greater the perception of innovative performance.*

Absorptive capacity influences innovation, enhancing competitiveness and adaptation to the environment (Mikhailov & Reichert, 2019; Sancho-zamora et al., 2022). This ability positively impacts a firm's capacity to absorb the technological value of innovation, thereby stimulating subsequent innovations (Meyer & Subramaniam, 2014). Firms with high absorptive capacity can efficiently identify and exploit knowledge or technologies (Zhou et al., 2019). Furthermore, absorptive capacity has increasingly been viewed as a strategic process embedded in organizational routines and managerial decision-making, facilitating the transformation of external knowledge into innovation outcomes (Cunha Filho et al., 2025). Through partnerships, cus-

tomer interactions, and accumulated prior knowledge, firms enhance their ability to convert external information into innovative products, processes, and organizational practices. This supports the following hypothesis:

> ***H2c*** *- The greater the absorptive capacity of low-tech manufacturing industries, the greater the perception of innovative performance.*

METHODOLOGICAL PROCEDURES

Research Context

To evaluate companies in low-technology manufacturing, we followed (Jaegers et al., 2024) classification and focused on companies within Division 16 (Wood Products) and Division 31 (Furniture).

We selected Brazilian companies to maintain consistency in cultural, economic, and social aspects. Over the past decade, companies in emerging markets, such as Brazil, have attracted increasing academic attention due to their significant competitive strength in the global context (Stettiner et al., 2021). So, this study focuses on low-tech Brazilian companies that use wood as a primary raw material. Wood has historically been crucial to Brazil's development, and the country remains one of the world's largest wood exporters. The research includes companies in the wood and furniture manufacturing sectors in Santa Catarina and Rio Grande do Sul, Brazil.

The Brazilian Forest sector comprises three main production chains: industrial wood (pulp, paper, and wood panels); mechanical processing of wood (sawn wood and plywood); and wood for energy (firewood, chips, and charcoal). The furniture and wood sector are particularly noteworthy, employing 17.1% of all forest sector workers in Brazil, while the pulp and paper sector employs 12.2% of the workforce as of 2018. The selection criteria for respondents are outlined in Table 1.

Table 1.

Selection Criteria

Criteria	Implications
Economic activity	Manufacturing
Region	Santa Catarina and Rio Grande do Sul states
Technological Intensity	Low
Sector	Wood and Furniture
Size	Medium and large companies
Company age	More than 3 years

Source: Prepared by the authors

In Santa Catarina, there are 7,576 timber companies with the CNAE code C-16, of which only 84 are classified as medium or large. Additionally, there

are 57 companies in the furniture sector. In Rio Grande do Sul, there are 8,057 active timber companies, with only 19 classified as medium or large, and 9,887 furniture companies, of which only 124 are medium or large. This results in a total population of 284 medium or large companies.

Data and Sample Collection Strategy

The data collection stage was conducted over three months in 2022 through a cross-sectional survey. A structured questionnaire was administered online via email, LinkedIn, phone calls, and WhatsApp. The questionnaire was sent to 284 companies, and we received 41 responses, representing a response rate of 15%.

The sample included firms exclusively operating in the wood industry (48.8%), furniture industry (29.3%), and firms simultaneously engaged in both sectors (22.0%). Geographically, the firms were distributed across several regions of Southern Brazil, with a concentration in the Mid-West region of Santa Catarina (39.0%), followed by the Western (14.6%) and Northern (12.2%) regions of the state. Additional firms were in the Serra Catarinense, Southern Santa Catarina, Vale do Itajaí, and several regions of Rio Grande do Sul, including the Northeast, Northwest, Metropolitan Porto Alegre, and Central regions.

The participating firms exhibited substantial heterogeneity regarding organizational age, size, technological intensity, and revenue levels. Firm age ranged from 3 to 122 years, with nearly half of the firms (47.5%) founded between 1950 and 2000, indicating the predominance of mature organizations with long-term market experience.

Firm size also varied considerably. The number of employees ranged from 12 to approximately 3,000 workers. More than half of the sample (53%) consisted of firms employing between 12 and 500 employees, while the remaining firms included medium-sized and large organizations with workforces exceeding 1,000 employees. Revenue indicators revealed a similar pattern. While micro and small firms represented 17.1% of the sample, most organizations were classified as medium-sized, medium-large, or large firms, with annual revenues exceeding R$16 million.

The sample characteristics further support the low-technology nature of the investigated context. Most firms reported relatively low levels of production automation. Nearly half of the organizations indicated that no more than 20% of their production processes were automated, while only a small proportion reported automation levels above 60%. This evidence is consistent with previous studies describing wood and furniture industries as sectors characterized by mature technologies, labor-intensive production systems, and innovation processes that are predominantly incremental rather than science based.

These characteristics indicate that the sample captures substantial organizational diversity while remaining consistent with the theoretical context of low-technology manufacturing industries.

Measurements

Independent Variables

For this research, the three dimensions of the dynamic capabilities (DC) construct were used, namely: Adaptive Capacity, Absorptive Capacity, and Innovation Capacity. According to Wang and Ahmed (2007), these capacities are common components of DCs observed among companies.

- **Innovation Capacity:** Measured based on the model proposed by (Camisón & Villar-López, 2014), which includes measures of product innovation, process innovation, and organizational innovation, with 20 statements verified using a 5-point Likert scale.
- **Adaptive Capacity:** Measured using the scale developed by (Zaluski et al., 2020), which includes the dimensions of multiplexity, redundancy, and flexible coupling, verified using a 5-point Likert scale with 21 observable variables.
- **Absorptive Capacity:** Considered either as a single construct (Wang & Ahmed, 2007) or comprising four components: acquisition, assimilation, transformation, and exploration (Xie et al., 2018). This was measured using the model of (Najafi-Tavani et al., 2018), employing a 5-point Likert scale with 20 observable variables.

Dependent Variables

The dependent variables in this study are:

- **Organizational Performance:** operationalized as a multidimensional construct composed of financial and market performance dimensions, following the approach proposed by (Brouthers & Werner, 1999) and subsequently adopted in international business and strategic management research (Brouthers et al., 2003). The construct was measured using eight items assessed on a five-point Likert scale, ranging from 1 (much worse) to 5 (much better), based on respondents' perceptions of their firms' performance over the previous three years. The financial performance dimension comprised three indicators: (1) sales growth, (2) sales level, and (3) profitability. The market performance dimension comprised five indicators: (4) market share, (5) marketing performance, (6) corporate reputation, (7) distribution performance, and (8) market access, including access to new customers, suppliers, and investors.
- **Innovative Performance:** Operationalized following the model of Inkinen et al. (2015), based on (Weerawardena, 2003). This model includes items where companies compare themselves to competitors in terms of innovations in products, processes, management, and marketing. Inkinen et al. (2015) introduced an additional variable to this measurement: the company's business model.

Control Variables

Two control variables were used in this research:

- **Industry/Sector:** Companies were categorized into the wood sector, furniture sector, or both sectors.
- **Company Age:** Measured by the number of years since the company's founding, as this impacts market experience (Mazzola et al., 2016) and the utilization of information and knowledge (Gwebu et al., 2019), which can influence performance (Wegner et al., 2013).

Data Analysis and Measurement Model Assessment

PLS-SEM Procedure

Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS 3.3 software. PLS-SEM was selected because it is particularly appropriate for exploratory and prediction-oriented research, complex models involving multiple latent constructs, and situations where theoretical development remains emergent (Hair et al., 2022).

Prior to model estimation, an analysis of variance (ANOVA) was conducted to examine the potential need for control variables. The results indicated no statistically significant differences in the latent constructs according to firm age or industrial segment (wood, furniture, or both sectors). Consequently, these variables were not included as controls in the final model.

Following current PLS-SEM guidelines (Hair et al., 2022), the analysis was conducted in two stages. First, the measurement model was assessed through indicator reliability, internal consistency reliability, convergent validity, and discriminant validity.

Measurement Model Assessment

The measurement model was evaluated through indicator reliability, composite reliability (CR), Cronbach's alpha (α), and average variance extracted (AVE) (Table 2). During the estimation process, indicators presenting unsatisfactory factor loadings were excluded to improve model quality and ensure adequate convergent and discriminant validity.

Table 2.

Values of the goodness of fit of the SEM model after eliminating OVs to obtain discriminant validity

Construct	Dimension	Number of Indicators	Extracted Variance	Compound Reliability	Cronbach's Alpha
Absorptive Capacity (IV)	Acquisition	3	0.592	0.813	0.655
	Assimilation	3	0.744	0.897	0.825
	Transformation	5	0.634	0.896	0.854
	Exploration	5	0.688	0.916	0.883
Adaptive Capacity (IV)	Market information and analysis systems	5	0.692	0.918	0.887
	Plurality and Multi. of the Teams	7	0.678	0.936	0.920
	Flexible organizational structure and innovative management	5	0.784	0.948	0.931
Innovative Capacity (IV)	Organizational Innovation	3	0.706	0.878	0.798
	Process Innovation	5	0.701	0.921	0.892
	Product Innovation	4	0.629	0.871	0.804
Financial Performance (DV)		2	0.777	0.874	0.714
Market Performance (DV)		4	0.584	0.848	0.765
Innovative Performance (DV)		3	0.703	0.876	0.789

Source: Research data / **Note:** DV – Dependent Variable

As shown in Table 1, all constructs exceeded the recommended thresholds for internal consistency reliability, with Cronbach's alpha and composite reliability values above the minimum acceptable level of 0.70 (Hair et al., 2022). Convergent validity was assessed through the Average Variance Extracted (AVE), with all constructs presenting values above the recommended threshold of 0.50, indicating that the latent variables explain a substantial proportion of the variance of their indicators. Overall, the results demonstrate satisfactory psychometric properties for the measurement model.

Discriminant Validity

Discriminant validity was assessed using the Fornell-Larcker criterion (Fornell & Larcker, 1981a), which compares the square root of each construct's AVE with its correlations with the remaining constructs. According to this criterion, discriminant validity is established when the square root of the AVE exceeds all corresponding inter-construct correlations. The results presented in Table 3 indicate that all constructs satisfy the Fornell-Larcker criteria, confirming adequate discriminant validity. Therefore, each construct captures a unique phenomenon that is empirically distinct from the others included in the model.

To further assess discriminant validity, the Heterotrait-Monotrait ratio (HTMT) was examined following current PLS-SEM recommendations (Hair et al., 2022). All HTMT values among the higher-order constructs remained below the recommended threshold of 0.90, providing additional evidence of discriminant validity. Therefore, the results obtained through both the Fornell-Larcker criterion and HTMT support the distinctiveness of the study constructs.

Table 3.

Discriminant validity / Fornell-Larcker Criterion

	Acquisition	Assimilation	Transformation	Exploration	Organiz. Innovation	Process Innovation	Product Innovation	IS and Analysis	Plurality and Multi. +	Organizational Structure +	Financial Performance	Innovative Performance	Market Performance
Acquisition	0.769												
Assimilation	0.539	0.862											
Transformation	0.459	0.733	0.797										
Exploration	0.685	0.785	0.740	0.829									
Organizational Innovation	0.570	0.581	0.593	0.760	0.840								
Process Innovation	0.548	0.607	0.578	0.656	0.467	0.837							
Product Innovation	0.452	0.629	0.547	0.600	0.393	0.670	0.793						
Information Systems and Market Analysis	0.521	0.730	0.714	0.799	0.607	0.771	0.740	0.832					
Plurality and Multi. of the Teams	0.544	0.690	0.716	0.784	0.805	0.646	0.654	0.777	0.824				
Flexible Org. Structure and Innovative Management	0.531	0.779	0.739	0.817	0.746	0.776	0.606	0.779	0.805	0.885			
Financial Performance	0.426	0.417	0.399	0.418	0.237	0.486	0.342	0.327	0.203	0.376	0.881		
Innovative Performance	0.447	0.650	0.681	0.712	0.716	0.580	0.370	0.694	0.635	0.741	0.382	0.838	
Market Performance	0.398	0.543	0.484	0.491	0.337	0.511	0.408	0.493	0.301	0.501	0.668	0.682	0.764

Source: survey data

Structural Model Assessment

Following confirmation of the measurement model quality, the structural model was evaluated. The assessment included the coefficient of determination (R^2), predictive relevance (Q^2), effect sizes (f^2), and overall model fit indicators. The coefficient of determination (R^2) was used to assess the explanatory power of the model. Following Cohen (1988), R^2 values of approximately 0.02, 0.13, and 0.26 indicate small, medium, and large explanatory effects, respectively. Predictive relevance was evaluated through Stone-Geisser's Q^2 statistic, with positive values indicating predictive capability of the model.

Effect sizes (f^2) were also examined to assess the individual contribution of each exogenous construct to the endogenous variables. According to (J. Cohen, 1988), values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively. Finally, the significance of the hypothesized relationships was assessed using the bootstrapping procedure with 5,000 subsamples. Path coefficients (β), t-values, and p-values were examined to determine the statistical significance of the proposed hypotheses. The results of the structural model (Table 5 and Figure 1) and hypothesis testing are presented in the following section.

To assess the explanatory power of the structural model, the coefficients of determination (R^2) and adjusted coefficients of determination (adjusted R^2) were examined for all endogenous constructs. The R^2 indicates the proportion of variance in an endogenous construct explained by its predictor constructs, whereas adjusted R^2 provides a more conservative estimate by accounting for model complexity. The SmartPLS results (see Table 4) indicate substantial explanatory power for the three performance outcomes analyzed in this study. Specifically, the model explains 47.6% of the variance in financial performance, 65.1% of the variance in innovative performance, and 44.6% of the variance in market performance.

Table 4.

Explanatory Power of the Structural Model

Endogenous construct	R^2	Adjusted R^2	Interpretation
Absorptive Capability	0.996	0.996	Substantial
Innovative Capability	0.898	0.890	Substantial
Adaptive Capability	0.997	0.997	Substantial
Financial Performance	0.476	0.433	Substantial
Innovative Performance	0.651	0.622	Substantial
Market Performance	0.446	0.401	Substantial

Source: survey data

These results suggest that the proposed model explains a meaningful proportion of the variance in organizational and innovative performance in low-tech manufacturing industries.

RESULTS

Table 4 presents the results of the structural model and hypothesis testing. The findings reveal a heterogeneous pattern regarding the effects of dynamic capabilities on organizational and innovative performance in low-tech manufacturing industries.

With respect to organizational performance (H1), the results indicate that innovative capability exerts a positive and statistically significant effect on both market performance ($\beta = 0.737$; $t = 3.627$; $p < 0.001$) and financial performance ($\beta = 0.922$; $t = 3.150$; $p < 0.001$), supporting hypotheses H1a and H1b. Similarly, absorptive capacity positively influences market performance ($\beta = 0.465$; $t = 1.930$; $p = 0.050$) and financial performance ($\beta = 0.631$; $t = 2.237$; $p = 0.025$), providing support for hypotheses H1e and H1f.

In contrast, adaptive capacity did not exhibit the expected positive effects on organizational performance. The relationships between adaptive capacity and market performance ($\beta = -0.561$; $t = 2.113$; $p = 0.035$) and between adaptive capacity and financial performance ($\beta = -1.002$; $t = 3.433$; $p = 0.001$) were negative, leading to the rejection of hypotheses H1c and H1d. Consequently, the first central hypothesis (H1) was only partially supported.

Table 5.

Measurement of final path models (causal relationship) and effects/hypothesis testing

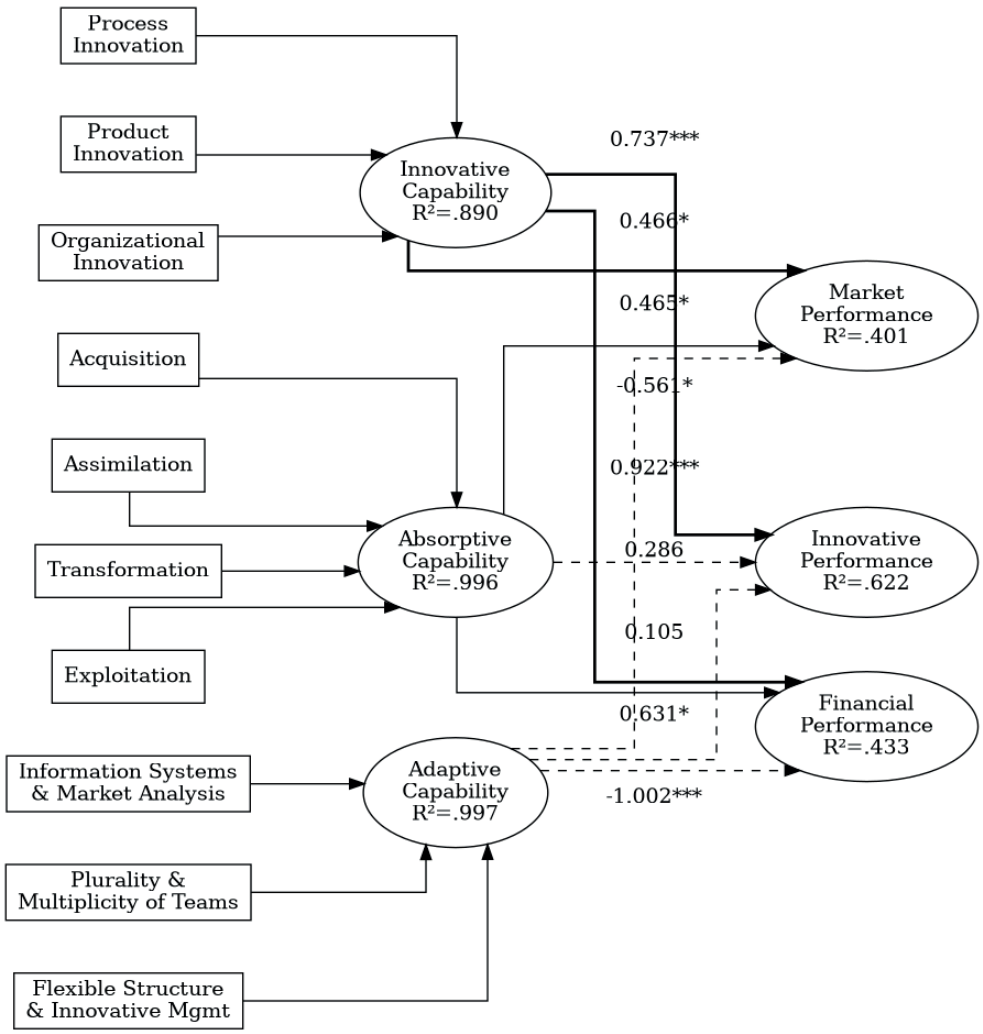
Hypothesis	Sample Average	Standard Deviation	Standardized Path Coefficient (β)	Value-t	Value-p	Effect	Hypothesis situation
H1 (central hypothesis 1) - Dynamic capabilities positively influence the organizational performance of low-tech manufacturing industries.	—	—	—	—	—	—	**Partially Supported**
H1a - The greater the innovative capacity of low-tech manufacturing industries, the better the perception of market performance.	0.858	0.203	0.737	3.627	0.00	Large	Supported
H1b - The greater the innovative capacity of low-tech manufacturing industries, the better the perception of financial performance.	0.853	0.293	0.922	3.150	0.00	Large	Supported
H1c - The greater the adaptive capacity of low-tech manufacturing industries, the better the perception of market performance.	-0.499	0.265	-0.561	2.113	0.03	—	Not Supported
H1d - The greater the adaptive capacity of low-tech manufacturing industries, the better the perception of financial performance.	-0.817	0.292	-1.002	3.433	0.00	—	Not Supported
H1e- The greater the absorptive capacity of low-tech manufacturing industries, the better the perception of market performance.	0.343	0.241	0.465	1.930	0.05	Large	Supported
H1f- The greater the absorptive capacity of low-tech manufacturing industries, the better the perception of financial performance.	0.549	0.282	0.631	2.237	0.02	Large	Supported
H2 (central hypothesis 2) - Dynamic capabilities positively influence the innovative performance of low-tech manufacturing industries.	—	—	—	—	—	—	**Partially Supported**
H2a - The greater the innovative capacity of low-tech manufacturing industries, the greater the perception of innovative performance.	0.527	0.207	0.466	2.250	0.02	Large	Supported
H2b - The greater the adaptive capacity of low-tech manufacturing industries, the greater the perception of innovative performance.	0.158	0.265	0.105	0.397	0.69	—	Not Supported
H2c - The greater the absorptive capacity of low-tech manufacturing industries, the greater the perception of innovative performance.	0.203	0.205	0.286	1.390	0.16	—	Not Supported

Source: survey data
Note: All VIF values remained below 5, indicating no collinearity concerns.
Reference values: coefficients of determination (R^2) of approximately 0.02, 0.13, and 0.26 represent small, medium, and large effect sizes, respectively (Cohen, 1988). t-values ≥ 1.96 correspond to p-values ≤ 0.05 (95% confidence level).

Regarding innovative performance (H2), the results demonstrate that only innovative capability significantly influences firms' innovative performance (β = 0.466; t = 2.250; p = 0.024), supporting hypothesis H2a. Neither adaptive capacity (β = 0.105; t = 0.397; p = 0.691) nor absorptive capacity (β = 0.286; t = 1.390; p = 0.165) showed statistically significant effects on innovative performance. Therefore, hypotheses H2b and H2c were not supported.

Figure 1.

Final Structural Model of the Relationships Between Dynamic Capabilities and Performance in Low-Tech Manufacturing Industries



Source: survey data

The findings indicate that innovative capability is the only dynamic capability consistently associated with all performance dimensions investigated in this study. Absorptive capacity contributes positively to organizational outcomes, particularly market and financial performance, but does not significantly affect innovative performance. Adaptive capacity, in turn, failed to produce the expected positive effects and exhibited negative relationships with organizational performance measures. Figure 1 presents the final structural model and the statistically significant paths identified through the PLS-SEM analysis.

These results provide initial evidence that the performance implications of dynamic capabilities are not homogeneous across low-tech manufacturing industries. Rather than contributing equally to organizational outcomes, different dynamic capabilities appear to generate distinct effects depending on the type of performance considered.

DISCUSSION AND IMPLICATIONS

This study examined which dynamic capabilities effectively generate organizational and innovative performance in low-tech manufacturing industries. Contrary to the implicit assumption found in much of the dynamic capabilities literature that dynamic capabilities uniformly contribute to superior outcomes, the results reveal a heterogeneous pattern of effects. Innovative capability emerged as the only dynamic capability consistently associated with all performance dimensions investigated, while absorptive capacity contributed only to organizational performance and adaptive capacity failed to generate the expected positive effects.

The first important finding concerns the central role of innovative capability. Innovative capability positively influenced market, financial, and innovative performance, making it the only dynamic capability that consistently generated favorable outcomes across all dependent variables. This finding supports previous studies suggesting that innovation-related capabilities represent a primary mechanism through which firms transform resources and knowledge into competitive advantage (Lawson & Samson, 2001; Piening & Salge, 2015; Robertson et al., 2023). However, the present results extend this argument by demonstrating that innovative capability remains strategically relevant even in industries characterized by low technological intensity.

This finding is particularly important because low-tech industries are often portrayed as sectors with limited innovation potential due to their lower R&D intensity and reliance on mature technologies (Kirner et al., 2009; Zawislak et al., 2020). The results suggest a different interpretation. Rather than depending on science-based innovation or technological breakthroughs, firms in these sectors appear to benefit from organizational, process, and product innovations that enable continuous adaptation to customer needs, operational improvements, and market requirements. In this sense, innovative capability functions as a strategic mechanism through which low-tech firms sustain competitiveness despite operating in relatively mature technological environments.

A second important finding concerns absorptive capacity. The results indicate that absorptive capacity positively influences market and financial performance but does not significantly affect innovative performance. While prior studies generally report positive relationships between absorptive capacity and innovation outcomes (Kostopoulos et al., 2011; Wales et al., 2013; Xie et al., 2018), the present findings suggest that the benefits of absorptive capacity in low-tech industries may follow a different pathway.

One possible explanation is that firms operating in low-tech sectors absorb external knowledge primarily to improve operational efficiency, production processes, customer relationships, and managerial practices rather than to develop new products or technologies. In this context, external knowledge may contribute directly to market and financial performance without necessarily generating observable innovation outcomes. This interpretation is consistent with recent perspectives that view absorptive capacity as a strategic mechanism for accessing and leveraging external knowledge under resource constraints (Cunha Filho et al., 2025). Therefore, absorptive capacity may create value through incremental improvements and operational effectiveness rather than through innovation itself.

The most unexpected finding concerns adaptive capacity. Contrary to theoretical expectations, adaptive capacity exhibited negative relationships with market and financial performance perception and no significant relationship with innovative performance. At first glance, these findings appear inconsistent with the dynamic capabilities' literature, which generally associates adaptation with organizational success (D. J. Teece, 2007; Wang & Ahmed, 2007). However, when examined within the context of low-tech manufacturing industries, an alternative interpretation emerges.

Unlike high-technology sectors characterized by rapid technological change and continuous market disruption, low-tech industries often operate within relatively stable technological trajectories. Under such conditions, frequent organizational adaptation may not necessarily generate superior performance. Instead, excessive adaptation may increase organizational complexity, create adjustment costs, divert managerial attention, and reduce operational efficiency. Firms may therefore achieve superior performance not by continuously reconfiguring resources but by exploiting accumulated experience, refining existing routines, and improving operational execution.

This finding contributes to recent discussions suggesting that the value of dynamic capabilities is contingent upon environmental and industrial conditions (Fan & Liu, 2025; Scheuer & Thaler, 2023). While adaptive capability may be essential in highly turbulent environments, its benefits appear less evident in industries characterized by mature technologies and incremental innovation trajectories. Consequently, the present study suggests that not all dynamic capabilities contribute equally to performance and that their effectiveness depends on the context in which they are deployed.

These findings, together, contribute to the dynamic capabilities' literature in three ways. First, they extend dynamic capabilities research to low-tech manufacturing industries, a context that remains underrepresented in the strategic management literature. Second, they demonstrate that dynamic capabilities generate heterogeneous performance outcomes, challenging assumptions that treat these capabilities as uniformly beneficial organizational resources. Third, they suggest that innovative capability may represent the most strategically relevant dynamic capability in low-tech industries, while absorptive and adaptive capacities appear to generate more limited or context-dependent effects.

From a managerial perspective, the findings suggest that managers of low-tech manufacturing firms should avoid assuming that all dynamic capabilities contribute equally to organizational success. Investments aimed at strengthening innovative capability appear to offer the greatest potential returns across multiple performance dimensions. Similarly, efforts to enhance absorptive capacity may improve market and financial outcomes through more effective utilization of external knowledge. In contrast, adaptive initiatives should be carefully aligned with actual environmental demands, as excessive organizational adaptation may not necessarily translate into superior performance in relatively stable industrial contexts.

CONCLUSION, RESEARCH LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study examined which dynamic capabilities effectively generate organizational and innovative performance in low-tech manufacturing industries. The findings reveal that dynamic capabilities do not contribute uniformly to organizational outcomes. Innovative capability emerged as the most influential capability, positively affecting market, financial, and innovative performance. Absorptive capacity contributed to market and financial performance but did not significantly influence innovative performance, while adaptive capacity failed to generate the expected positive effects. These results challenge the assumption that all dynamic capabilities equally enhance performance and suggest that their effectiveness is contingent upon the characteristics of the context in which they are deployed. By extending dynamic capabilities research to low-tech manufacturing industries, this study contributes to a more context-sensitive understanding of strategic adaptation and highlights the importance of examining the heterogeneous performance implications of different dynamic capabilities.

As with any empirical investigation, this study presents limitations that should be acknowledged when interpreting the findings. First, the study was based on a relatively small sample of 41 firms operating in the wood and furniture industries in Southern Brazil. Although PLS-SEM is considered appropriate for exploratory and prediction-oriented studies involving limited sample sizes (Hair et al., 2022), the findings should be interpreted as representative of the investigated context rather than broadly generalizable to all low-tech manufacturing industries. Future studies could expand the sample to include firms from additional sectors and regions. Second, the data were collected using a cross-sectional survey design and relied on respondents' perceptions of organizational and innovative performance. While perceptual measures are widely used in strategic management research, future studies could incorporate objective performance indicators, longitudinal data, and multiple informants to reduce potential respondent bias and strengthen causal inferences.

Third, data collection relied on a single key informant from each organization, typically the CEO, owner, or senior manager responsible for strategic decision-making. Although these respondents were selected because of their comprehensive knowledge of organizational processes and performance, the use of a single-informant design may introduce perceptual bias and limit the capture of alternative organizational perspectives. Future research could adopt multi-informant designs to assess the consistency of perceptions across different hierarchical levels and functional areas, thereby providing a more comprehensive understanding of dynamic capabilities and performance outcomes.

Beyond methodological considerations, the findings also open several theoretical avenues for future research. The most notable concerns the heterogeneous effects of dynamic capabilities observed in this study. While innovative capability consistently influenced organizational and innovative performance, absorptive and adaptive capacities produced more limited or unexpected effects. These findings suggest that dynamic capabilities should not be treated as uniformly beneficial organizational resources and that

their effectiveness may depend on industry characteristics, environmental conditions, and organizational configurations.

In particular, the negative effects associated with adaptive capacity deserve further investigation. Future studies could examine whether excessive adaptation generates organizational costs, managerial overload, strategic fragmentation, or operational inefficiencies in mature industries characterized by relatively stable technological trajectories. Comparative studies between low-tech and high-tech sectors may be especially useful for understanding under which conditions adaptive capability contributes positively or negatively to organizational outcomes.

Similarly, future research could further explore the mechanisms through which absorptive capacity generates value in low-tech industries. The present findings suggest that absorbed knowledge may contribute more directly to operational improvements, efficiency gains, and market responsiveness than to innovation outcomes. Qualitative and mixed-method studies could provide deeper insights into how firms transform external knowledge into different forms of performance.

Additional opportunities for future research include cross-country comparisons, investigations involving different low-technology industries, and longitudinal analyses capable of capturing the evolution of dynamic capabilities over time. Such efforts would contribute to a more nuanced understanding of how dynamic capabilities operate across diverse organizational and institutional contexts.

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