Leveraging supply integration, mass customization and manufacturing flexibility capabilities and the contingency of innovation orientation

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Abstract

Purpose – This paper aims to examine the relationship between supply integration and firm performance by first, investigating the mediating effects of manufacturing flexibility and mass customization; and second, exploring the moderating role of innovation orientation on the link between internal capabilities and performance.

Design/methodology/approach – Resource orchestration and contingency theories are used to address the mediating and moderating effects. A cross-sectional data set on 242 Swedish manufacturers is used to test for the hypotheses using structural equation modeling.

Findings – The findings provide support for the mediating roles of manufacturing flexibility and mass customization in the relationship between supply integration and firm performance. However, the results point to contrasting contingent effects of innovation orientation. While innovation orientation positively moderates the association between mass customization and firm performance, it shows a negative impact on the link between flexibility and performance.

Research limitations/implications – The study contributes to the literature on the integrative activities with upstream supply chain actors. Specifically, the authors highlight how specific capability configurations comprising of supply integration, manufacturing flexibility and mass customization lead to firm performance. Moreover, the authors provide insights on the contingency role of innovation, especially if firms consider flexibility or customization capabilities.

Originality/value – While the individual impacts of flexibility and customization on performance have been addressed previously, there is a paucity of research on how these two capabilities are integrated with supply integration. Moreover, there is little known regarding the role of innovation orientation on these integrated relationships.

Keywords Supply integration, Manufacturing flexibility, Mass customization, Innovation orientation, Resource orchestration

Paper type Research paper

1. Introduction

Why and how some firms are more successful than others is the ongoing focus of research in the operations and supply chain (SC) literature. The resource-based view (RBV) has been an influential theoretical lens to explain "why the performance across firms vary" from a resource heterogeneity perspective (D'Oria *et al.*, 2021), but it does not answer "how some firms outperform others" (Malik *et al.*, 2021). The RBV suggests a

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direct relationship between the possession of strategic resources and competitive advantage, which has been criticized as a "black box" conceptualization because it ignores the managerial actions that are needed to translate the possession of strategic resources into performance (Gligor *et al.*, 2022a). The resource orchestration theory (ROT) addresses this shortcoming of RBV by "looking into the black box" to explain how managers structure and bundle resources to create unique capabilities and the specific ways in which the combinations or configurations of complementary capabilities are leveraged to create a sustained competitive advantage (Sirmon *et al.*, 2007). The notion of capability configurations is central to the ROT because it describes the specific ways in which the complementary capabilities are coordinated and deployed to create value (Malik *et al.*, 2021). The ROT is specifically relevant to the SC literature because of its ability to explain how a firm's internal capabilities are integrated with supplier facing capabilities to leverage competitive advantage (Chavez *et al.*, 2021). Integrating resources to create capability configurations comprising of internal capabilities and supplier facing capabilities is rather complex (Adams *et al.*, 2014) but essential for a competitive advantage (Wiengarten *et al.*, 2019). We contribute to this stream of literature by suggesting the specific ways (a capability configuration) in which internal and supplier facing capabilities are coordinated and deployed to gain competitive advantage. In doing so, we delineate how managers orchestrate strategic resources into idiosyncratic capabilities that are difficult to replicate and hence, provide competitive advantage (Carnes *et al.*, 2022).

We specifically draw on the leveraging process of the ROT to conceptualize and empirically test a configuration of three types of capabilities for competitive advantage:

1 internal production related capabilities (manufacturing flexibility [MF] and mass customization [MC]);
2 supplier facing capability (supply integration [SI]); and
3 the strategic orientation of firm toward innovation (innovation orientation [IO]).

This conceptualization is consistent with the resource advantage leveraging strategy for the manufacturing sector to produce incremental product improvements for expansion of existing markets (Carnes *et al.*, 2022). In this research, we posit that MF is a key internal capability to produce incremental product improvements (Ramos *et al.*, 2021) and MC enables the product improvements to be expanded to the existing market (Liu *et al.*, 2021). Thus, our thesis in this study is that in conjunction with SI, MF and MC capabilities leverage a resource-based advantage for a manufacturing sector. MF is defined as the ability of a system to efficiently respond to both internal and external uncertainties with minimum resource compromise (Ramos *et al.*, 2021). Firms with high MF are more efficient to change output volumes and adjust their production system to accommodate for a different mix of products demanded by customers (Nawanir *et al.*, 2020). MC is another internal production related capability that refers to the ability of a manufacturing system to allow its customer to personalize and/or customize the features of products at a cost and timeframe comparable to mass production (Qi *et al.*, 2020). MC allows manufacturing firms to differentiate their products, create customer value, and, therefore, outperform competition (Salvador *et al.*, 2020). The SC literature, however, suggests integration of internal capabilities with suppliers to stay competitive (Chen and Paulraj, 2004). SI capability represents the ability of a firm to seamlessly integrate the logistics functions with upstream end of the value chain (Stock *et al.*, 2000, p. 535). The literature has addressed the individual effects of the MF and MC on firm performance (FP), but how these two internal capabilities are integrated with SI and if these integrated relationships are affected by the IO of a firm is unknown.

We address this literature shortcoming by drawing on the ROT to explicate how managers orchestrate actions to fully exploit the "structured and bundled resources" for a resource-based advantage (Carnes *et al.*, 2022). This line of inquiry has allowed us to respond to the recent calls in the literature to investigate the specific ways in which strategic resource are used (orchestration actions) to create value because possession of strategic resources is not enough for a competitive advantage (D'Oria *et al.*, 2021). In doing so, we provide more clarity and detail to the operations and SC literature on the importance of specific leveraging actions (mobilization, coordination and deployment) that the managers need to undertake to connect "resource possession" with performance realization (Sirmon *et al.*, 2011). Effective leveraging actions correspond to capability configurations that provide a market fit and, therefore, a source of competitive advantage (Gligor *et al.*, 2022a). In this study, we conceptualize and empirically test a capability configuration – internal production capabilities of MF and MC mediate the relationship between the supplier facing capability (SI) and FP. Our thesis in this research is that the proposed mediation of the relationships between SI and FP by MF and MC represents effective leveraging actions because the literature suggests that a sustained high FP reflects a firm's competitive advantage (Malik *et al.*, 2021). Specifically, our first research question (*RQ*) is:

RQ1. Do MF and MC mediate the relationship between SI and FP?

In this study, we also examine the contingency of the strategic orientation of a firm toward innovation (IO) on how the capability configurations are leveraged. A firm's strategic orientation reflects business tendencies toward a set of activities, which the literature also recognizes as a strategic capability that affects performance (Schweiger *et al.*, 2019; Baker *et al.*, 2022). IO has become a core concept to examine firm behavior toward developing innovation-enabling competencies related to resource allocation, technology, employees, operations and markets (Simpson *et al.*, 2006; Chen *et al.*, 2022). In resource-constrained environments, IO is known as a desirable organizational attribute that fosters creativity, facilitates new forms of resource mobilization, and allows organizations to "anticipate" and "react" to market requirements quicker than their counterparts (Lii and Kuo, 2016). While there are suggestions for the positive contribution of MF and MC toward FP, drawing on the contingency theory (CT) (Sousa and Voss, 2008), we seek to generate additional insights by examining the moderating effect of IO for the relationships between internal capabilities (MF and MC) and FP. Specifically, we also investigate:

RQ2. Does IO moderate the effects of MF and MC on FP?

In Section 2, we provide further details on the theoretical underpinnings for this research, while in Section 3, we develop support for the conceptualized mediating and moderating hypotheses. Section 4 describes the research methodology, and the results. A discussion on the results in terms of theoretical contributions and managerial implications is carried out in Section 5. We conclude the paper with limitations and directions for future research in Section 6.

2. Theoretical foundations

2.1 Resource orchestration theory

ROT, the theoretical lens to answer *RQ1*, is in the intellectual lineage of the resource-based inquiry to explain "why and how some firms outperform others" (D'Oria *et al.*, 2021). The genesis of this line of inquiry is the RBV which suggests that the firms possessing strategic resources that are valuable, rare, inimitable and nonsubstitutable would have a competitive advantage (Kraaijenbrink *et al.*, 2010). The RBV, however, gave a partial explanation because its focus is on why firms outperform others, and it does not provide enough details on how the strategic resources enable a competitive advantage (Gligor *et al.*, 2022a). The augmentation of the RBV to more adequately answer the variations in FP began with the inquiries on how strategic resources are transformed into idiosyncratic firm capabilities (Sirmon *et al.*, 2011). Resources in the resource-based inquiry refer to both tangible and intangible assets that a firm has access to, whereas a firm's capability is derived from using the strategic resources to perform a set of tasks to achieve an outcome (Malik *et al.*, 2021). This shift of focus in the resource-based inquiry from "resource possession" to "resource usage" led to the emergence of the dynamic capabilities (DCs) and the ROT – both DC's and ROT provide a complementary logic to enhance our understanding of how some firms outperform others. Dynamic Capabilities theory doesn't sufficiently differentiate between the "resources that are inputs to the firm and the capabilities that enable the firm to select, deploy and organize such inputs" (Kraaijenbrink *et al.*, 2010). Thus, despite acknowledging the value of organizational responses to the rapidly changing external environment, DC's fall short of examining the key managerial actions to integrate and apply idiosyncratic capabilities for a competitive advantage (D'Oria *et al.*, 2021). The ROT, on the other hand, establishes managerial actions firmly in the nomological network to explain the "black box" of resource possession and competitive advantage (Sirmon *et al.*, 2007).

Specifically, ROT identifies managerial roles to create competitive advantage along three interdependent processes of structuring, bundling and leveraging (Sirmon *et al.*, 2011). Structuring process describes how managers create a portfolio of strategic resources either through acquisition, accumulation or/and divestment. The bundling process puts the spotlight on how managers combine resources to create capabilities which are then used by the leveraging process, as complementary capability configurations, to meet specific market needs (Malik *et al.*, 2021). This capability-market-need fit then translates into competitive advantage (Sirmon *et al.*, 2007). We specifically draw on the "leveraging" process of the ROT as the theoretical framework because leveraging actions are the missing link in connecting "structured and bundled resources" to performance (Carnes *et al.*, 2022). For effective leveraging, the three managerial actions of mobilization, coordination and deployment need to be synchronized. Mobilization refers to the identification of capabilities needed for a specific market and the design of a leveraging strategy to establish the capabilities-market fit (Sirmon *et al.*, 2011).

A ROT leveraging strategy appropriate for a manufacturing context (our study sample) is the "resource advantage" to produce incremental product improvements for expansion of existing markets to strengthen the market advantage (Carnes *et al.*, 2022). Consistent with the resource advantage leveraging strategy for the manufacturing sector, we conceptualize MF as a key internal capability to produce incremental product improvements and MC as an internal capability to expand the existing market. MF is the ability of a firm to efficiently respond to both internal and external uncertainties (MF) (Ramos *et al.*, 2021) and MC is the ability of a manufacturing system to mass-customize (Liu *et al.*, 2021; Qi *et al.*, 2020). Further details on how the two internal capabilities contribute to competitive advantage have been identified in Section 3. Effective leveraging also requires the internal production capabilities of a firm to be integrated with the ability of a firm to integrate its operations with its suppliers (SI) (Boone *et al.*, 2018). The specific ways (capability configuration) in which MF, MC and SI are integrated is determined by the "coordinating" action of the leveraging process of ROT. Coordinating internal capabilities with SC partners is challenging because of conflicting objectives, differences in resource base and core competencies, cultural differences and commitment issues (Adams *et al.*, 2014). The resource orchestration actions relevance to answer *RQ1* is accentuated here because the managerial relational skills to build a social capital (within and across firms in SC's) plays an important role in effective capability coordination (Sirmon *et al.*, 2007). The physical deployment of capability configuration is the third and the final managerial action within the leveraging process of the ROT. The deployment actions heavily draw on the explicit and tacit managerial knowledge and skills to build and maintain the resource base advantage that translates into a competitive advantage (Sirmon *et al.*, 2011; Gligor *et al.*, 2022a). Taken together, mobilization, coordination and deployment are the three sets of orchestration actions representing managerial knowledge and experience that explain how firms may perform differently despite have similar resource base.

2.2 Contingency theory

To address *RQ2*, we draw on the theoretical lens of CT, which suggests that the relationship between the explanatory variables and the outcome is affected by contingencies such as national context, organization factors (e.g. firm size, age, industry type) and the strategic context of a firm (Sousa and Voss, 2008). Recently, more attention has been directed toward elucidating and explaining how strategic context or orientation of a firm can influence the effectiveness of its practices (Schweiger *et al.*, 2019; Baker *et al.*, 2022). In line with CT, we suggest that a strategic orientation toward innovation acts as a moderating force on the relationships between internal capabilities and FP. Often, when change or improvement is introduced in similar ways across multiple firms, the performance is variable (Chavez *et al.*, 2021),

and thus, the benefits are not being fully materialized. Such phenomena can be explained by the lack of innovation culture or orientation in organizations (Simpson *et al.*, 2006; Hughes *et al.*, 2019). According to Wei and Wang (2011), firms with higher IO tend to be quicker and more efficient in materializing new ideas in response to market requirements. Therefore, in such firms, innovative ideas and processes are being spread at a faster rate and wider acceptance (Chen *et al.*, 2009). Hence, we advance the proposition that firms with higher IO could capitalize on their MF and MC capabilities toward achieving a more competitive position (Stock and Zacharias, 2011).

3. Literature review and hypothesis development

3.1 Supply integration

With the developments of supply chain management (SCM), firms have realized the importance of reaching out to SC actors to combine, coordinate, collaborate and align their objectives, resources and capabilities to stay competitive and spread risks (Soosay and Hyland, 2015). Nevertheless, attempts to integrate resources with external parties is a rather complex process due to the heterogeneity of resources, cultural differences, resistance and commitment issues (Adams *et al.*, 2014); to an extent that often an external party is often used to "orchestrate" the interorganizational resources (Zacharia *et al.*, 2011).

Logistics integration is defined as the "specific logistics practices – operational activities that coordinate the flow of materials from suppliers to customers throughout the value stream" (Stock *et al.*, 2000, p. 535). External integration typically involves extensive information sharing, collaborative planning, IT capability and logistics assets, which is highly dependent on the resources and capabilities of the firm and those of the respective SC actors (Chavez *et al.*, 2021). Often in SCM research and practice, closely working with a select number of key suppliers is preferred to arms-length relationships with large number of actors in achieving integration (Paulraj and Chen, 2007). Lack of a strategic view on integration among SC actors could lead to complexities and conflicts, whereas integration with suppliers has proven to streamline risk management initiatives (Munir *et al.*, 2020). Therefore, SC orientation is often considered as necessary philosophy in achieving integration (Boone *et al.*, 2018). Seamless SI results in configuring the interorganizational boundaries, and avoiding logistics challenges, including the bullwhip effect (Prajogo and Olhager, 2012).

3.2 Manufacturing flexibility

Upton (1994) defines flexibility as the ability of a manufacturing system to respond to change with minimum resource compromise. Since the early introduction of computers and advanced automation, flexibility has become a desirable attribute of manufacturing systems and a key capability to efficiently respond to both internal and external uncertainties (Chaudhuri *et al.*, 2018). MF is conceptualized as the ability of a firm to manage production resources against such uncertainties to meet various customer requests (Zhang *et al.*, 2003). A major portion of the literature has a central focus on characterizing different types of flexibility and developing taxonomies, while more recent studies aim at conceptual and empirical examination of its performance implications (Nawanir *et al.*, 2020; Chaudhuri *et al.*, 2018).

Particularly, earlier studies on MF have distinguished between two types of flexibility: resource and manufacturing system flexibilities. Resource or lower-order or internal flexibility refers to the specific instruments and techniques applied to achieve flexible attributes, including those related to processes, workforce and equipment (Pérez-Pérez *et al.*, 2018). On the other hand, high-order or external flexibility types are those that directly influence the competitive position of a firm, with *volume* and *mix* known as the most prominent types. Volume flexibility is defined as the ability of a firm to adjust volumes to varying changing demands by operating at a variety of batch sizes and/or different production output levels with minimum disruption (Scherrer-Rathje *et al.*, 2014). Mix flexibility, on the other hand, is associated with the ability to manufacture various combinations of products economically and effectively (Nawanir *et al.*, 2020). Through the lens of DCs, Zhang *et al.* (2003) provide a unique conceptualization for such interaction, by formulating internal-external flexibilities as competence-capability mechanism. They argue that internally facing flexible competences are fundamental to support the development of flexible manufacturing capability, desired by and visible to the customer. Considering the competitiveness implications of flexibility as a capability that influence firm's position in the market (Mishra and Mishra, 2019), volume and mix flexibility types are the main emphasis of this study.

3.3 Mass customization

MC has emerged as the new manufacturing paradigm in practice to blend the advantages of tailored manufacturing and economies of scale from mass production. As a manufacturing capability, MC refers to the ability to meet heterogeneous customer requirements by offering a high volume of customized product options (Liu *et al.*, 2021). Hence, central to MC capability are cost efficiency, high volume production, product quality and reliable customer service-levels characterized by on-time delivery (Qi *et al.*, 2020; Huang *et al.*, 2008). Therefore, several trade-offs should be taken into account by a manufacturing organization when selecting and implementing the right manufacturing strategy – standardization vs MC – depending on the products type, market segment and costs (Shao, 2020). Nevertheless, generally, capitalizing on MC has been stressed to outperform competition in the long tail and creating customer value (Salvador *et al.*, 2020; Pérez-Pérez *et al.*, 2018). A variety of MC typologies have been presented depending on industries, level of customer involvement, product modularity and SC complexity (Swaminathan, 2001; Suzić *et al.*, 2018). In leveraging and realizing MC, managing the upstream SC is often cited as a major challenge (Pérez-Pérez *et al.*, 2018).

The popularity of MC should be considered in relation to the technological and informational developments, as well as intensified competition, shortened product life cycles and increasingly varying customer demand (Kim and Lee, 2022). The literature proposes several mechanisms to achieve MC. For example, modularity facilitates MC by decreasing complexities and operational challenges in processes and

components (Wang and Zhang, 2020). Similarly, postponement strategies have a contributing role to this process (Purohit *et al.*, 2016). Digital technologies, as well as lean and agile practices, have been regarded as other enablers of MC (Purohit *et al.*, 2016; Wang and Zhang, 2020; Tu *et al.*, 2004).

3.4 Innovation orientation

IO reflects a firm's culture encouraging its members to create, contribute to and experiment new ideas (Hurley and Hult, 1998; Chen *et al.*, 2009). As a strategic orientation, it is defined as "the capacity to introduce some new process, product or idea in the organization" (Hult *et al.*, 2004, p. 430). Siguaw *et al.* (2006) describe IO as a complex knowledge structure which involves a "learning philosophy, strategic direction, and transfunctional beliefs." Stock and Zacharias (2011) conceptualize IO in relation to a set of internal arrangements, including strategy, structures and processes, human resource systems, organizational culture and leadership. Firms are adopting IO foster a philosophy which reflects the deep-rootedness of innovation and creativity to challenge the status-quo (Lii and Kuo, 2016). IO is preceded by learning orientation, and other organizational and cultural factors, such as power sharing and communication, participative decision-making, tolerance for conflict and risk, as well as support and collaboration (Hurley and Hult, 1998). IO, which is sometimes used interchangeably with or in strong connection to product or technology orientation, has shown to have associations with market orientation of the firm (Grinstein, 2008). In fact, Berthon *et al.* (2004) maintain that customer (or market) and innovation (or product/technology) orientations are not mutually exclusive.

With such capacity, firms can be more responsive, develop new capabilities; and hence, have a higher chance for developing competitive advantage (Hurley and Hult, 1998; Chen *et al.*, 2009). Hult *et al.* (2004) found support for innovativeness to be the outcome of market, learning and entrepreneurial orientation of firms. On the other hand, scholars have drawn attention to balancing the benefits and potential pitfalls of innovativeness in the short- and long-run (see also Yu *et al.*, 2020). For instance, Simpson *et al.* (2006) underlined both positive and negative outcomes of IO in terms of market, employees and operations. As such, while IO could lead to outperforming competition or higher customer and employees job satisfaction, it may result in product failures, job stress or increased costs. Empirical and conceptual contributions regarding IO in SCM research are scant; even so, the limited studies have different approaches in positioning IO in the overall SC or capability building framework. Hult *et al.* (2002) conceptualize innovativeness, along with learning and entrepreneurship, as an indicator of cultural competitiveness in SC's. A few studies have focused on the nexus of IO and manufacturing or SC-related capabilities (Clauss and Spieth, 2016; Chen *et al.*, 2022). For instance, Lii and Kuo (2016) found that IO positively influences integration along the SC by fostering cooperation and trust among SC partners, especially in new products and meeting customer demand.

3.5 Firm performance

Measuring FP is a well debated topic in the SCM literature due to its multidimensionality implications for both internal and external decision-making. Generally, metrics are verifiable measures, which are "defined with respect to a reference point" (Melnyk *et al.*, 2004, p. 3). Thereby, FP has been widely measured relative to the performance of competitors or the industry average. Predominantly, in the operations and SCM literature, FP is measured quantitatively, both in objective and subjective forms. The most prevalent operationalizations of FP are operations-related – reflecting customer service levels in terms of on-time and accurate delivery, product quality and competitive position, as well as business-related – reflecting financial performance (Flynn *et al.*, 2010; Wisner, 2003; Gu *et al.*, 2017). Other studies suggest including relational performance as another dimension of FP in regard to interorganizational performance of firms in the SC context (Gligor *et al.*, 2022b). While prior research has documented the sequential relationships among the dimensions of FP, some studies opt for a unified and comprehensive approach of measurement. For instance, Green *et al.* (2008) provide support for operational and logistics performance resulting in financial performance via market-facing performance. Yet, to capture FP, Green *et al.* (2019) use a single construct composed of several indicators. Widely agreed in the literature, FP is impacted by the competencies and capabilities of firms (Hüseyinoğlu *et al.*, 2020). Following this line of reasoning and based on ROT, we seek to investigate the mediated effects of SI on FP via MC and MF capabilities.

3.6 Research hypotheses

3.6.1 The mediated effects of supply integration on firm performance

The performance outcomes of integration are nonconclusive. Several contributions have suggested indirect effects of SI on FP. For instance, SI could have benefits for both parties in dyadic relationships, ranging from supplier development to delivery performance and overall cost reduction (Devaraj *et al.*, 2007). The early configurational study by Frohlich and Westbrook (2001) revealed that "outward" integration appears to have the strongest association with performance among all types within the "arcs of integration." On the other hand, given that SI is a long-term exercise, requiring significant investments in resources and mutual trust, it can incur high costs. For instance, Flynn *et al.* (2010) found no support for the impact of SI on operational or business performance.

Drawing on ROT, we maintain that the competitive advantage from SI can be realized once SI is translated or materialized into other capabilities. This is in line with prior research, which suggests that the effect of SI on market or competitive performance is channeled through competitive capabilities (Rosenzweig *et al.*, 2003; Swink *et al.*, 2007). In this regard, supplier relationships can influence operational and competitive strategies (Prajogo and Olhager, 2012). Since logistics has a coordinating mechanism within firms and along the SC's, SI plays a significant role in facilitating time-based competitive capabilities and strategies such as JIT, especially in globally spread SC's (Paulraj and Chen, 2007). Nowadays, manufacturing firms are facing extreme demand volatility and rapid changes in channel requirements, which generally requires adjustments to product volume and mix (MF). Furthermore, driven by recent technological advancements, MC is increasingly becoming a key capability for manufacturing

firms to produce large scale product variety without increasing costs or sacrificing quality (Qi *et al.*, 2020; Liu *et al.*, 2021). We argue that since both MF and MC have a direct interface with the upstream facing integration and capabilities (SI), they could act as transformative and intermediary mechanisms between SI and FP in markets characterized by demand volatility.

Several theoretical lenses are used to explain this mediated relationship, including the dynamic capability perspective (Vanpoucke *et al.*, 2014) and strategic fit theory (Swink *et al.*, 2007). In this regard, we argue that ROT provides a more suitable lens for explaining how the performance outcomes resulting from SI are channeled via the intermediary competitive capabilities of *MF* and *MC*. In this regard, leveraging capabilities involves resource configuration for exploiting market opportunities and value creation (Sirmon *et al.*, 2007). We test the indirect effects of SI (independent variable) on FP (dependent variable) via MF and MC (mediating variables). The ROT perspective allows for explaining how orchestrating resources and/or resource flows with suppliers can be bundled and leveraged with internal capabilities such as MF and MC (Hitt, 2011).

3.6.2 The role of MF

SI has been widely discussed as a main contributor to increasing flexibility. Integration facilitates matching resources with demand, and supports flexibility in uncertain markets by seamless communication and complexity reduction (Swink *et al.*, 2007). Sharing critical information regarding inventory planning and forecasting enables manufacturers to improve their decision-making regarding capacity allocation and planning (Vanpoucke *et al.*, 2014). Therefore, SI is influential in shaping different SC configurations, which results in volume and mix flexibility (McKone-Sweet and Lee, 2009). Supplier-facing logistics integration (e.g. use of common logistics resources, equipment or third-party logistics providers, as well as delivery coordination) could also have benefits in terms of changeover times, lead-times and labor productivity (Frohlich and Westbrook, 2001). Therefore, via SI, manufacturers are in a better position to quickly change production volumes and/or change over to other products in response to demand variations (Liu *et al.*, 2018). As a result, integration facilitates smooth operations and delivery processes and supports dynamic processes (Vanpoucke *et al.*, 2014).

By taking an RBV and information processing theory perspective, Schoenherr and Swink (2012) elaborate on why and how integration could help internalize partners' resources and capabilities, leading to flexibility. Therefore, the well-established literature shows a direct positive link between SI and flexibility (Devaraj *et al.*, 2007). In turn, the effect of flexibility on FP has been an area long gaining scholarly attention, notwithstanding their respective dimensions (Upton, 1994). The types of MF have evolved and been often discussed within the context of SC flexibility or agility. Nevertheless, research on the performance outcomes of MF is prevalent, primarily regarding it as critical in gaining competitive advantage (Pérez-Pérez *et al.*, 2018) or the costs associated with its setup and implementation (Olhager, 1993). While prior research has underlined the "intervening" role of flexibility in linking integration with firm competitive performance, they conceptualize MF as a subdimension of SC flexibility; hence, limiting conclusions regarding the individual role of MF (Jin *et al.*, 2014). In this regard, and drawing on ROT, we argue that MF resulting from SI would create a unique capability configuration, which could lead to competitive advantage. Therefore, we posit that:

H1. MF mediates the relationship between SI and FP.

3.6.3 The role of mass customization

To ensure raw materials, components, modules, resources and information are available to meet MC requirements, a seamless coordination with SC partners is essential. While the research on internal competencies, tools and techniques for successful MC implementation is ample (Suzić *et al.*, 2018), we draw further attention to the boundary-spanning of SC initiatives beyond the firm. We maintain that MC requires orchestrating activities and sharing information with SC actors. SI supports leveraging MC capability in better capturing, forecasting and processing demand to more effectively procuring components, and developing products and processes (Liu *et al.*, 2018). For instance, information-sharing not only supports synchronized decision-making but also can act as a monitor mechanism to observe the dynamics in operations and along SC's (Jin *et al.*, 2014). Therefore, SI is crucial to enable MC (Fogliatto *et al.*, 2012). Nevertheless, despite the costs associated with leveraging MC, several operational and strategic benefits result from MC (Wang and Zhang, 2020), including cost efficiency, customer value, product quality, delivery and product innovation (Zhang *et al.*, 2019; Qi *et al.*, 2020).

MC can also manifest the effective implementation of integration in the SC (Kotzab *et al.*, 2021). Through collaboration and SI, the assembly and configuration of resources, knowledge, skills and assets are further fostered, which enables operational productivity and enhanced customer service (Adams *et al.*, 2014). We contend that ROT provides a proper lens in this regard. Therefore, we posit that collaborating with upstream suppliers in aligning resources and logistics activities, is critical in realizing MC and addressing customer demand. Thus, a unique configuration of orchestrated resources and capabilities with upstream suppliers could be shaped to exploit and capitalize on market opportunities, which ultimately leads to gaining competitive advantage. Thus, we posit that:

H2. MC mediates the relationship between SI and FP.

3.6.4 The moderating effects of innovation orientation

Strategic orientations are manifested in organizations' culture, and IO has attracted scholarly attention as a relevant contextual factor. IO becomes even more relevant in environments associated with turbulence since uncertainty necessities adopting innovations to stay competitive (Mishra and Mishra, 2019). According to Berthon *et al.* (2004, p. 1068), IO has the potential to even "create markets" by "determining the nature of demand." Therefore, IO can act as a catalyzer in how capabilities are mobilized to address demand dynamics. Innovation-oriented firms support using and developing new resources, enabling them to overcome complications in implementing new idea, products, processes or systems

(Hurley and Hult, 1998; Chen *et al.*, 2022). Moreover, in meeting disruptions and challenges, an IO atmosphere allows firms to develop creative recognition of resources and capabilities at their disposal (Chen *et al.*, 2011).

Strategic orientations play significant roles in shaping business strategies. Meanwhile, matching capabilities with firm strategies is critical in achieving competitive advantage, mainly because capabilities *per se* may not guarantee success. Chang *et al.* (2003) underlined that MF does not necessarily lead to improved performance under all circumstances and that the resulting FP is contingent on firm's strategies. In this regard, the role of contingencies in attaining FP from flexibility has been widely stressed by prior research (Vokurka and O'Leary-Kelly, 2000). Based on CT, we argue that an innovation culture within the firm fosters creativity in combining and leveraging resources, as well as seeking for alternatives in production system. For instance, if innovative ideas are supported by management and proposed by production teams, they can effectively support multitasking or reduce changeover times in production lines to meet customer demand quicker (Yu *et al.*, 2020). Also, in addressing production challenges, IO serves as a culture supportive of creativity in providing solutions. Therefore, one can expect more efficient and profitable production operations, and hence competitive position. According to Mishra and Mishra (2019), IO helps predict requirements and grasp opportunities in the market, and as a result, supports how flexibility leads to better FP. Hence, IO supports how the performance outcomes of flexibility in manufacturing systems and processes are manifested.

Strategic orientations, including IO, lead to competitive advantage, specifically, in terms of both incremental and disruptive product and/or process innovations (Baker *et al.*, 2022). "Pro-innovation" firms have higher inclination to better information exchange internally and externally, as well as using knowledge regarding products or markets. For instance, if the firm culture supports information sharing regarding product development and customization with key suppliers, timeliness and quality in the delivery of mass customized products is nurtured, which translates into improved FP. Wang *et al.* (2015) shed light on the nexus of IO and MC delineating how an innovation culture cultivates MC. While we maintain that strategic orientations of firms generally have a role in materializing capabilities (see also Lii and Kuo, 2016), our contention is more in line with that of Chen *et al.* (2011), which rather stress on their contingent role. Innovativeness supports addressing customer requirements, but also exceeding them, in a SC context (Hult *et al.*, 2002). This implies that IO helps firms to prioritize MC capabilities to go beyond simply meeting customer requirements, by harvesting the potential outcomes of such capability to its utmost extent. For instance, if the top management supports innovation, firms will have a higher propensity to capitalize on creative solutions by their employees in product development, and hence improving their overall competitive position (Stock *et al.*, 2014; Chen *et al.*, 2009).

Reflecting on prior research emphasizing on balancing the benefits and costs of developing manufacturing capabilities such as MF and MC (Olhager, 1993; Qi *et al.*, 2020), we posit that their interaction with IO can lead to higher FP. Such cultural factors have been regarded as influential moderators in how capabilities lead to performance (Schilke *et al.*, 2018). Drawing on ROT, we argue that IO not only magnifies the effectiveness of capabilities but also facilitates coordinating and mobilizing them (Sirmon *et al.*, 2007). CT holds that finding the right "fit" between the strategies or practices, and contexts leads to more effective performance gains (Sousa and Voss, 2008). Effective leveraging of resources is contingent on a clear "mobilizing" vision and shared purpose in the firm for how they shall be used (Chirico *et al.*, 2011). We maintain that the role IO plays in how MF and MC lead to FP, can be explained by the "interaction fit," as proposed by Drazin and Van de Ven (1985). Hence, IO can be characterized as a moderating internal contingency (Prajogo *et al.*, 2018). In this vein, we postulate that firms associated with IO, have a higher propensity to support the benefits generated by MF and MC:

H3. IO moderates the relationships between (a) MF, (b) MC and (c) FP.

Figure 1 illustrates the conceptual model of this study that draws on the ROT and CT to suggest two mediating and two moderating relationships.

4. Methods and results

4.1 Data collection

Data was collected using a cross-section survey on manufacturing firms in Sweden (NACE codes 10 to 31). This sample frame is believed to represent firms with fair understanding and implementation of the research constructs tested in this study, therefore, suitable for our analysis (Pashaei and Olhager, 2019). To extract a list of 9,000 manufacturers in Sweden, the BvD Amadeus database was used. Then, a random sample frame of 714 manufacturers were contacted via telephone to determine their interest in participation. Data collection was undertaken professionally by a market research firm with extensive experience in similar survey research in the Swedish language. When required, follow-up calls were made to engage with the relevant informant executive. A total of 242 useable responses were returned primarily filled in by knowledgeable executives within logistics and SCM, purchasing, operations and production (33.8% actual response rate), followed by CEO's and owners (29.7% and 17.7%, respectively). To assess the nonresponse bias in the survey, we conducted "the extrapolation technique," which is commonly used in SCM research (Clottey and Grawe, 2014) to test whether the nonrespondents differ from respondents in a way that would impact the results of the study. This technique assumes that late respondents are more similar to nonrespondents (Armstrong and Overton, 1977). In this regard, *t*-tests were carried out to compare the early (94) and late responses (148), by comparing the variances in ten randomly selected variables from the survey. As no significant differences were found between the two groups, nonresponse bias did not appear to be a concern. Table 1 summarizes the characteristics of the respondent firms, including the industry classification (Eurostat, 2008), and technology intensity. Since almost half of the respondents are either CEO's or owner of the firms, the risk for key informant bias is minimized. Moreover, the majority of the sample consists of small and medium enterprises (SMEs), according to their reported annual

Figure 1 Research model

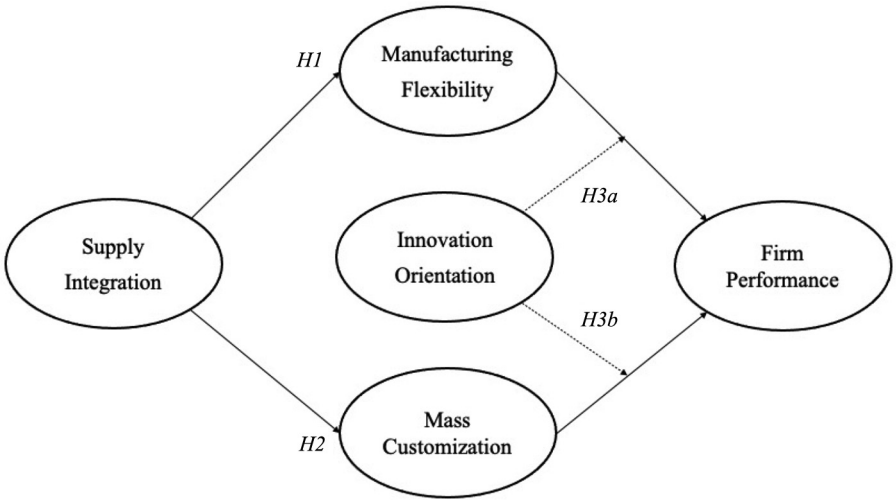

Table 1 Sample characteristics

Characteristic	Frequency	(%)
Technology intensity		
Low technology	82	33.9
Low-med Technology	99	40.9
Med-high Technology	49	20.2
High technology	12	5.0
Industry classification		
25. Manufacture of fabricated metal products, except machinery and equipment	72	29.8
28. Manufacture of machinery and equipment	27	11.2
16. Manufacture of wood and of products of wood and cork, except furniture	20	8.3
10. Manufacture of food products	17	7.0
22. Manufacture of rubber and plastic products	17	7.0
32. Other manufacturing	15	6.2
26. Manufacture of computer, electronic and optical products	12	5.0
31. Manufacture of furniture	11	4.5
27. Manufacture of electrical equipment	10	4.1
23. Manufacture of other nonmetallic mineral products	7	2.9
13. Manufacture of textiles	7	2.9
Others	27	11.2
No. of employees		
0–10	165	68.2
11–50	65	26.9
51–250	12	5.1
Size		
Large	12	5.0
Medium	9	3.7
Small and micro	221	91.3
Position		
Logistics, SC, operations and production manager	77	31.8
CEO	72	29.7
Owner	43	17.7
Marketing manager	28	11.5
CFO	12	4.9
Others	20	8.2

turnover and number of employees (European Commission, E, 2020), which is in line with the profile of the Swedish manufacturing sector (Statistics Sweden, 2022). Furthermore, none of the firms participating in the study were publicly quoted.

4.2 Measurement instrument

The survey was designed using established and valid scales (seven-point Likert) and was then translated into Swedish by an SCM researcher. Since this study was part of a university-industry collaboration project, it provided access to six large industrial manufacturers to carry out a pilot study for refining the questionnaire. SI was measured using Chen and Paulraj (2004). MC was adopted from Huang *et al.* (2008) and IO from Chen *et al.* (2009). Various operationalization of flexibility has been used in the literature, which mainly either focus on internal competencies and/or wider SC capabilities (D'Souza and Williams, 2000; Sáenz *et al.*, 2018; Jafari *et al.*, 2022b). For instance, Chaudhuri *et al.* (2018) use two single items for capturing volume and mix flexibility. For measuring MF, and acknowledging the lack of consensus in operationalization of MF (Pérez-Pérez *et al.*, 2018), we adopted Zhang *et al.* (2003)'s conceptualization since it captures various dimensions of volume and mix flexibility.

To capture FP, items related to *overall product quality*, *competitive position* and *customer service levels* were adopted from Wisner (2003). These items have proven to rank high among the relevant reflective items of FP (Tan *et al.*, 1998) and have been widely used in the literature (Jafari *et al.*, 2022a; Hüseyinoğlu *et al.*, 2020). *Overall customer service levels* primarily indicates the relative productivity of the firm's logistics operations in on-time and accurate delivery, and service provision (Murfield *et al.*, 2017; Mentzer *et al.*, 2001). *Overall product quality*, as an operational performance, measures the relative level of meeting the specifications, and conformance to standards in manufactured products (Gu *et al.*, 2017). *Overall competitive position* represents competitiveness in the marketplace, and can be associated with market share and performance (Wisner, 2003; Tracey *et al.*, 2005; Chahal *et al.*, 2020; Zhang *et al.*, 2019). We used number of employees, annual sales, total assets and technological intensity (Eurostat, 2008) as control variables, in line with prior research indicating their relevance for SC and manufacturing capabilities and performance (Wang and Sarkis, 2017).

4.3 Data analysis

4.3.1 Confirmatory factor analysis

To assess model fit, we conducted a confirmatory factor analysis (CFA) in AMOS 27. The measurement model fit was acceptable as χ^2/df = 1.96, comparative fit index (CFI) = 0.912, Tucker–Lewis Index (TLI) = 0.900, incremental fit index (IFI) = 0.913, root mean square error of approximation (RMSEA) = 0.061 since all measures met the recommended thresholds (Hair *et al.*, 2018). The factor loadings for all constructs were close to 0.7 (Table 2).

In addition, we adopted different procedures to assess the convergent validity of the results, as reported in Table 3. The values for average variance extracted (AVE) was greater than 0.50 cutoff for all constructs (with the exception of *FP*, which scored a close 0.47). As for internal consistency, the composite reliability (CR) values ranged from 0.72 to 0.85, which is considered a satisfactory level (Hair *et al.*, 2018). Altogether, convergent validity was established. Also, discriminant validity was supported since the square roots of the AVE's for the constructs were larger than the respective correlation coefficients, as suggested by Fornell and Larcker (1981).

4.3.2 Common method bias assessment

To assess the potential problems in relation to common method bias, we conducted two methods of procedural and statistical analysis. First, following Podsakoff *et al.* (2003), in designing the questionnaire and after the pilot study, we took measures to reduce social desirability and ambiguity. We also assured the respondents about anonymity and voluntary participation. Furthermore, we employed "proximal separation" between independent, mediating and dependent variables to reduce the risk of common method bias (Chavez *et al.*, 2021; Krause *et al.*, 2018).

Second, we adopted Harman's one-factor statistical test. The exploratory factor analysis results confirmed that five factors had eigenvalues exceeding 1 following the conceptual model. The percentage of variance that corresponded to all five factors was 62.56%, whereas as the highest loading factor accounted for only 31.3% of variance. In addition, we conducted CFA by connecting all items of all constructs into a single factor. The model fit result was poor: χ^2 = 1,120.70, df = 166, χ^2/df = 6.751, CFI = 0.437, TLI = 0.356, IFI = 0.445, RMSEA = 0.154. Also, we carried out a further test by adding a common latent factor to the constructs of the research model. The CFA model fit was slightly changed (ΔCFI = 0.006, ΔTLI and ΔIFI = 0.007). The marginal difference indicates that common method bias is not a concern in our data (Chavez *et al.*, 2021). Based on the results of both procedural and statistical analysis, we confirmed that common method bias was not an issue in our research data.

4.4 Results

We used structural equation modeling (SEM) to test our hypotheses in AMOS 27, and the overall fit was acceptable (χ^2 = 314.995, df = 297,83 χ^2/df = 1.850, CFI = 0.916, TLI = 0.902, IFI = 0.918, RMSEA = 0.059). We tested the mediation paths by using a boot strapping approach, including 5,000 bootstrapped samples and 95% confidence intervals (Wang and Sarkis, 2017). The findings show that the path from SI to MF (PC = 0.387, $p < 0.01$) and MC (PC = 0.326, $p < 0.01$) is positive and significant. Also, the paths from MF to FP (PC = 0.190, $p < 0.05$) and from MC to FP are both positive and significant (PC = 0.179, $p < 0.05$). The indirect effect of SI on FP through the mediation roles of MF (PC = 0.071, $p < 0.05$) and MC (PC = 0.060, $p < 0.05$) were significant. The relevant *p*-values and path coefficients indicate that the indirect effects from SI to FP through MF and MC are significant, while the direct effect from SI to FP is not significant. Thus, the relationship between SI and FP is fully mediated by MC and FP. Accordingly, the findings support the two mediation hypotheses of *H1* and *H2* (Table 4). The mediation test results reveal that the effect of SI on FP is channeled through the internal capabilities of MF and MC. Hence, to improve FP, manufacturing firms cannot solely rely on increasing integrative

Table 2 Constructs, items and loadings

Constructs and items	Standardized loadings
Supply integration (SI)	
Our interorganizational logistics activities are closely coordinated with our suppliers	0.73
We have a seamless integration of logistics activities with our "key" suppliers	0.83
Our logistics integration is characterized by excellent distribution, transportation and/or warehousing "facilities"	0.75
Our inbound and outbound distribution of goods is well-integrated with our suppliers	0.74
We have a smooth flow of information and materials with our suppliers	0.60
Mass customization (MC)	
We are highly capable of large-scale product customization	0.72
We can easily add significant product variety without increasing cost	0.61
We are able to add product variety without sacrificing quality	0.74
We are highly capable of responding quickly to customization requirements	0.78
Innovation orientation (IO)	
We emphasize the need for innovation for development	0.71
We promote the need for development and utilization of new resources	0.77
We embrace, accept and measure innovation	0.73
Management actively seeks innovative ideas	0.76
Our teams and employees are encouraged for new ideas even if they are risky or do not work	0.60
Manufacturing flexibility (MF)	
We are able to operate efficiently at different levels of output	0.67
We can quickly change the quantities for our products produced	0.76
We are able to build different products in the same plant(s) at the same time	0.72
Firm performance (FP)	
Overall product quality	0.72
Overall competitive position	0.62
Overall customer service levels	0.70

Table 3 Reliability and validity tests

Share	Mean	SD	Cronbach's alpha	CR	AVE	LI	EF	CU	IO	FP
LI	4.68	1.19	0.85	0.852	0.538	*0.733*				
MF	5.50	1.11	0.70	0.760	0.514	0.320**	*0.717*			
CU	5.66	1.16	0.79	0.806	0.512	0.29**	0.644**	*0.715*		
IO	4.85	1.27	0.83	0.839	0.513	0.285**	0.194*	0.197*	*0.716*	
FP	5.35	0.85	0.62	0.720	0.462	0.218**	0.303**	0.319**	0.147	*0.68*

Notes: $^{*}P < 0.05$, $^{**}P < 0.01$; square root of AVE's in italic

Table 4 Mediation results

	Indirect effect			Direct effect			
Hypothesis	Effect	S.E.	95% CIs	Effect	S.E.	95% CIs	Findings
H1: SI → MF → FP	0.071*	0.049	[−0.006,0.205]	0.090	0.105	[−0.061,0.376]	Full mediation
H2: SI → MC → FP	0.060*	0.041	[0.005,0.195]	0.090	0.105	[−0.061,0.376]	Full mediation

Notes: $^{*}p < 0.05$, $^{**}p < 0.01$

activities with their key upstream suppliers (SI), but they should also consider increasing their internal capabilities (MF and MC). Furthermore, to test the moderating effects of IO, we considered the interaction of IO with MF and MC, respectively. Interestingly, the results show that the interaction effect of MF and IO is negatively significant (PC = –0.161, $p < 0.05$); hence, *H3a* is not supported. Therefore, IO negatively moderates the relationship between MF and FP. On the other hand, considering that the standardized beta coefficient is significant and positive (PC = 0.146, $p < 0.05$), *H3b* is supported (Table 5). Hence, IO positively moderates the path from MC to FP.

Table 5 Moderation results

Path main effect	Path estimate	S.E.	95% CI lower	95% CI upper
Main effect				
SI → EF	0.394**	0.070	0.172	0.517
SI → CU	0.338**	0.079	0.170	0.529
SI → FP	0.095	0.062	0.031	0.330
MF → FP	0.120	0.077	−0.102	0.352
MC → FP	0.203**	0.063	0.014	0.381
IO → FP	0.052	0.043	−0.055	0.148
Interaction				
MF × IO → FP	−0.161*	0.064	−0.127	0.186
MC × IO → FP	0.146*	0.097	0.032	0.294
Control				
Size	−0.106	0.004	−0.011	0.002
Annual sales	0.203	0.018	0.002	0.068
Total assets	−0.055	0.087	0.002	0.143
Low-med tech	0.087	0.120	−0.104	0.454
Med-high tech	0.119	0.151	−0.019	0.582
High tech	0.052	0.249	−0.226	0.709

Notes: $^{*}p < 0.05$, $^{**}p < 0.01$

5. Discussion

5.1 Theoretical implications

Our theoretical contributions are multifold. First, by taking an ROT perspective, we delineate *how* leveraging bundled resources, and capabilities could lead to competitive advantage (Sirmon *et al.*, 2011). In this regard, we conceptualized and empirically tested the specific capability configurations of SI with MF and MC for competitive advantage. Theoretically, we have contributed to the literature by proposing a unique configuration of three types of capabilities of internal production related capabilities, supplier facing capability, the strategic orientation of firm toward embracing innovation, and how firms could develop competitive advantage by orchestrating such configuration. The empirical support for the full mediation effects show that the positive impact of SI on FP is only realized if manufacturing firms also have internal manufacturing capabilities such as MF and MC. This finding provides new insights to the literature because the prior work, such as Swink *et al.* (2007) with apparently contradictory findings, may have suffered from a narrow theoretical conceptualization. The ROT perspective has brought the focus on how the strategic resources can be configured into a complementary combination of capabilities. For instance, integrating inbound and outbound flows of goods with suppliers, allows firms to improve their capability to adapt production volumes, range and variety, which, in turn, could contribute to superior competitive position or customer service levels. In fact, bundling and synchronizing interorganizational capabilities allow firms to create value for customers by problem-solving or need satisfaction (Sirmon *et al.*, 2007; Zacharia *et al.*, 2011).

Second, at a broader scale, we contribute to the extant literature on integration in contemporary SC's. Specifically, we highlight the strategic importance of integrative practices with suppliers in achieving superior performance (Droge *et al.*, 2004). We engage in the overall debate in the SCM literature regarding the positive and negative performance impacts of integration (Prajogo and Olhager, 2012). Our findings indicate a mediated relationship between SI and FP, which is in line with a noticeable body of literature (Amoako-Gyampah *et al.*, 2020). Our results further underline the significant role SI plays in enhancing internal and customer-facing capabilities of MF and MC. Also, SI may involve facilities in distribution, transportation or warehousing (Chen and Paulraj, 2004). From an ROT point of view, pooling or establishing a portfolio of such resources with key suppliers could be crucial in explaining how they lead to competitive advantage (Malik *et al.*, 2021). In fact, suppliers have a critical role in bundling and leveraging resources, and, in turn, how firms implement their strategies to gain sustainable competitive advantage (Hitt, 2011). In line with prior research (Prajogo and Olhager, 2012), we further stress that seamless integration with suppliers and acting as a unified entity in logistics processes or resources, equips firms to have higher MF and improve their MC capability; both key contributors to FP (Olhager, 1993).

Third, we reflect upon the notable, yet relatively under-researched, role the strategic orientation of firms plays in realizing and capitalizing on capabilities in the SCM literature (Baker *et al.*, 2022). We use CT to explain how IO can moderate the way MF and MC translate into FP. Interestingly, our results indicate the dual and contrasting impact of IO, accordingly. On the one hand, we found that the effect of MC on FP is contingent on the IO of firms. This implies that fostering a supportive culture for innovative ideas, strengthens the ability of manufacturing firms in realizing the benefits expected from MC initiatives. We argue that this may be due to the natural complementarity between IO and MC. Since firms with higher IO have a better inclination in succeeding in developing and implementing new ideas, products, processes

or systems (Hurley and Hult, 1998), presumably, they can expect superior success in capitalizing on MC. For instance, firms with higher IO may be more inclined to applying digital technologies and tools – including those within the Industry 4.0 framework – which support MC. The developments in digital technologies, and the resulting transformation, are believed to further contribute to the "paradigm shift" in MC (Kim and Lee, 2022). The ample literature suggests that digital tools are extremely valuable in connecting with customers, particularly with involving them in the processes, offering further variety and increasing the sense of belonging and attachment, and hence increasing satisfaction (Jafari *et al.*, 2015).

On the other hand, contrary to our initial expectation, IO negatively moderates the MF–FP relationship. Therefore, it appears that higher IO is counterproductive in firms prioritizing MF. In other words, cultivating a culture which is overly receptive to new ideas (Hurley and Hult, 1998; Chen *et al.*, 2009), apparently could incur higher complexity. Meanwhile, there is consensus in the literature that simplicity and discipline are key to flexibility (Fogliatto *et al.*, 2012), which may juxtapose the notion of IO, especially in its extreme. From a different angle, IO is highly associated with the market orientation of firms (Grinstein, 2008). Following the lines of Salvador *et al.* (2020), we argue that new ideas must be aligned with the solution designed to serve customers, especially given that any flexible system has a threshold beyond which its performance deteriorates. Based on this, we posit that under circumstances of high IO, MF begins to lose its effectiveness and efficiency. For instance, since IO may involve seeking new resource development and deployment (Hurley and Hult, 1998), it may impair the performance of flexible systems in the way that the alignment with market requirements would diminish (e.g. due to higher costs, lower quality or longer lead-times). This could be further supported in accordance with the findings of Simpson *et al.* (2006), who underline the possible negative role of IO in relation to product failures, job stress or increased costs. From a different perspective, our moderated model may imply that manufacturers operate separate organizational units focusing on flexible production operations, and innovation/R&D, which may increase operational and coordination costs (Yu *et al.*, 2020). Therefore, based on the CT, we maintain that firms should find a fit between their strategic orientation and capabilities to achieve competitive advantage (see also Aslam *et al.*, 2020; Baker *et al.*, 2022). This contributes by highlighting the contexts in which best practices in SCM research can be expected (Sousa and Voss, 2008). Specifically, we further engage in the call to elaborate on the contingent factors in flexibility research (Ketokivi, 2006). Moreover, we draw attention to addressing the interplay of the strengths and weaknesses of capabilities in achieving competitive advantage (Sirmon *et al.*, 2010).

5.2 Managerial implications

The above theoretical contributions also have strong managerial implications. Most importantly, we draw the attention of managers on how to bundle firm capabilities into complementary configurations to create a sustained competitive advantage and to consider the contingencies of the relevant organizational factors (Hughes *et al.*, 2019). Manufacturing firms pursue different strategies to remain profitable and competitive. Some capitalize on integrating processes with suppliers through establishing shared understanding and investment in both physical and cyber systems, which is regarded as a desirable attribute for cost reduction, quality improvement and new product development. On the other hand, some invest heavily in manufacturing systems that are capable to respond quickly and efficiently to market dynamism, including variations in volume and mix of products, but also increasing customer demand for MC. While both are essential, the literature highlights the isolated operationalization of such efforts as the result of asynchronistic nature of manufacturing and procurement functional roles (Wiengarten *et al.*, 2019; Won Lee *et al.*, 2007). We emphasize that the investment in developing both internal and supplier facing capabilities (SI) should not be absorbed independently; rather, an orchestrated effort across functional areas is required to maximize the expected outcomes. Recognizing the link between SI and internal manufacturing capabilities could also overcome "silo mentality," a well-known issue within manufacturing environments. With the emergence of SCM, firms are recognizing the value of streamlining and aligning upstream logistics processes with their internal production activities to develop competitive advantage. We stress the harmonizing role of SC managers to convene and leverage SI to manufacturing capabilities and the consequential performance outcomes.

Furthermore, we investigated how the relationship between internal manufacturing capabilities and FP is contingent upon the existence of innovation culture and supporting environment. Promoting innovative thinking and creativity has become a key practice within manufacturing ecosystems. Specifically, IO is known as an indicator of firm behavior toward the development of innovation-enabling competencies related to resource allocation, technology, employees, operations and markets (Siguaw *et al.*, 2006). In resource-constrained environments, IO is known as a desirable organizational attribute that promotes creativity, leading to new forms of resource mobilization and solutions. Relevant to the context of this research, IO could act as an effective catalyzer for the transformation of internal manufacturing capabilities into FP. For example, innovative manufacturers may identify new methods to minimize machine setup and down times when accommodating for a different volume and mix of products demanded by customers, which could be a source of reduced labor and machine-related expenses. Similarly, to address the operational challenges of MC, creative manufacturing workforce could observe and seize opportunities in minimizing the required efforts by identifying the right configurations between product design, manufacturing processes and systems functionalities. From a managerial perspective, however, management support accompanied with appropriate incentive and risk sharing mechanisms are prerequisites to create such innovation-enabled culture.

Previous studies have highlighted that innovation could act as a "double-edge sword". Manufacturing environments are known for their deadline-oriented and process-intense attributes. Therefore, to create a change culture in an industry where productivity gains were traditionally defined through standardization, innovation must be defined through a synchronized people-process-technology approach.

Finally, with the development of modern technologies, especially those within the framework of Industry 4.0, MC can be achieved by involving other downstream SC actors, including the consumers (e.g. via 3D printing or artificial intelligence). For instance, machine learning could have high potential for tackling the major challenges in MC, namely, production planning and scheduling. As such, sophisticated demand forecasting and marker estimation techniques could be applied to plan even without knowing future customer requirements (Kim and Lee, 2022). Moreover, our study could have implications for managers in making a *strategic choice* between MF or MC capabilities in achieving competitive advantage, especially, if they are considering fostering an innovative culture within their firm. This could be notably beneficial for SMEs, which have relatively limited resources to invest, as opposed to their larger counterparts. Therefore, given the complexity in contemporary global SC's, such indications could be valuable in practice to tackle "causal ambiguity" and formulate decisions (Sirmon and Hitt, 2009).

6. Concluding remarks

In this research, we used ROT to explain the mediating effects of MF and MC on the SI–FP relationship. As we found support for full mediation in both cases, we contend that to effectively leverage integrative activities with upstream suppliers, manufacturers may consider capitalizing on MF or MC capabilities. Hence, our study addresses the mixed results from prior research regarding the performance outcomes of SI. Furthermore, we applied CT to shed light on the contingent effects of IO on the MF–FP and MC–FP relationships. Our findings reveal that while IO positively moderates the latter relationship, it appears to negatively impact the former. Therefore, we contribute to the literature on the role of strategic orientations of firms in configuring and leveraging capabilities (Aslam *et al.*, 2020; Baker *et al.*, 2022). The results of our study provide insightful implications for decision-makers regarding prioritizing capabilities and fostering an innovative culture in their organizations.

Despite this, we believe there are still promising directions for future research which were not covered within the scope of this study. First, our conceptualization only considered integrative capabilities with upstream SC actors. Future studies could consider other dimensions of SC integration (i.e. customer or internal) to investigate whether the findings remain true regarding orchestrating these capabilities with MF and MC. Second, we acknowledge the importance of the trade-offs in optimizing manufacturing capabilities and strategizing. For instance, customer value is intrinsically influential in whether or not standardization or MC should be considered (Shao, 2020). In this regard, we encourage complementary studies to explore the discrepancies related to the mis-fit of MF and/or MC considering the product type or other determining factors. Third, future studies could consider other mediating capabilities (e.g. responsiveness and agility) or their synergetic effects, in the SI-FP relationship. This could be of interest given the recent technological developments in contemporary manufacturing. As digital technologies evolve, the resulting transformation would be an attractive research area in manufacturing capabilities, especially in relation to enablers such as human-robot interaction, virtual reality and machine learning (Kim and Lee, 2022; Suzić *et al.*, 2018). Fourth, other dimensions of FP (e.g. financial performance) can be incorporated into the conceptual model to provide a different picture of competitive advantage. Fifth, future studies could consider more specificity in the type of innovation performance (e.g. incremental/disruptive, product/process) could further delineate the role of other strategic orientations of firms and to capture their complementarity effects. According to Chavez *et al.* (2021), the strategic orientations of a firm can lead to superior synergetic effects on realizing competitive advantage. For instance, the role of SC orientation as a facilitating mechanism to support resource orchestration can be an interesting arena for investigation. On a different note, the possible negative role of strategic orientations is worthy of further exploration. Based on our findings and the work of Simpson *et al.* (2006), firms should not always expect positive outcomes from IO. Also, while we used firm as our unit of analysis, the role of SC managers for resource orchestration comes with research value in future. Moreover, we acknowledge the importance and relevance of digital technologies in supporting and enabling innovative SC and manufacturing capabilities. Hence, we suggest future studies explore the symbiosis interplay between digital orientation and IO within manufacturing organizations. Furthermore, such digital advancements along with the blurring of boundaries among SC actors, could provide opportunities for downstream players, such as retailers, to consider flexibility and MC (Jafari *et al.*, 2022a). Moreover, there exists great potential in exploring the leveraging aspect of MF and MC capabilities in specific sectors within the manufacturing industry via in-depth qualitative case studies. Also, the lack of consensus in operationalizing manufacturing capabilities, underscores the potential for purifying or further developing the measures (Pérez-Pérez *et al.*, 2018; Liu *et al.*, 2021). Finally, our research did not include external contingent factors. Given the current developments resulting from the pandemic, we encourage future studies to investigate the moderating effects of turbulence, disruption and complexity along SC's.

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