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The influence of cultural compatibility and product complexity on manufacturing flexibility and financial performance

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Abstract

The literature has highlighted manufacturing flexibility as an important requirement for an effective response to market uncertainty; however, the impact on financial performance often showed mixed results. Through the lens of congruence and uncertainty reduction theories, this study argues that cultural compatibility can enhance the efficacy of this relationship. In addition, as product complexity increases, these relationships can be influenced differently. A survey was conducted on 150 Vietnamese manufacturers and found that cultural compatibility acted as a mediator to enhance the effects of manufacturing flexibility on financial performance. The results revealed that manufacturers initially experienced unfavorable financial measures from the implementation of manufacturing flexibility, however, with the cumulative efforts of cultural compatibility resulting in competitive advantage for the firm. That is, when achieving cultural alignment with their supply chain partners, firms can leverage manufacturing flexibility to capture higher market share and profits. On one hand, product complexity dampens the impact of manufacturing flexibility on cultural compatibility, however, its joint effects with cultural compatibility can positively influence financial performance, in terms of market share and revenues. This represents a unique opportunity for firms, as cultural compatibility can be an alternative to offset or to accommodate higher levels of complexity when competing in a global economy.

Keywords Culture · Complexity · Flexibility · Manufacturing · Supply chain · Vietnam

1 Introduction

In today's fast-changing and complex environment, firms tend to develop a higher level of manufacturing flexibility (MF) that focuses on volume flexibility, variety of products and accelerated response times (Sáenz et al. 2018; Wei et al. 2017). While MF operations require significant investment, at the same time, they create value through logistics activities, enhances profitability and customer satisfaction (Prahalad and Ramaswamy 2013). This is often the reason why literature shows mixed results of MF on performance, especially in term of financial measures (FIN) such as market share, revenues and profits (Chan et al. 2017; Hilmola et al. 2015). Chan et al. (2017) examined range and response flexibility measures and found that the relationship between manufacturing flexibility and FIN was statistically insignificant. In contrast, other studies have shown that using its manufacturing flexibility, a firm can reconfigure its manufacturing resources to produce different products efficiently (Pérez-Pérez et al. 2018; Wei et al. 2017) and therefore reduce their costs. Many authors suggest that identifying a set of factors that

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facilitate the MF and performance relationship is critical (Pérez-Pérez et al. 2018; Solke and Singh 2018; Wei et al. 2017).

Previous literature looked for antecedents of MF (Bozarth et al. 2009; Chan et al. 2017; Mishra 2016; Mishra et al. 2017; Sethi and Sethi 1990) and in doing so, most research on MF focused on operational and infrastructure compatibility (Irfan et al. 2019; Rajaguru and Matanda 2013; Williams et al. 2013). Researchers have extensively examined the importance of advanced IT in supporting information sharing and facilitating MF (Brettel et al. 2016; Jain et al. 2013; Sáenz et al. 2018). Regarding the performance measures, previous studies have primarily analyzed the benefits of operative collaborations that involved material movements and ordering processes that bring speedy delivery, volume and variety flexibility, and flexible response times (Mishra 2016; Sáenz et al. 2018; Terkaj et al. 2009). It was mentioned that the "soft" aspects such as organizational culture practices (Rajaguru et al. 2011) have been neglected, e.g., whether manufacturing flexibility fosters organizational and cultural changes. In these areas, studies have extensively investigated the differences among supply chain members (Gopal et al. 2016; Hsu et al. 2008), but far less has been discussed with regard to what compatibility can bring to the whole network.

This study argues that the proactive contextual environment of MF drives organizational changes and cultural alignment among supply chain members. This cultural alignment or cultural compatibility (CC) could enhance the dynamic capabilities of the supply chain actors (Gelderman et al. 2016), and mediate the financial improvements. The cultural compatibility (CC) reflects processes or mechanisms that promote alignment (Rajaguru et al. 2011), learning and adaptation (Kim et al. 2013) and it may offer important opportunities for supply chain members to be flexible in dealing with the complexity of environmental changes. The concept of CC rests on the process of shared business philosophies, subjective norms, traditions, and values (Buono et al. 1985) in the partnering firms. According to congruence theory (Nadler and Tushman 1980), to achieve supply chains alignment, companies must work with similar operating principles and employ similar business norms, language, codes and technical concepts. Social capital theory (Tsai and Ghoshal 1998) advocates that the cognitive outcomes from sharing a common understanding, business norms and technical concepts could enhance the manufacturing flexibility and overall performance. For example, Volkswagen Brazil invited suppliers to relocate the production facilities next to their manufacturing site and create compatible cultural platforms (e.g., from joint workshops on quality to unified working uniforms). Consequently, overall costs were down by 15 to 25% and flexibility increased due to closer proximity and efficient communication (Marx et al. 1997).

It was noted that, as the product proliferation increased, the complexity of the manufacturing processes put more pressures on MF to respond to the financial measures. Product complexity (PCX) refers to the level of complexity of the products produced at the firm, including numbers of components and tier-one suppliers (Bortolotti et al. 2013; Caniato and Größler 2015). The product proliferation and level of differentiation among the components and interdependencies between them, create further complexity for the manufacturing processes. Manufacturing firms need to align their operations with supply chain partners to offset or to accommodate these high levels of complexity. Supplier collaboration is needed for clarifying specifications and requirements as well as information communication at an operational level (Li and Chen 2019). This study aims to examine the influence of cultural compatibility and product complexity on the relationship between manufacturing flexibility and financial performance. Thus, this study proposes the following research questions. First, to what extent does CC enhance the effects of manufacturing flexibility on financial performance? Further, under what conditions do these relationships occur?

These areas of research can be encouraged for further investigation, especially in the context of developing markets, where manufacturing flexibility is still at a very nascent stage (Mishra 2016; Mishra et al. 2017; Stentoft et al. 2016). This study uses Vietnam as the research context due to two main interests. First, the increasing trend of the global offshoring and relocation to lower-cost countries (Barbieri et al. 2019; Mohiuddin et al. 2018), manufacturing firms shift towards less developed countries, such as Vietnam. Given the differences among their business practices, cultural norms and even technical terminologies (Nguyen and Aoyama 2015; Tsang 2005), we argue that alignment efforts among supply chain partners could bring some positive effect to the relationship between manufacturing flexibility and performances. Second, Vietnam has become an additional manufacturing hub next to China due to USA-China trade conflicts (Pencea 2019). The manufacturing industries in Vietnam had a 44% increase in foreign direct investment capital inflow, from big global players such as Samsung, Microsoft, Intel, and LG (Shira 2018). Größler (2010) found that companies' most recent competitive priorities are quality and flexibility, rather than cost and time. Several studies indicated the need for flexibility enhancement when supplier networks extend in emerging and developing regions (Größler 2010; Mishra 2016; Yang 2014). Chan et al. (2017) suggests to implement supply chain strategies wisely, especially when dealing with supply chain agility and organizational flexibility at both strategic and operational levels to offset risks and uncertainties. This provides an ideal context for investigating these relationships since recent studies indicated that many foreign buyers remain skeptical of Vietnam manufacturers' ability to provide the same level of manufacturing performance levels, as offered in China (Burkhart 2019).

The paper is set out as follows. The first section provides the theoretical background of this study, followed by the

development of the research model and hypotheses. Then, the study design section describes methods and findings. The last section offers interpretations, contributions and limitations.

2 Literature review and theoretical framework

This section describes literature related to manufacturing flexibility (MF) and the relationship with financial performance (FIN). Although previous research has emphasized cultural and organizational antecedents of MF and performance, the research model developed in the next section investigates the mediating influence of cultural compatibility on the relationship between MF and FIN. Since MF depends on product characteristics and the supplier network, the moderating influence of product complexity (PCX) on this mediation is investigated as well.

2.1 Manufacturing flexibility (MF) and financial performance (FIN)

Previous research examined how quickly and efficiently a manufacturer can adjust product and service features to the needs of particular customers. MF is not a new concept, however, recent studies related to operations and manufacturing flexibility, call for more comprehensive research into the roles of inter-organizational factors that impact the relationship between MF and performance (Mishra et al. 2017; Pérez-Pérez et al. 2018; Sáenz et al. 2018; Wei et al. 2017). Recent studies in manufacturing flexibility (Chan et al. 2017; Thomé et al. 2014; Williams et al. 2013) indicated several flexibility measures, including new product flexibility, volume flexibility, variety flexibility, and product modification. Pérez-Pérez et al. (2018) found at least 50 overlapping flexibility types have risen from manufacturing research literature. This study adopts the MF view that emphasizes flexible volume, variety of products and numbers of tier-one suppliers. Many researchers show that inter-organizational linkage is an important factor influencing a firm's flexibility and overall performance (Sáenz et al. 2018; Wei et al. 2017).

While there are costs associated with MF operations, at the same time, it creates value to cost reduction, enhance profitability and customer satisfaction (Prahalad and Ramaswamy 2004). Since MF links the marketing and operations strategy, therefore, it deals with growth strategies such as venturing into new markets and subsequently enhances financial performance. MF facilitates new product flexibility by enhancing product variety (Fantazy and Salem 2016) thus interacting with marketing strategy. This enables an organization to respond effectively and efficiently to change product mix, customization of product and introducing new products (Chen et al. 1992). MF creates a linkage between marketing and operations in capturing new market share. Gunasekaran et al. (2002) found that flexible manufacturing processes enable companies to capture market share by meeting the needs of a new market segment. These expansion flexibilities help to reduce implementation time and cost for new products, variations of products, or added capacity (Sethi and Sethi 1990). Companies increase their market shares by gaining new customers and developing a financial competitive advantage. The new product and volume flexibility should be taken into consideration, as the need for a firm to meet the customers' expectations are continuing to change at an increasing rate (Wei et al. 2017). Therefore, this study proposes:

> H1. A manufacturer's manufacturing flexibility (MF) has a positive relationship with financial performance (FIN).

2.2 The influence of manufacturing flexibility (MF) on cultural compatibility (CC)

While MF aims to facilitate resources reallocation, reduce switching costs, and speed up resource recombination (Seebacher and Winkler 2015), MF may also create pressures to remove internal resource constraints, thus enabling effective collaboration. In the supply chain context, MF enhances dynamic capability, which serves as a key driver of inter-organizational compatibility to mitigate risks and enhance competitiveness (Rajaguru and Matanda 2013). The next sections discuss how the dynamic capabilities, joint learning and resources allocation pressures, created from MF, drive organizational and cultural changes.

In this study, we define cultural compatibility (CC) as the degree of a shared vision between supply chain partners, including shared values and beliefs (Niklas and Robert 2005). Shared culture refers to the degree in which business norms of behavior govern relationships, whereas congruent goals represent the degree to which parties share a common understanding and approach to the achievement of common tasks and outcomes (Villena et al. 2011). According to social capital theory (Tsai and Ghoshal 1998), the cognitive outcomes from sharing a common understanding, from business norms to technical concepts, may enhance the flexibility and overall performance. Rajaguru and Matanda (2013) examined the compatible inter-organizational environment by including comparable culture and management techniques. Congruence theory (Nadler and Tushman 1980) argues that when partners align their business practices and operate with similar operating principles, and employ similar business norms, languages, codes and technical concepts, their dynamic capabilities may be enhanced (Gelderman et al. 2016), and would result in improvements in financial performance (Yang 2014). Congruence theory contributes to the understanding of CC and its role in absorbing the business environment fluctuations through enhancing adaptation, alignment, and

integration with partnering organizations. Congruency refers to "*the degree to which the needs, demands, goals, objectives, and/or structure of one component are consistent with the demands, goals, objectives, and/or structure of another component*" (Nadler and Tushman 1980). Thus, it facilitates joint understanding (Tsai and Ghoshal 1998), free communication and the exchange of resources based on common objectives and interests. Further, it fosters information exchange, facilitates joint activities and creates knowledge to hedge against uncertainty (Lane et al. 2001).

Through its volume and variety flexibility, manufacturing processes transfer customer pressures onto its supply chain partners to share risks and benefits (Nguyen and Harrison 2019). To reduce risks and uncertainty, firms in supply chains share similar business objectives and visions, which in turn offers important opportunities for the supply chain members to be flexible in dealing with the complexity of environmental changes. Hsu et al. (2008) indicated that manufacturers become more competitive when partners enhance supply chain relationship architecture that enables common concepts, norms, values and beliefs. Indeed, dynamic capabilities facilitate the understanding of how a manufacturer in supply chains can acquire, deploy, and reconfigure resources within the organization and the supply chain (Eckstein et al. 2014). Chan et al. (2017) found that MF, such as response and range flexibilities, enhanced dynamic capability and mediated the impact on performance. MF can deal with fluctuations in volume and sudden materials needs via effective collaboration with suppliers. MF requires better communication and collaboration with these suppliers, sharing best practices to enhance quality and product conformance (Onofrei et al. 2020). Increasing product proliferation and differentiation might create a higher level of flexibility in dealing with JIT systems and distribution networks. Literature has confirmed the importance of congruence in top management support, management styles, and best practices to enhance these dynamic capabilities (Kodama 2018; Rajaguru and Matanda 2013; Zeng et al. 2017). In inter-organizational relationships, several authors confirmed that to ensure successful business-to-business partnership, partnering organizations must have some degrees of congruency with their supply chain members (Angeles and Nath 2001; Gopal et al. 2016; Rajaguru and Matanda 2013). Due to competitive pressures, firms in supply chains increasingly adopt similar behavior, common technical terminologies, and business norms to hedge against uncertainty and to improve flexibility through effective communication and knowledge exchange (Emden et al. 2006). Thus, this study proposes:

H2a: Manufacturing flexibility has a positive relationship with cultural compatibility

2.3 The influence of cultural compatibility (CC) on financial performance (FIN)

Although some research suggests that relational norms do not play a direct role in performance outcomes (Palmatier et al. 2007), other studies disagree (Liu et al. 2009). The current study argues that cultural compatibility, similar relationship norms and shared visions can directly improve FIN, such as market share and profit. When both the buyer and the supplier adopt a similar culture of market orientation (Mello and Stank 2005), this leads to better learning in the relationship and ultimately better relationship performance (Lai et al. 2009). CC among supply chain partners enables marketing and operations to work closer together and supports activities such as venturing into new markets (Grewal and Tansuhaj 2001). CC facilitates volume and product flexibility through close interactions between firms (Mello and Stank 2005), which enables them to capture higher market share. Similar culture and common practices between manufacturing firms are influenced by the quality of information exchange and it plays a fundamental role in sensing market changes (Ashrafi et al. 2019). CC acts as a conduit that enables the firm to effectively sense market changes, anticipate shifts in the market environment before competitors do, create and retain durable links with customers, and develop strong bonds with supply chain members (Mariadoss et al. 2011). By conforming to similar procedures, having common technical terminologies, similar business rules, norms and shared visions, manufacturing firms can enhance their profits by reducing their operational cost and capture more revenues through collaborative market-oriented activities. Thus, this study proposes:

H2b: Cultural compatibility (CC) is positively related to financial performance (FIN)

2.4 The mediating role of cultural compatibility (CC) on the manufacturing flexibility/financial performance (MF- FIN) relationship

This study argues that the effect of MF on FIN will be greater when CC can be emphasized. This means that, in addition to the direct effect of MF on financial performance, an indirect effect exists through CC. This indirect effect exists due to collaboration and knowledge exchange, social capital, and opportunistic behavior reduction.

Indeed, when supply chain members can enhance cultural compatibility, the opportunism mitigation created reduces the transaction costs in negotiating, monitoring, and safeguarding the involved parties' behavior. The uncertainty reduction theory (URT) states that similarities between persons reduce uncertainty (Berger 2015). Relationships with high compatibility are more likely to reach relationship objectives due to social

capital created. This reduces conflict in the relationship by parties finding ways to resolve issues. At the same time, this enables collaboration by reducing complexity in the relationship (Adamides et al. 2008). In addition, when opportunistic behavior is restrained through a compatible and flexible supply chain, coordination cost and uncertainty between exchange parties are also reduced (Joshi and Stump 2015), and this facilitates operations and market orientation activities.

MF fosters a stronger collaboration and a compatible vision in supply chains through its capital investment. MF is strongly affected by capital intensive investments in system flexibility (Terkaj et al. 2009). To be financially viable, MF often requires additional resources to meet dynamic customer requirements through shared physical assets and tangible knowledge of transaction economics (Bode and Wagner 2015), so that the transaction costs and total input resources can be reduced. This reduction can happen through stronger collaboration and compatible vision between manufacturers and their supply chain partners such as fostering transparent information exchange (Hsu et al. 2008) and mechanisms for resource allocation (Mishra et al. 2017). Here, many failures are due to cultural misalignment, impeding both the integration process, cultures, strategic goals, and technological systems (Björkman et al. 2007; Claycomb et al. 2005). For example, several studies found failures in aligning incentives of Cisco's supply chains (Narayanan and Raman 2004). in addition, cultural differences in Daimler's alliance with Mitsubishi and Chrysler resulted in poor FIN (DePamphilis 2015). These cultural differences and incompatible value systems have been identified as key causes of merger and integration failures (DePamphilis 2015). The recent development of the shared economy triggers a trade-off between efficiency versus resilience (Ivanov et al. 2016). These tradeoffs and the complexity of supply chain network have contributed to mixed findings in a range of financial measures such as return on investment, market share and net profit (Chan et al. 2017; Hilmola et al. 2015).

Without a common understanding between supply chain partners (e.g., of quality management and technological concepts), or if there is a lack of business vision and top management support, MF may not deliver the expected results. MF requires a newly created collaborative environment that facilitates learning and adaptation (Kim et al. 2013), this supports flexibility and agility (Chan et al. 2017). Joint workshops on quality, on development of common understanding, technical terminologies and best practices could help manufacturers and their suppliers to enhance their dynamic capabilities (Gruchmann et al. 2019) to react to frequent changes of customer requests or volume adjustments. In the light of buyer-supplier relationships, effective joint activities are influenced, either directly or indirectly, by the choices and alignment efforts of members in the supply chain (Handfield and Nichols 2002) in order to respond to dynamic market changes. A higher level of CC among firms in the supply chain creates valuable, rare and hard to inimitable or substituted. From the lenses of the resource-based view (Barney 1991), firms' competitive advantages can be achieved when CC within the supply chain network is specific, difficult to replicate (due to complexity in the network and the relationships), and/or when a firm can create greater value for customers in comparison to its competitors (due to the synergy among supply chain network). Therefore, we propose:

> H3: The relationship between manufacturing flexibility (MF) and financial performance (FIN) will be stronger when firms develop a higher level of cultural compatibility (CC)

2.5 The impact of product complexity (PCX) on the mediating role of cultural compatibility CC

The above sections raise the importance of CC as a mediator, absorbing MF pressures and facilitating the enhancement of market share, revenues and profits. When the product characteristics and supplier network become more complex, can this relationship be sustained? The next section highlights the moderating roles of PCX on these mediating relationships. Specifically, we examine how PCX affects the MF - CC and CC - FIN relationships.

In operations management, the concept of product complexity has been associated with "the number of parts or components needed to build the product" (Inman and Blumenfeld 2014) and the number of interconnections between them (Bode and Wagner 2015). In light of supply chain networks, the product complexity also reflects number of suppliers involved since it involves also structural and operational dimensions that present a more comprehensive view of product complexity (Trattner et al. 2019). This study adopts product complexity (PCX) from the perspective of the focal firm and focuses on both product and supplier complexity, which stems from the customization and variety of the firm's products (Schoenherr et al. 2010). The complexity has often been referred to also as the number of items in the bill of materials (BOM), number of supplier levels or degree of items outsourced to a third party (Eckstein et al. 2014).

In current literature, PCX reflects shorter product lifecycles, an increasing number of supplier tiers, wider product proliferation and more global competition. These complexities may create further pressures on relationships between MF and CC, however the effects on the CC - FIN relationship could be quite different. These complexities create challenges in communication that reduce alignment efforts between supply chain partners. In operations, quality control processes require partners to share common language and codes (e.g., special vocabulary, abbreviations and technical

terms); common understanding about the same concepts (e.g., good, fit, quality) and to develop common values and culture. For example, an increasing number of items in BOM imply not only increased dimensions of the number of suppliers in the supply base, but also the degree of coordination (information exchange and joint workshop on quality concepts) required to maintain the level of quality and optimization of profits (Gaur et al. 2019). The literature has shown that cultural differences in partners' business visions, values or even common understanding on technical concepts have adverse effects on collaboration in both manufacturing (Cadden et al. 2013) and services industries (Basfirinci and Mitra 2015; Gurung and Prater 2017). The research revealed not only the direct impact of complexity on performance, such as cost and financial measures (Wu et al. 2010) but also the inability to react to the inter-organizational changes (Bozarth et al. 2009). According to the above findings of the direct relationship, and in line with contingency theory, this study argues that:

> H4a: Product Complexity (PCX) dampens the relationship between Manufacturing Flexibility (MF) and Cultural Compatibility (CC).

While many studies have acknowledged the significant effects of product complexity on manufacturing operations and supply chain strategy of the firm, few discuss its impacts related to cultural issues. A higher level of product complexity is related to higher levels of supply chain risks and disruptions (Bode and Wagner 2015; Inman and Blumenfeld 2014), which subsequently requires a higher level of top management coordination. The more complex the product is, the higher the requirement for top management through cultural compatibility to ensure quality (e.g. technical specifications) and production schedules (Shou et al. 2017). Supplier coordination and collaborative actions are critical for resolving complex situations and disputes (Bai et al. 2016), e.g., if the production and delivery of a particular component of a complex product experience difficulties or delays.

Thus, complexity in the network, product structure and supply chain can intensify the opportunism created, affecting transaction costs in negotiating, monitoring and safeguarding the collaboration outcomes. On the downstream side, with an increase in product complexity, reconciling the goal of expanding market share requires additional resources (e.g., time slack, sales staff) that are difficult to be redistributed among partners without enhancing corporate vision sharing and top management support. Smith and Tushman (2005) argue that with increases in product complexity, sales personnel are more likely to behave opportunistically and reduce the time commitment and acquisition of technical knowledge. Therefore, synergies between CC and PCX tend to diminish financial measures such as market share and profits. Thus, this study argues that:

> H4b: Product complexity (PCX) dampens the positive relationship between cultural compatibility (CC) and financial performance (FIN).

Figure 1 shows the proposed research model based on the theoretical arguments presented.

3 Research methodology

3.1 The study design

The data collected for this research were acquired through the Global Manufacturing Research Group (GMRG) survey. The questionnaire included several sections on firm characteristics, manufacturing investment, innovation and supply chain management aspects. Data collection was accomplished via email, which targeted production and manufacturing managers as key informants. These managers were advised to seek assistance on data collection from other departments, such as finance, quality or marketing, when needed (Onofrei and Fynes 2019). As the questionnaire was translated into Vietnamese, a rigorous process of translation and back-translation was employed to ensure consistency in interpretation. A pilot study was conducted with seven executives in the annual meeting of the Vietnam Supply Chain Association. Several firm characteristics have been adjusted to reflect better local practices, such as the omitted percentages of inventories since local manufacturers are sensitive with providing such details. Data collection was completed in several stages to increase the response rate. Initially, emails were sent to the initial population sample of 825 firms, drawn from databases provided by Dun & Bradstreet and the Vietnam Supply Chain Association. These databases were chosen to ensure the survey captured a high number of executives of sufficient seniority and knowledge to answer the survey. This was followed by telephone calls so as to increase the response rate. On average, we used 3 phone calls per company to complete the questionnaire.

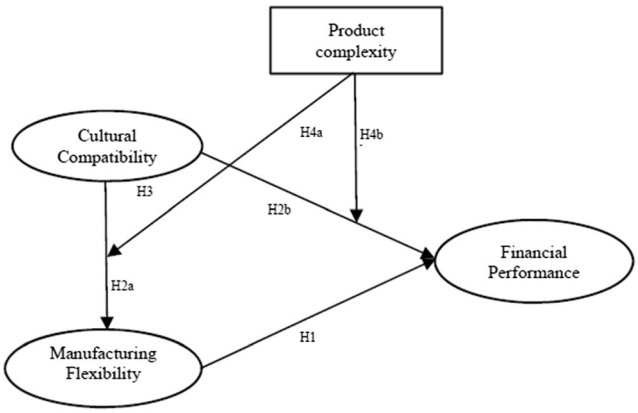

Fig. 1 Research model - Manufacturing flexibility and Financial performance

Overall, 150 completed and useable responses were received, representing a response rate of 18%. In follow-up phone calls to non-respondents, we have found that Vietnamese companies are reluctant to engage in international surveys from foreign institutions as in this case. These companies indicated that they are likely to respond to studies from the government or their ministries. Nevertheless, the response rate can be considered quite acceptable, especially in light of the response rates achieved in recent research investigating operations management topics (Schoenherr and Mabert 2008).

Appendix Table 5 provides an overview of company profiles. The sample consists primarily of small and medium-sized companies (80%). Included in the survey are more than 18 manufacturing industries, which represent food processing, garment and textile, chemical, furniture, metal products, semiconductor, electrical machinery, precision instrument, automotive, and other transport industries. Majority of participants are local plants which export up to 70% of their outputs and the majority (90%) of inputs are imported.

3.2 Testing for construct development and reliability, convergent validity and discriminant validity tests

The items used to measure this study's variables are derived from the thorough literature review below. The model includes the MF construct, which focuses on firms' ability to add product variety without sacrificing quality and cost, capability for responding quickly to customization requirements, and the high volume of products (Wu et al. 2010). The concept of CC represents the extent this plant and its major external partners have a common understanding of their relationship, shared objectives and visions, common language and codes, and similar behavioral rules and norms (Choi et al. 2002; Ketokivi and Jokinen 2006). FIN measures the market share, revenue and profit (Choi et al. 2002). Responses were measured in a seven-point Likert Scale, where a value of 1 indicates "to no extent" or "unimportant" and a value of 7 indicates "completely" or "very important".

To test common method bias, this study used ex-ante and ex-post mechanisms and Harman's single-factor approach (Podsakoff 2003). The results from the exploratory factor analysis (see Appendix Table 6) indicated that there were more than four factors, although the first factor (CC) explained 33% of the total variance of the sample data. Also, in the GMRG questionnaire, the indicators of manufacturing flexibility and cultural practices are in two separate sections, with several questions between them. The proximal separation in the questionnaire between the independent and the dependent variables indicated that the common method bias is minimized (MacKenzie and Podsakoff 2012). The internal consistency reliability test revealed that Cronbach's alphas ranged from 0.712 (MF) to 0.812 (FIN), which exceeds the threshold value 0.60 (Hair et al. 2010). Table 1 provides constructs' mean of measurement items, standard deviation, loading and p values. The confirmatory factor analysis (CFA) measurement models confirmed the presence of four unique constructs, and their CFA details are presented in Table 2. The model fit indices were $\chi 2/df = 1.89$, which is in the recommended range of 1 to 3. Further, the RMSEA value of 0.04 suggests a good model fit. The results in Table 2 showed that all of the AVE square root values were higher than the correlations, again indicating acceptable discriminant validity. Also, both MSV and ASV values are smaller than AVE (Hair et al. 2010).

To test the proposed hypotheses, structural equation modelling (SEM) was used. Table 3 shows the fit indices and displays the directions and significance of the hypothesized relationships among the constructs. The results rejected H1, indicating no significant positive influence of MF on FIN. The results supported H2a and H2b, confirming the strong relationships between MF, CC and FIN.

3.3 Cultural compatibility (CC) and the manufacturing flexibility/financial performance (MF- FIN) relationship

In the proposed conceptual model, CC mediates the effects of the relationship between CCs and firm FIN. We tested for such mediation effects using a structural equation model with bootstrapping procedures (Mallinckrodt et al. 2006). Table 4 indicated the outcomes, which show the direct effects with and without a mediator. While there was no significant direct relationship between MF to FIN, the test of the indirect effects between MF ➔ CC ➔ FIN was significant ($\beta = 0.302$ at $p = 0.001$). Thus, there is a full mediation effect of CC on MF and FIN.

3.4 The impact of product complexity (PCX)

Hypothesis H4a suggested that MF will be pursued with different emphases on CC based on the degree of product complexity (PCX). The dependent variable, CC, is jointly influenced by the interaction of the predictors (PCX and MF). The findings show a negative moderation effect, which supports H4a. The joint effects between PCX and MF dampen the relationship between MF and CC.

Hypothesis H4b argued that joint efforts between CC and PCX will dampen FIN. Indeed, Table 3 (the last row) indicates that PCX strengthen the relationship between CC and FIN ($\beta = 0.307$ at $p = 0.03$). Therefore, H4b was not supported and was contrary to our expectations. These interactions are presented in Fig. 2a and b. Follow up discussion and implications will be presented in Section 4.

Table 1 Constructs means and measures

Research construct's measurements	Estimate	Mean	SD
Manufacturing flexibility - MF (α = 0.781)			
We can add product variety without sacrificing quality	0.768	5.17	1.34
We can easily add significant product variety without increasing cost	0.713	4.64	1.33
Our capability for responding quickly to customization requirements is very high	0.749	5.18	1.22
Our plant produces a high volume of products	0.614	4.96	1.48
Cultural compatibility - CC (α = 0.812)			
This plant and its major external partners have …			
Common understanding about what activities are best for our relationship	0.768	5.09	1.18
Shared objectives and visions	0.757	4.85	1.21
Common language and codes (e g special vocabulary, abbreviation, and technical)	0.724	4.89	1.25
Similar behavioral rules and norms	0.614	4.89	1.05
Financial performance -FIN (α = 0.827)			
Total sales	0.825	4.61	1.60
Profitability	0.890	4.33	1.38
Market share	0.724	4.53	1.21
Product complexity - PCX (α = 0.712)			
N° of BOM's items produced internally	0.804	2.22	1.54
N° of items in the BOM	0.890	2.28	1.70
N° of BOM's items coming tier-one suppliers	0.569	1.55	1.21

$\chi 2 = 294.261$; df = 155; $\chi 2/df = 1.89$; CFI = 0.979; NFI = 0.957; RFI = 0.941; RMSEA = 0.04. Note: RMSEA = Root Mean Square Error of Approximation, GFI = Goodness-of-fit Index, *CFI* Comparative Fit Index. *BOM* Bill of Materials; the scale format for each of these measures was 1 = strongly disagree to 7 = strongly agree

4 Discussion and implications

This study examined the linkages between manufacturing flexibility (MF) and financial performance (FIN), which has been presented in manufacturing literature with mixed results. Drawing upon the congruence theory, social cognitive capital and uncertainty reduction view, this study confirmed that cultural compatibility (CC), exerted a mediating role in enhancing FIN. While the literature focused on identifying enablers and antecedents of MF (Bode and Wagner 2015; Sáenz et al. 2018; Yu et al. 2015), this study differs by examining the power of nudge emanated from MF on cultural factors. This study empirically shows a strong relationship between MF with CC, where collaborative cultural alignment among supply chain partners can reconfigure the existing processes to capture more market share and profits. These results are encouraging for a developing manufacturing industry sector as in Vietnam where there are growing pressures for flexibility performance (Nguyen et al. 2018). This study also examines the synergistic effect of product complexity on CC and FIN.

Table 2 Correlation matrix and construct measures

Research constructs	CR	AVE	MSV	ASV	[1]	[2]	[3]	[4]
[1] Product complexity (PCX)	0.805	0.587	0.061	0.043	**0.766**			
[2] Cultural compatibility (CC)	0.809	0.516	0.489	0.224	−0.105	**0.718**		
[3] Manufacturing flexibility (MF)	0.805	0.509	0.489	0.201	−0.246**	0.699**	**0.713**	
[4] Financial performance (FIN)	0.856	0.666	0.314	0.188	−0.221**	0.563**	0.357**	**0.816**

Diagonal elements in **bold** are the square root of the average variance extracted (AVE) between the constructs and their measures. Off diagonal elements are correlations between constructs. *MSV* Max shared variance and *ASV* Average shared variance. For discriminate validity, AVE should be greater than off-diagonal elements

** Correlation is significant at 0.01

Table 3 Results of the hypothesis testing

Research impacts			Estimate	S.E.	C.R.	P	Hypotheses
MF	→	FIN	−0.246	0.278	−0.887	0.375	H1 - Rejected
MF	→	CC	0.867	0.146	5.935	***	H2a-Accepted
CC	→	FIN	0.992	0.262	3.782	***	H2b-Accepted
PCX_MF	→	CC	−0.232	0.073	−3.179	0.004	H4a-Accepted
PCX_CC	→	FIN	0.307	0.114	2.692	0.031	H4b-Rejected

$\chi 2 = 183.17$; df = 98; $\chi 2/df = 1.89$; CFI = 0.917; NFI = 0.8422; IFI =0.934; RMSEA = 0.069. *** $p < 0.001$

In H1, we argued a positive impact of MF on the FIN as accumulative market shares and reduced transaction costs can overwhelm the costs of MF. Empirically testing this hypothesis is important because, under customer and market differentiation, firms and supply chain members are most concerned with the final bottom line of the effectiveness of these flexibility operations (Vickery et al. 1999; Weeks et al. 2018). The results from this study indicated that MF did not impact directly on FIN. That would mean that the efforts on the reconfiguration of manufacturing resources, manufacturing layout for quicker new product development and volume changes may not significantly improve revenues, market shares and profits directly. This might be due to several reasons. Firstly, the flexibility strategy often requires more complicated decisions (Dreyer and Grønhaug 2004). Su et al. (2012) suggested that the interaction between flexibility strategy and power distance hurts performance. That could be relevant as this study refers to the Vietnamese context, where consultative decision-making is not always a better choice (Nguyen and Aoyama 2013). Secondly, previous literature also indicated cases where the marketing function did not take advantage of the resulting flexibility opportunities, thus resulting in manufacturing flexibility having a limited impact on a firm's performance (Anderson et al. 1989). In the present Vietnamese context, there is a strong possibility that manufacturers may have a low marketing capability or lack of strong connection between business and operations strategies, compared to manufacturers in developed countries. Thirdly, Vietnamese manufacturers may pursue a defensive strategy, thus they tend to seek very little manufacturing flexibility. The majority of Vietnamese manufacturers follow an export-led growth strategy (Tommaso and Angelino 2015), where dependence on a foreign order leads to a reactive strategy. This tends to be reactive and emphasizes the implementation of cost reduction and efficiency improvement methods.

While there are mixed results for the relationship between MF and financial measures (Chan et al. 2017; Hilmola et al. 2015; Yu et al. 2015), this study contributes to the literature by identifying a cultural factor that can enhance the relationship. The findings from this study show that CC can serve as a conduit to enhance manufacturing flexibility that delivers FIN. While MF fosters more volume and variety changes, the dynamic capability and social capital created from aligning technological concepts, business norms and shared visions among partners might reduce the transaction cost. The collaborative cultural efforts can also provide a good environment for enhancing market-based information sharing, operational resource planning and sharing (Kumar et al. 2016). To be flexible or to enhance capability for responding quickly to a customization requirement, manufacturing companies need to connect with customers to understand their requests, and to learn about customers' business practices, norms and beliefs. On the upstream side, to maintain a good level of quality amid any demanding volume changes or amendments of product specifications, both manufacturers and suppliers need to conform not just technical specifications, but also to develop a common understanding, language and codes to avoid discrepancies.

The results theoretically explain and empirically demonstrate how inter-organizational compatibility can be aligned with manufacturing flexibility to enhance performance (Chan et al. 2017; Rajaguru et al. 2011). In addition, CC promotes shared business visions and cultures, which can be associated with a higher level of supply chain visibility and integration. Previous studies confirmed positive relationships between visibility, supply chain flexibility and performance (Sáenz et al. 2018; Williams et al. 2013). The results extend the current knowledge by explaining why some firms are successful at such alignment whereas others are not. These results reflect the organizational failures from Daimler's alliance with Mitsubishi (Pires and Sacomano Neto 2008) and Volkswagen Brazil (DePamphilis 2015), where the key reasons for failure were the lack of appropriate inter-organizational and professional working environment. CC provides an effective foundation for supply chain partners to exchange their business visions and share a common language and culture. These mechanisms (e.g., joint workshops, information exchange)

Table 4 Results of the mediating effects of CC

Mediator - Cultural compatibility	Direct with mediator	Indirect	Mediation	Hypotheses
Manufacturing flexibility to Financial perf.	−0.246(0.349)	0.302(0.001)	Full	H3 -Accepted

p value in brackets

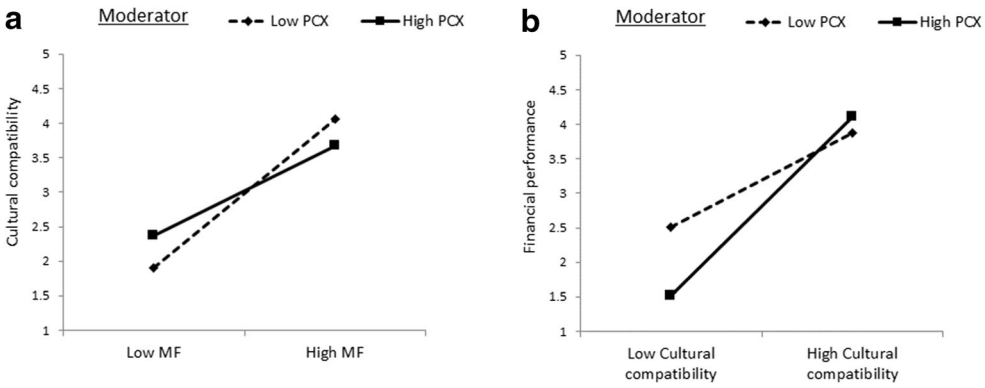

Fig. 2 (**a**) Moderating effects from product complexity (PCX) on Manufacturing flexibility and Cultural compatibility. (**b**) Moderating effects from product complexity (PCX) on Cultural compatibility and Financial performance

show that developing shared beliefs, principles, and goals with external partners created convergence among members by developing common values (Gama et al. 2017). In return, these compatible organizations can respond more quickly to customer and market requirements, such as volume flexibility (Chu et al. 2012), production variety flexibility (Patel et al. 2012) and enhance financial positioning.

This study confirmed that under conditions of greater product complexity (PCX), the effect of MF on CC is reduced (see Table 3 and Fig. 2a). We thus contribute to prior research that has provided evidence of the negative effect of product complexity on supply chain collaboration. MF has a positive relationship with CC through adopting similar behavior, common technical terminologies, and business norms to hedge against uncertainty and to improve flexibility through effective communication and knowledge exchange (Emden et al. 2006). The results of H4a show that the challenges for resource allocations and dynamic capabilities resulting from MF operations will intensify if complexity increases due to fluctuations in volume and product variety.

Contrary to our expectations, the positive moderation effects of PCX on the relationship between CC and FIN is intriguing (see Table 3 and Fig. 2b). Although complexity is commonly accepted as "a bad thing", the interactions with CC could enhance our understanding of possible synergistic effects with an organizational matter on FIN, which is encouraging. The implication of this finding is that complexity not necessarily affects relationships negatively. Cultural compatibility has positive relationships to FIN measures due to its collaborative cultural efforts. When manufacturers and supply chain partners have already engaged in a compatible working environment, they can handle more complex projects. With culturally compatible organizations, the increasing product complexity can be handled easier as learning curve effects of accumulated best practices can lead supply chain collaboration towards an efficient approach. Also, it highlights that cultural compatibility is an important approach to facilitate manufacturing flexibility, given the complexity of the product and the supply chain network. Previous studies (Li and Chen 2019) found that a higher level of product proliferation, associated with product complexity, can negatively impact on firms' collaboration with their suppliers. However, if product complexity and product proliferation can be managed well within complex organizational structures, this will generate commitment and enhance the opportunity to capture more market share (Piazzai and Wijnberg 2019). When firms are manufacturing products with more heterogeneous attributes, developing compatible culture could be an option to offset or to accommodate these higher levels of complexity. This is important, as complexity and flexibility are often not a choice, but are imposed on the firm by demands of consumers, and the realities of competition in a global economy.

5 Limitation and future research

The results of this study are subject to several limitations. First, this study was conducted in manufacturing organizations across different industries. While we collected the data from a variety of industries, and thereby potentially reached a greater source of variance, certain industries (e.g., chemical industry) might have a limited capability in enhancing their flexibility. Therefore, the generalizability of this study's findings to other types of organizations might be limited. Hence, future researchers may replicate and extend this study to a specific sector, thus bringing more insight into the model. Second, the current study uses financial measures as the bottom-line performance results; it would be better to expand the research model to examine influences of MF on social and environmental measures (Wiengarten et al. 2017).

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest

Appendix

Table 5 Respondent profiles

Industry	Frequency	Percent	Size (No of employees)	Frequency	Percent
Food and kindred products	18	12.0	Large (> 500)	20	13%
Textile mill products	1	.7	Medium (200–500)	50	33%
Apparel and other finished products made from fabrics	19	12.7	Small (1–200)	80	53%
Leather and leather products	1	.7			
Lumber and wood products, except furniture	7	4.7	Foreign Direct Investment (FDI-%)		
Paper and allied products,	4	2.7	Fully Own (100%)	11	7%
Printing, publishing, and allied industries	5	3.3	Local (0%)	119	79%
Chemicals and allied products	2	1.3	FDI related	20	13%
Rubber and miscellaneous plastics products	21	14.0			
Primary metal industries	18	12.0	Export (%)		
Fabricated metal products	21	14.0	Fully Export	1	1%
Industrial and commercial machinery and computer equipment	4	2.7	Domestic Only	45	30%
Electronic and other electrical equipment and components	6	4.0	Dominant	104	69%
Measuring, photographic, medical, optical, watches and clocks	3	2.0			
Manufacture of motor vehicles, trailers and semi-trailers	4	2.7	Import (%)		
Furniture and fixtures	2	1.3	Fully Import	42	28%
Stone, clay, glass, and concrete products	3	2.0	Local Sourcing	2	1%
Miscellaneous manufacturing industries	11	7.3	Dominant Import	106	71%
Total	150	100.0	Total	150	100.0

Table 6 Exploratory factor analysis

Research constructs	Exploratory Factor Analysis			
	CC	MF	FIN	PCX
This plant and its major external partners				
... have common understanding about the same concepts (e g good, fast, cost)	.807			
...share common language and codes (e g special vocabulary, technical concepts)	.733			
... have shared objectives and visions	.729			
... have similar behavioral rules and norms	.718			
... have common understanding about what activities are best for our relationship	.679			
... have common values and culture	.647			
Our plant produces a high volume of products		.846		
We can customize products while maintaining high volume		.818		
We are highly capable of large-scale product customization		.812		
We can add product variety without sacrificing quality		.636		
Our capability for responding quickly to customization requirements is very high		.492		
We can easily add significant product variety without increasing cost		.435		
Profitability			.899	
Total sales			.839	
Market share			.743	
N° of BOM's items produced internally				.888
N° of items in the BOM				.840
N° of BOM's items coming tier-one suppliers				.748
Kaiser-Meyer-Olkin Measure with Bartlett's Test of Sphericity	0.827	Sig.	0.000	
Eigenvalues	6.186	2.471	1.995	1.277
% of Variance	34	14	11	7

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