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ORIGINAL EMPIRICAL RESEARCH

Unpacking when and how customer involvement as co-developer affects supplier new product performance

Ghasem Zaefarian[1] · Constantine S. Katsikeas[1] · Zhaleh Najafi-Tavani[1] · Matthew J. Robson[2]

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Abstract
Scholars and practitioners concur on the importance of involving business customers in the development of new products as a viable solution to suppliers' need for continuous improvement in innovation and enhanced performance. Yet, under certain circumstances, the difficulties of involving customers as co-developers in collaborative innovation projects can outweigh the benefits. We adopt the social context and task experience sub-dimensions of organizational learning theory to investigate whether and under what conditions customer involvement as co-developer (CIC) improves or impairs the supplier's market-based, new product performance. Using quasi-longitudinal, lagged survey data from 217 Chinese manufacturing suppliers, we find that CIC has an inverted U-shaped relationship to new product performance. Trust negatively and shared vision positively moderate this relationship, while social interactions do not significantly influence the effectiveness of CIC practices. Finally, market experience negatively moderates the inverted U-shaped link between CIC and new product performance.

Keywords Customer involvement · New product development · Organizational learning · Social capital · Market experience

Introduction

Driven by increasing local and global competition and rapid technological changes, suppliers view the involvement of their business customers in product innovation as an important mechanism to strengthen their competitiveness (Fu et al., 2022; Samiee et al., 2021). However, learning customers' needs and using these to successfully innovate is a complex undertaking, exacerbated by a lack of knowledge of and experience in the marketplace (Weerawardena et al., 2015). The traditional form of involvement in collecting information from customers and using this to develop new products (Tang & Marinova, 2020) is less than fully effective for firms in surfacing complex and tacit knowledge of evolving customer requirements. Instead, for many manufacturers value is best co-created in a downstream relationship in which a customer as "co-developer" is actively involved in and contributes to tasks across the new product development (NPD) effort (Cui & Wu, 2016; Fang, 2008) to enhance new product performance, in terms of achieving economic objectives in the marketplace.[1]

For example, Toyota's R&D program in Europe has repeatedly involved its long-standing customer, the British specialist car maker, Lotus. With respect to this innovation partnership, Stijn Peeters, the senior European technical project manager observed, "There was an immediate advantage, as Lotus uses a large number of Toyota products in its vehicles, so it has built up a lot of knowledge about their performance potential […] We learned a great deal from [Lotus] about low volume, high-performance vehicle manufacturing." We were given "great insight into working with a

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✉ Ghasem Zaefarian
G.Zaefarian@leeds.ac.uk

Constantine S. Katsikeas
C.S.Katsikeas@leeds.ac.uk

Zhaleh Najafi-Tavani
Z.NajafiTavani@leeds.ac.uk

Matthew J. Robson
Robsonm@cardiff.ac.uk

1 University of Leeds, Leeds University Business School, Maurice Keyworth Building, Leeds LS2 9JT, UK

2 Cardiff Business School, Cardiff University, Aberconway Building, Cardiff CF10 3EU, UK

1 We conceptualize supplier new product performance as market-based performance, which represents economic and accounting measures of a new product's performance, such as return on investment, sales, and market share.

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supercharged engine and managing low-volume production. Lotus was very happy from the start to supply engineering services" (*Toyota UK Magazine*2018).

Our review of the literature on the outcomes of customer involvement as co-developer (CIC) (see Table 1) reveals three issues. First, while some studies suggest a positive link between CIC and new product performance (Morgan et al., 2018), others report no association (Cui & Wu, 2017) or even a negative effect (Menguc et al., 2014). Field interviews with top managers of manufacturing firms and their customers also revealed that the outcome of CIC is far from conclusive (see Table A1 of Web Appendix A). For example, an executive (NPD partnership 6) of an apparel manufacturer highlighted the bright side of CIC: "I know that co-developing with our business customers is a big win for both parties. By working together, we have developed more market fit and truly impactful products." By contrast, an executive (NPD partnership 3) of an integrated circuit manufacturer, described how a high level of CIC could negatively affect NPD: "Problem is, when you involve [customers] too much you can see a pile up of design debt. So, you end up having design debt reviews all the time."

Accordingly, the CIC–new product performance relationship is complex and not well understood. Scholars' application of theory—most often the resource-based view and its extensions—to predict a linear link may not be well suited to unravel the complexity involved in interfirm exchange relations (Stock et al., 2017). Indeed, while a few studies conceptualize CIC as part of a process of knowledge management (e.g., Cui & Wu, 2017), they do not consider that heightened CIC could impede itself by creating impediments to the supplier's ability to generate productive knowledge from exchanges with the customer. CIC provides a useful platform for the supplier to receive coaching on the tacit needs of the market. Yet increases in CIC beyond an optimal level create deleterious challenges for interfirm learning (Cui & Wu, 2016). Furthermore, many practitioners (e.g., Toyota example) understand that CIC presents a valuable learning opportunity regarding product–customer need fit but may lack a more nuanced set of guidelines with which to optimize their use of CIC.

Second, new knowledge is socially constructed and ideally learned through social resources embedded in an interfirm relationship (Tsai & Ghoshal, 1998). Work on co-development alliances suggests that the nature of the social context in general and social capital in particular can explain performance differences (Cousins et al., 2006). Social capital refers to the sum of the resources embedded within, available through, and derived from relationships possessed by a social unit (Nahapiet & Ghoshal, 1998). Furthermore, our field interviews highlighted the salience of different dimensions of social capital for CIC success (Web Appendix A). Still, the CIC literature does not provide insights into whether and how social capital facets tied to a specific, focal customer relationship shape CIC's performance relevance (Table 1). Unpacking conditioning effects of these dimensions can offer fine-grained guidance to managers on which social capital dimensions to focus on and when.

Third, research on the outcomes of CIC in NPD has not considered the effects of market-specific experience, defined as the length of time the firm has been operating in the specific customer's market (Rickley, 2018). Likewise, work on co-development alliances has largely overlooked the role of market experience in favor of a focus on shared experiences through previous collaborations (e.g., Hoang & Rothaermel, 2005). Yet, the wider literature views market experience as an enabler of organizational learning (e.g., Georgallis et al., 2021). Direct experience with the marketing tasks offers a baseline that allows firms to leverage tacit external knowledge (Yeniyurt et al., 2009). Still, it could encourage rigid ways of thinking that limit beneficial learning (Assadinia et al., 2019). Examining the exact role of market experience in moderating the link between CIC and market-based performance would provide a more accurate view of when CIC is effective.

Our research thus addresses two important questions: How does the CIC of a business customer influence supplier new product performance? and How do social capital and market experience shape the link between CIC and new product performance? Drawing from Argote and Miron-Spektor's (2011) theorization of organizational learning, we suggest that the supplier's ability to learn and incorporate the customer's knowledge during CIC is a function of the intersection of task experience and social context, captured by market experience (Spyropoulou et al., 2018) and social capital (Kang et al., 2007), respectively. Social capital theory (Tsai & Ghoshal, 1998) encourages the distinction among social dimensions that aid or hinder the ability of a supplier to reap the benefits of CIC. Our study's empirical setting is CIC in NPD projects of Chinese firms. We test theory using successive surveys of Chinese manufacturers in trading relationships with foreign customers.

This study contributes to marketing knowledge in several ways (for a summary, see Table 2). First, we reconcile studies that theorize and observe favorable and unfavorable effects of CIC on new product performance, by advancing a new organizational learning theory-based, curvilinear mechanism for the link. In doing so, we extend work (Stock et al., 2017; Story & Larbig 2018) proposing both positive and negative effects of CIC in a nonlinear relationship with nonmarket performance outcomes (e.g., new product frequency) to CIC's market-based new product performance outcomes. We posit and show that initial increases in CIC augment information exchange and have positive returns but that subsequent increases beyond a threshold undermine the orchestration of the learning opportunity and have a negative effect on performance (inverted U-shaped relationship).

Table 1 Key contributions on the outcomes of business-to-business customer involvement as co-developer

Source	Empirical setting	Research design and sample	Customer focus	Theory	Main effect	Mediators	Moderators	Outcomes	Key findings
Skaggs and Youndt (2004)	U.S. service providers	Cross-sectional survey of 234 firms	General customers	Human capital theory	Linear	–	Human capital	Human capital; firm performance	- Customer co-production is negatively related to human capital. - Customer co-production–firm performance link is negatively conditioned by human capital.
Knudsen (2007)	European manufacturers and service providers	Panel data of 632 firms	General customers	Not specified	Linear	–	–	Innovative performance	- Customer involvement is negatively related to innovative performance. - Relationship holds for original ideas and completion of innovation stages.
Fang (2008)	OEM customers and component manufacturers	Cross-sectional survey of 143 dyads	A specific, focal customer	Social network theory	Linear	–	Customer network connectivity; process interdependence; process complexity	New product innovativeness; new product speed to market	- Customer involvement is positively related to new product speed to market. - Network connectivity negatively moderates the customer involvement as information provider–new product innovativeness link and positively moderates the involvement as information provider–speed-to-market link. - Process interdependence positively moderates the CIC–new product innovativeness link and negatively moderates the involvement as co-developer–speed-to-market link.

Table 1 (continued)

Source	Empirical setting	Research design and sample	Customer focus	Theory	Main effect	Mediators	Moderators	Outcomes	Key findings
Fang et al. (2008)	OEM customers	Cross-sectional survey of 188 firms	A specific, focal customer	Institutional arrangement perspective	Linear	Information sharing; coordination effectiveness; relationship-specific investment; new product value; dependence; fair share	Customer participation formality	New product value obtained by customer	- Customer participation is positively related to information sharing, coordination effectiveness, and relationship-specific investment. - Customer participation–relationship-specific investment link is positively conditioned by customer participation formality. - Information sharing, coordination, and relationship-specific investment are positively related to new product value. - New product value, supplier dependence, and fair share are positively related to new product value obtained by customer.
Carbonell et al. (2009)	Spanish service providers	Cross-sectional survey of 102 firms	General customers	Resource dependence theory	Linear	Operational outcomes: innovation speed; technical quality	Stage of the development process	Market outcomes: competitive superiority; sales performance	- Customer involvement has a positive indirect relationship to market outcomes via operational outcomes. - Customer involvement not related to market outcomes. - Stage of the development process does not moderate customer involvement–operational outcomes link.

Table 1 (continued)

Source	Empirical setting	Research design and sample	Customer focus	Theory	Main effect	Mediators	Moderators	Outcomes	Key findings
Lau et al. (2010)	Chinese manufacturers	Cross-sectional survey of 251 firms	General customers	Resource-based theory	Linear	Product innovation	–	Product performance	- Product co-development with customers is not related to product innovation or product performance. - Product innovation is positively related to product performance.
Melton and Hartline (2010)	U.S. service providers	Cross-sectional survey of 160 firms	General customers	Not specified	Linear	Service marketability; launch preparation	–	Project efficiency; sales performance	- Customer involvement in the development stage is positively related to launch preparation of the new service development product. - Launch preparation is positively related to project efficiency and sales performance.
Foss et al. (2011)	Danish manufacturers and service providers	Cross-sectional survey of 169 firms	General customers	Not specified	Linear	Delegation of responsibility; knowledge incentives; internal communication	–	Innovation performance	- Interactions with customers is positively but indirectly related to innovation performance through delegation of responsibility, knowledge incentives, and internal communication.
Al-Zu'bi and Tsinopoulos (2012)	U.K. manufacturers	Cross-sectional survey of 313 firms	General customers	Not specified	Linear	–	–	Product variety	- Collaboration with lead users is positively related to the product variety offered to customers.
Smets et al. (2013)	A plastics manufacturer	Cross-sectional survey of a firm on 63 international NPD projects	A specific, focal customer	Not specified	Linear	–	–	New product performance	- Customer participation is positively related to new product performance.

Table 1 (continued)

Source	Empirical setting	Research design and sample	Customer focus	Theory	Main effect	Mediators	Moderators	Outcomes	Key findings
Chatterji and Fabrizio (2014)	U.S. manufacturers	Panel data of 727 firm-year (public medical device companies) from 1985 to 1997	General customers	Not specified	Linear	–	New/old technology area; radical/ incremental innovations	Innovative performance	- Inventive collaborations are positively related to innovative performance. - This association is stronger in the new technology area and in the generation of radical innovations
Menguc et al. (2014)	Canadian manufacturers	Cross-sectional survey of 216 firms	General customers	Resource-based view	Linear	–	Radical/incremental product innovation capability	New product performance	- Customer involvement is positively related to new product performance. - This link is conditioned negatively by radical and positively by incremental innovation capability.
Zhang et al. (2015)	Chinese service providers	Cross-sectional survey of 175 firms	General customers	Not specified	Linear	–	–	Supplier international. performance	- Customer involvement is positively related to supplier internationalization performance.
Cui and Wu (2016)	Manufacturers and utility providers	Cross-sectional survey of 245 firms	General customers	Knowledge-based view	Linear	–	Technological capability	New product performance	- CIC is positively related to new product performance. - Technological capability moderates the CIC–new product performance link in an inverted U-shaped manner.

Table 1 (continued)

Source	Empirical setting	Research design and sample	Customer focus	Theory	Main effect	Mediators	Moderators	Outcomes	Key findings
Cui and Wu (2017)	Manufacturers and utility providers	Cross-sectional survey of 236 firms	General customers	Knowledge management view	Linear	New product innovativeness	Experimental NPD approach	New product advantage; new product financial performance	- CIC is not related to new product innovativeness. - This link is negatively conditioned by experimental approach. - New product innovativeness mediates conditional link of involvement to new product advantage and new product financial performance.
Stock et al. (2017)	Manufacturers and service providers	Cross-sectional survey of 135 firms	General customers	Boundary theory; resource dependence theory	Quadratic	–	–	New product frequency	- Customer involvement has an inverted U-shaped relationship to new product frequency.
Storey and Larbig (2018)	European service providers	Cross-sectional survey of 126 firms	General customers	Absorptive capacity theory	Quadratic	Customer knowledge assimilation; concept transformation	Resource slack	New service success	- Customer involvement has a U-shaped relationship to customer knowledge assimilation and an inverted U-shaped relationship to concept transformation. - Knowledge assimilation mediates the customer involvement–new service success link. - Resource slack positively moderates concept transformation–new service success link.

Table 1 (continued)

Source	Empirical setting	Research design and sample	Customer focus	Theory	Main effect	Mediators	Moderators	Outcomes	Key findings
Morgan et al. (2018)	U.S. manufacturers	Cross-sectional survey of 243 firms	General customers	Dynamic capability view	Linear	New product innovativeness	Absorptive capacity	New product performance	- Customer participation is positively related to new product performance both directly and indirectly via new product innovativeness. - These effects are strengthened by absorptive capacity.
Our study	Chinese manufacturers	Two-round, semi-longitudinal survey of 217 firms	A specific, focal customer	Organizational learning theory; social capital theory	Quadratic	–	Trust; shared vision; social interactions; export market experience	New product performance	- Customer involvement has an inverted U-shaped link with supplier new product performance; this relationship is conditioned positively by trust and negatively by shared vision and market experience. - Market experience and social interactions substitute for each other's effects such that higher levels of social interactions make up for a lack of market experience, enabling suppliers to benefit from intensive involvement of their customers in NPD efforts.

[a] Studies published in leading academic journals

Table 2 Summary of study contributions against existing work on the outcomes of co-development partnerships

Themes	Indicative key studies	Indicative key findings	Limitations of studies	Theoretical contributions of our study	Managerial contributions of our study
CIC and performance outcomes	Lau et al. (2010); Melton and Hartline (2010); Smets et al. (2013); Menguc et al. (2014); Cui and Wu (2016); Cui and Wu (2017); Stock et al. (2017); Morgan et al. (2018)	- CIC is positively related to new product performance. - CIC is positively but indirectly related to sales performance, product advantages, and new product financial performance. - CIC is negatively related to new product performance when coupled with radical innovation capability.	- Mixed findings for the new product performance outcomes of CIC - Theoretical focus chiefly on linear effects of CIC on new product performance - The few studies capturing quadratic performance effects of CIC limited to nonmarket performance outcomes	- Offers a new organizational learning theory-based, curvilinear mechanism for the CIC–market-based new product performance link - Challenges linear view and offers an explanation for mixed findings in earlier studies	- Offers managerial guidance of when and how CIC actually influences the supplier's new product performance
CIC efficacy and social context	Kale et al. (2000); Sivadas and Dwyer (2000); Sarkar et al. (2001); Skaggs and Youndt (2004); Carey et al. (2011); Fang (2011); Chatterji and Fabrizio (2014); Storey and Larbig (2018)	- Firm-level factors such as human capital, resource slack, technology, and innovation type condition the outcomes of CIC. - Relationship-level factors such as mutual dependency, trust, commitment, alliance partner knowledge complementarity, and interaction enhance co-development alliance innovation, learning, and performance.	- Social context of CIC is neglected in prior work on CIC's outcomes. - Predominant focus on general customer involvement in co-development tasks and on firm-level conditioning variables - Examines only direct, not moderating, effect of relationship-level factors on success of co-development alliances	- Social capital as the social context mechanism of learning theory moderates the CIC–new product performance link. - Extends social capital theory by observing heterogenous moderation effects of relational, cognitive, and structural facets of social capital - Contributes moderation mechanisms that vary across CIC relationships	- Provides fine-grained guidance to managers on which social capital dimensions to focus on, or avoid, and when to benefit more from CIC relationships
CIC efficacy and experience	Hoang and Rothaermel (2005); Sampson (2005); Gulati et al. (2009); Harmancioglu et al. (2019)	- General alliance experience has nonlinear relationship to co-development alliance performance - Partner-specific experience's effect on co-development alliance performance depends on availability of financial resources and level of firm-specific uncertainty. - Past partner experience positively affects short-term abnormal stock returns and negatively affects long-term returns.	- Conceptualizes experience as experience with the partner and disregards the importance of market-specific experience - Overlooks role of first-hand experiences and tacit knowledge - Focuses mostly on direct, not moderating, effect of experience	- Market experience as the task experience mechanism of learning theory moderates the CIC–new product performance link. - Shows that the experience aspect of learning is not limited to shared experiences of partners - Extends learning theory by offering a different view (i.e., substitution) of how two main components of learning work together	- Cautions that market experience encourages rigid ways of thinking that limit beneficial learning from CIC - Offers managerial guidance on whether and when market experience can make up for the lack of social interactions

Second, using social capital theory, we add to the limited work on CIC's social context (Chang & Taylor, 2016; Foss et al., 2011) by theorizing moderation effects of three dimensions of social capital: relational (i.e., trust), cognitive (i.e., shared vision), and structural (i.e., social interactions). Unpacking conditioning effects of these facets is precise theoretically as it taps mechanisms that can vary across CIC relationships. Our results reveal marked heterogeneity. While social interactions have no significant effect, trust negatively and shared vision positively moderate the inverted U-shaped link of CIC with new product performance. These findings provide further evidence that social capital "is not a universally beneficial resource" (Nahapiet & Ghoshal, 1998, p. 245) and that aligning social capital dimensions with CIC levels is an important way to manage CIC in developing products that meet market expectations. We offer practitioners a clear understanding of which dimensions of social capital to focus on, or avoid, at different levels of CIC to optimize performance.

Third, by extending our moderation thesis to capture the task experience facet of organizational learning (Argote & Miron-Spektor, 2011), we reveal that market experience can have unintended negative consequences for co-development activities, depending on the extent of CIC in the NPD project. We find that experience plays a positive role in CIC's performance impact during initial increases in involvement and a negative role when involvement increases beyond a threshold. In demonstrating that market experience can shape the outcomes of CIC in contrasting ways, our study advances the debate on the difficulty of channeling market experience into effective learning (Assadinia et al., 2019).

Fourth, we add to the literature by acknowledging the interplay between the social and experience aspects of learning. We scrutinize social interactions' nonsignificant moderation effect by exploring, in additional analysis, how their interplay with market experience alters the performance relevance of CIC. Contrary to learning theory's claim of a reinforcing effect of experience and context (Argote & Miron-Spektor, 2011), we find that extensive social interactions can substitute for limited market experience and vice versa, enabling a supplier to benefit from intensive CIC in NPD. Our findings highlight a manifest dark side of experience and context, when coupled with involvement, insofar as high levels of CIC are most detrimental under high levels of both social interactions and market experience.

Theory and hypotheses

Customer involvement as co-developer

The innovation field has employed a set of overlapping concepts (e.g., involvement, participation, co-creation) to reflect activities associated with incorporating customers' inputs in NPD. Fang et al. (2008) conceptualize customer participation as customers' involvement in the NPD process. Research on customer co-creation in product development and co-production often emphasizes the level of customer participation (Heidenreich et al., 2015; Skaggs & Youndt, 2004). Furthermore, studies on co-development alliances primarily consider processes and gains within formal or informal agreements regarding joint activities, communication, and cooperation in NPD (e.g., Kalaignanam et al., 2007; Sivadas & Dwyer, 2000).[2] What matters more than the concept label used is the closeness of the involvement construct. To this point, research has argued the importance of studying the particularly active and close form of customer involvement—CIC—that goes beyond customer involvement as a simple information source (Cui & Wu, 2016).

We use the term "CIC" to capture situations in which the responsibility for NPD activities is shared between a supplier and its business customer, with the customer taking a fair share of responsibilities (e.g., in problem solving) associated with NPD tasks (Cui & Wu, 2017). Indeed, we posit that CIC is ideally conceptualized in terms of the customer contributing to the overall NPD effort (vs. participation in any particular stage of NPD) and working closely (i.e., actively and frequently) with the NPD team in developing new products (Cui & Wu, 2016; Fang, 2008).

Our arguments focus on the left and right sides of the CIC curve—that is, "initial increases in CIC from low levels" and "subsequent increases in CIC beyond the threshold"—and their distinct implications for the supplier's new product performance. Initial increases in CIC signify moderate and manageable involvement of the customer as co-developer across the product development effort. Here, the involvement does not cause disruptions to the NPD project. The volume of customer feedback and inputs is manageable in the sense that these can be analyzed and incorporated effectively. The CIC contributions are balanced and controlled, with guidelines in place to ensure that co-creation activities align with strategic goals for the new product. Increases beyond the threshold pertain to excessive and unmanageable involvement of the customer as co-developer across the product development effort. Such involvement disturbs the NPD project by making co-creation tasks complex and hindering timely decision-making. The volume of customer feedback and contributions is overwhelming to the point that they exceed the supplier's ability to effectively process

[2] CIC occurs in interfirm relationships between buyers and suppliers. Strategic alliances are a highly integrative form of interfirm relationship. In essence, CIC functions as a construct, whereas strategic alliances serve as a rich context for (open) innovation among buyers, suppliers, and other project members. This distinction precludes a meaningful extrapolation of findings from strategic alliances in our Table 1, which focuses on CIC the construct.

and deploy knowledge resources available for NPD. There is limited control over the extent and boundaries of customer involvement in NPD. For a summary, see Web Appendix B.

Organizational learning

Learning new knowledge and skills is a key reason for firms to involve business customers in NPD. More active forms of customer involvement, such as CIC, are a means for accessing partners' complementary resources and skills in NPD (Cui & Wu, 2017; Morgan et al., 2018). However, such access may prove futile if the supplier cannot acquire and incorporate its customer's knowledge and expertise (Morgan et al., 2018). A supplier with greater learning ability is in a better position to benefit from involving the customer in NPD. Our study thus employs the organizational learning perspective (Argote & Miron-Spektor, 2011; Levitt & March, 1988) to examine the performance relevance of CIC.

The multidimensional nature of organizational learning makes it a useful theoretical lens for advancing understanding of how suppliers learn from customers and improve co-developer activities. Following Argote and Miron-Spektor (2011), we argue that experience and context form the tractable basis for organizational learning through which firms can develop, acquire, and transfer knowledge. In international marketing and interfirm partnerships work, task experience is provided by the amount of time a firm has spent in a focal market (Rickley, 2018), and context is captured in terms of resources embedded in the social context (Carey et al., 2011; Kale et al., 2000).

We focus on social capital to capture the social context of learning, as research suggests that it plays a crucial role in the creation of mechanisms and capabilities (e.g., knowledge exchanges, acquisition, protections) that determine the value firms gain from engaging in collaborative processes (Gulati et al., 2009; Kale et al., 2000).[3] Each dimension of social capital is unique and offers distinct learning benefits (Koka & Prescott, 2002). By treating the dimensions separately, the social capital perspective allows for a more accurate explanation of when CIC is most effective in driving new product performance.

The relational dimension of social capital theory captures the strength of the bond between firms in terms of trust, obligations, and mutual respect (Rouziès & Hulland, 2014). We consider trust, or the extent of the supplier's confidence in its customer's reliability, honesty, and benevolence (Li et al., 2010), as the core relational aspect. Trust can have a good or bad influence depending on how it is applied to the collaboration. It serves as an informal governance mechanism that may enhance channel partners' willingness to participate in interfirm knowledge exchanges (Yeniyurt et al., 2014). Still, heightened trust triggers a defensive reaction to fears of losing relationship-specific assets (Villena et al., 2011), which could discourage the supplier from acknowledging and effectively managing the challenges of coordinating NPD tasks with its customer.

The second dimension, cognitive capital, refers to "the resources providing shared representations, interpretations, and systems of meaning among parties" (Nahapiet & Ghoshal, 1998, p. 244). We capture cognitive capital through shared vision and define it as the extent to which channel partners share an understanding of collective aspirations and proper ways of acting to achieve common goals (Villena et al., 2011). Rather than being a tool that must be applied, shared vision is directly related to goals and actions of the collaboration. Whereas trust conveys the strength of the relational bond between the partners and can facilitate open communication within vulnerability-testing exchanges, shared vision conveys cognitive alignment that may discourage open communication and de-risk exchanges. Shared frames of reference for norms that guide co-creation activities would reduce the likelihood of conflict hampering the partners' coordination efforts (Wong et al., 2017). Still, such commonalities might lessen the exchange of diverse market knowledge for the NPD project, when customer decisions about the sharing of information are influenced more by shared frames of reference than by the merits of such inputs (De Carolis & Saparito, 2006).

The third dimension is the structural aspect of social capital—the actual social connections firms use for information and resource flows (Tsai & Ghoshal, 1998). We tap this dimension using social interactions, or the frequency and patterns of interactions between channel members (Wang et al., 2013). These include interactions in the form of interfirm social events, joint training programs and workshops, cross-functional teams, joint field activities, and extended visits (Carey et al., 2011). Such interactions enable the exchange of cues and feedback conductive to effective interfirm knowledge exchange (Zuo et al., 2019). Yet, apart from being costly (timewise and financially) to organize, too many social meetings can hamper interorganizational learning by increasing complexities of coordinating NPD activities (Noorderhaven & Harzing, 2009).[4]

[3] We chose social capital deliberately over relational capital and relationship capital. Despite some similarities, significant differences exist among these embeddedness concepts. Social capital is expansive in covering relational, cognitive, and structural dimensions. Relational capital may be taken to indicate trust and interaction (Kale et al., 2000), disregarding the cognitive facet of social capital. Relationship capital includes the relational dimension of social capital but not the cognitive and structural dimensions (Sarkar et al., 2001). It also conceptualizes relationships in terms of commitment and information exchange—factors often considered benefits of the relational facet of social capital.

[4] While interactions are inherently part of CIC, these interactions are formal and center on a specific NPD project (Cui & Wu, 2016). By contrast, social interactions extend across collaborative projects and

To capture the task experience aspect of learning, we focus on market experience. Following the international marketing literature, we suggest that to minimize the risk of pursuing suboptimal NPD directions and developing inferior products, the supplier requires experience in the marketplace (Chetty et al., 2006; Spyropoulou et al., 2018). Indeed, a great deal of valuable NPD learning involves the extraction of tacit knowledge in firsthand experiences with external actors (Madhavan & Grover, 1998). Market experience increases the supplier's market-specific knowledge (e.g., about evolving customer preferences and demand conditions), providing a baseline from which to acquire, incorporate, and optimize the customer's inputs into co-development (Georgallis et al., 2021). Still, heightened market experience might prove harmful if it reduces the flexibility of the supplier's mental models (Ener, 2019) and, with that, its ability to filter the customer's knowledge inputs and learn.

Prima facie, our set of context and experience moderators may have positive and negative effects on the efficacy of CIC. Our conceptual framework (Fig. 1) predicts differential moderation effects across social capital facets and market experience, as each dimension of social capital affects the effectiveness of CIC through different mechanisms or in different ways (positively or negatively) given their unique learning benefits.

CIC and supplier new product performance

Different levels of CIC have distinct "implications" for the supplier's new product performance. In brief, initial increases in CIC benefit supplier new product performance by providing opportunities for the exchange of market knowledge, whereas subsequent increases beyond the threshold hamper new product performance by triggering complexities of coordinating NPD activities and information overload—two main impediments to interorganizational learning.[5] It is likely that these implications are present at all levels of CIC. Nonetheless, the advantages afforded by opportunities for knowledge exchange are expected to dominate as CIC builds from low levels, while the disadvantages of complexities of coordinating NPD activities and information overload should dominate for intensified CIC. Indeed, we propose that CIC has an optimal level, and deviating from this can result in diminished new product performance.

Initial increases in CIC from low levels enhance supplier new product performance by furnishing opportunities for effective exchanges of market knowledge (Fang, 2008). Research suggests that, due to its tacit, ambiguous, and contradictory nature, market needs sometimes are not fully articulated by end users themselves (Storey & Larbig, 2018). Business customers, as knowledgeable intermediaries, can serve as a direct source of market knowledge (Zhang et al., 2015). Yet such tacit knowledge can only be applied to NPD if it is exchanged successfully between channel partners (Cui & Wu, 2016), that is, when market knowledge is effectively transferred by the customer and acquired by the supplier. Initial increases in CIC across NPD activities facilitate interfirm knowledge exchanges by providing sufficiently frequent opportunities for direct and meaningful interactions (Mahr et al., 2014). They also provide a baseline for the exchange of contextual knowledge, enabling the supplier to correctly understand and make real sense of tacit requirements of the marketplace (Cui & Wu, 2016), resulting in new products that better meet evolving market needs.

Despite the benefits of initial increases in CIC, subsequent increases beyond the threshold can entail significant costs and risks (Chang & Taylor, 2016). In fact, the relationship between CIC and the supplier's new product performance may suffer from diminishing returns. Intensified CIC impedes interfirm learning as a result of NPD coordination complexities (Cui & Wu, 2017). At high levels of CIC, employees of the supplier and customer depend on each other in completing NPD tasks (Fang, 2008). Such task interdependency requires sustained coordination efforts in terms of aligning, adapting, and adjusting customer inputs, combining resources, and joint decision-making (Gulati et al. 2012). Coordinating tasks becomes complex due to not only the ambiguity of gaging the progress of the NPD project, but also the heterogeneous ideas and expectations of the supplier and customer. Their differences would trigger disagreements and dysfunctional competition over the interpretation and criticality of knowledge inputs to the project. These complexities reduce the effectiveness of CIC by depleting the supplier's cognitive resources necessary for learning and reducing its motivation to learn from the customer (cf., Auh et al., 2014).

Moreover, as CIC increases beyond the threshold, learning becomes more challenging because of information overload (Hoyer et al., 2010). When customers become heavily involved in NPD, they provide large volumes of knowledge inputs (Cui & Wu, 2016). In such cases, learning is difficult for the supplier due to an inability to screen, interpret, filter, and use all the knowledge exchanged (Storey & Larbig, 2018).

Footnote 4 (continued)
denote general interaction patterns between business partners. They foster personal rapport and interpersonal familiarity conducive to open communications, fast problem-solving, and heightened interfirm learning capabilities (Gupta & Govindarajan, 2000; Villena et al., 2011).

[5] In our moderation hypotheses, we apply NPD coordination complexities to the social capital facets and information overload to market experience. In collaborative processes, the social context determines how coordination mechanisms derive value (Gulati et al., 2009). Task experience is converted into knowledge that shapes how new knowledge is transformed (Argote & Miron-Spektor, 2011). When a customer is providing large volumes of knowledge inputs, experience determines the efficacy of filtering and conversion.

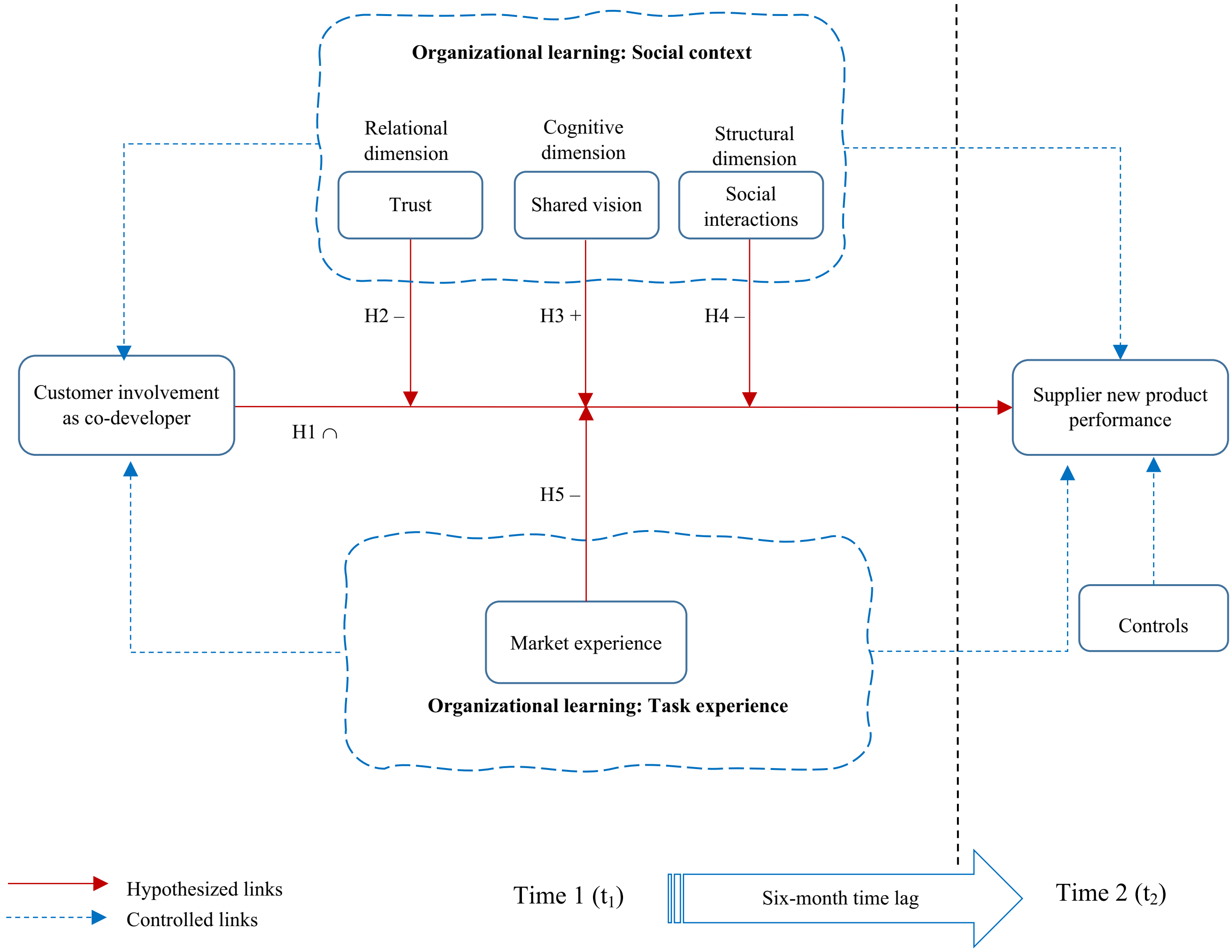


Fig. 1 Conceptual model

A risk is the supplier running with detailed customer inputs that are not feasible from a production standpoint (Hoyer et al., 2010), which can result in less effective NPD outcomes. As such, negative side effects of heightened CIC outweigh the benefits, leading to a decline in the supplier's new product performance. We thus hypothesize the following:

H1 CIC has an inverted U-shaped relationship with supplier new product performance. As the level of CIC increases, supplier new product performance first increases and then decreases.

Moderating effect of trust

We propose that trust strengthens the inverted U-shaped link between CIC and the supplier's new product performance. The positive effect of initial increases in CIC on new product performance is stronger when the level of trust is high. Trust utilizes expectations of behavioral predictability (Li et al., 2010), which means that channel partners are obliged to desist from exploiting vulnerabilities in one another (Wang et al., 2013). When trust is high, the supplier would feel more positive and secure about the goodwill of a customer building up its CIC role (De Oliveira Santini et al., 2020). The presence of trust also provides assurance to the supplier that the customer has the requisite expertise to co-develop products that meet market expectations (Lavie et al., 2012). Hence, the supplier is expected to be willing to proactively engage in interfirm knowledge exchanges, to learn about and utilize the trusted and increasingly involved customer's knowledge resources for the benefit of new product performance (Yeniyurt et al., 2014). By contrast, in the absence of trust, the supplier is likely to be having second thoughts about the customer's growing involvement. Questions over the integrity of the customer and quality of its expertise that become more pressing as CIC grows from low levels, may reduce the supplier's motivation to absorb and make good use of knowledge the customer transfers for the NPD project (Yeniyurt et al., 2014).

However, a high level of trust intensifies the negative effect of heightened CIC on the supplier's new product performance. As CIC increases beyond the threshold, coordination complexities can hinder interfirm learning. A high level of trust is often accompanied by positive affect toward the partner, obligations for accommodating partner requests, and fear of losing relationship-specific assets (Villena et al., 2011). In such an atmosphere, the supplier may not be willing to acknowledge and effectively manage the complexities of coordination associated with intensified CIC (cf., Kostis et al., 2022). Instead, the supplier is likely to pursue passive strategies (e.g., avoidance) that limit opportunities to solve coordination issues before they become more dysfunctional. Fear of jeopardizing a trusting relationship that the supplier painstakingly built with its customer, could impair decision making by constraining the supplier's decisiveness in dealing with disagreements over NPD inputs or directions. This, in turn, hampers learning and escalates the risk of co-development of new products that do not meet market expectations (Krishnan et al., 2006). In contrast, when trust is low, the supplier is likely to be more willing and capable of effectively addressing coordination complexities, which would lower the risk of developing inferior new products. Thus:

H2 Trust has a steepening effect on the inverted U-shaped relationship between CIC and supplier new product performance, such that the relationship becomes more positive for initial increases in CIC and more negative for subsequent increases beyond the threshold.

Moderating effect of shared vision

We propose that shared vision weakens the inverted U-shaped link between CIC and the supplier's new product performance. At a high level of shared vision, the positive association between initial increases in CIC and new product performance is attenuated. A shared vision between channel partners brings with it a common understanding of priorities and, thus, inputs needed for NPD activities (Tsai & Ghoshal, 1998). While such a common understanding facilitates interfirm collaboration generally (Wang et al., 2016), it can be a baseline for the customer to decide about the usefulness and relatedness of its knowledge and insights for the supplier's NPD project (De Carolis & Saparito, 2006). A customer building up its CIC role, and conscious of the opportunity presented, may be more inclined to contribute knowledge that aligns with shared views and less willing to provide dissenting insights that could offer novel directions for NPD. The supplier might inadvertently encourage the customer's cautious self-censorship by exhibiting an unwillingness to embrace insights that fall outside the common understanding of priorities, resulting in missed opportunities for the development of high-performing new products. Alternatively, a low level of shared vision coupled with the customer's growing CIC, would encourage the exchange of a more heterogeneous and diverse knowledge base that is essential for the development of products that meet market expectations (Fang, 2008).

However, a high level of shared vision offsets the negative effect of heightened customer involvement on the supplier's new product performance. The presence of shared vision implies that the supplier and customer prioritize joint goals over individual ones (Wang et al., 2013). They perceive and process environmental cues in the same way and, in effect, are able to share and access each other's thought processes (Carey et al., 2011). They also likely share an understanding of what the key facets of the new product are, who is steering the project, and how to co-develop the new product. In the presence of such a harmonious collaborative environment, the partners are better equipped to handle the complexities of coordinating interdependent NPD activities (Wang et al., 2016; Wong et al., 2017) and to overcome the difficulties of interorganizational learning associated with heightened CIC. By contrast, in the absence of shared vision, the supplier's and customer's diverging perspectives on inputs and directions for the NPD project would disrupt productive interorganizational learning by increasing task coordination complexities (e.g., conflict, disagreements). As a result, the negative effect of increases in CIC beyond the threshold on supplier new product performance would be amplified. Thus:

H3 Shared vision has a flattening effect on the inverted U-shaped relationship between CIC and supplier new product performance, such that the relationship becomes less positive for initial increases in CIC and less negative for subsequent increases beyond the threshold.

Moderating effect of social interactions

We propose that social interactions strengthen the inverted U-shaped relationship between CIC and the supplier's new product performance. High levels of social interactions increase the positive association between initial increases in CIC and new product performance. As CIC builds from low levels, it furnishes greater opportunities for effective exchanges of market knowledge between the partners. Still, these exchanges deal in tacit knowledge. Social interactions are an effective, if not the primary, means of exchanging tacit information on evolving market needs (Noorderhaven & Harzing, 2009). They include face-to-face connections that allow timely feedback as well as visual and nonverbal cues (Dyer & Chu, 2011). Indeed, by providing a basis for the exchange of contextual knowledge, social interactions help a supplier understand causal inferences, thereby facilitating more effective adaptation and incorporation of customer knowledge inputs (Morris et al., 2014). As such, while increasing CIC provides a framework for the exchange of knowledge resources, social interactions enable a supplier to benefit more from these by minimizing transmission losses in the exchange (Noorderhaven & Harzing, 2009). By contrast, low levels of social interactions limit the supplier's ability to acquire and understand tacit knowledge, reducing the effectiveness of growing levels of CIC (Cui & Wu, 2016). Even when CIC provides new opportunities for exchanges of knowledge, a supplier would not be capable of fully realizing these, to the detriment of new product performance.

However, high levels of social interactions increase the negative effect of intensified CIC on the supplier's new product performance, by taxing its ability to learn customer knowledge. Increases in CIC beyond the threshold create interdependencies and alignment requirements that, if not managed, can hamper interorganizational learning by generating dysfunctional conflict over the criticality of partners' knowledge inputs to the NPD project. While heightened CIC relies on continuous interactions and information exchanges between the supplier and its customer (Cui & Wu, 2017), these interactions are routinized and formal (Gupta & Govindarajan, 2000; Villena et al., 2011). In this context, social interactions that involve formal ties, but are inclusive of informal updates outside the due process and workarounds based on personal rapport, would cause confusion and tension over what is and what is not important for NPD. Therefore, social interactions can undermine formal efforts to manage intensive CIC-related interactions in a way that encourages task coordination misunderstandings and complexities that hinder interorganizational learning. By contrast, when social interactions are at a low level, a supplier can rely straightforwardly on the efficacy of formal mechanisms embedded in CIC to manage potential coordination complexities that are detrimental to interorganizational learning. This, in turn, weakens the negative effect of heightened CIC on new product performance. Thus:

H4 Social interactions has a steepening effect on the inverted U-shaped relationship between CIC and supplier new product performance, such that the relationship becomes more positive for initial increases in CIC and more negative for subsequent increases beyond the threshold.

Moderating effect of market experience

We posit that the supplier's market experience strengthens the inverted U-shaped association between CIC and the supplier's new product performance. A high level of supplier market experience is likely to enhance the performance relevance of initial increases in CIC. Under bounded rationality conditions, a supplier has limited capacity to acquire, make sense of, and deploy tacit environmental information (Georgallis et al., 2021). As the ability of suppliers to absorb and apply new knowledge from customers is a function of their experience and current knowledge (Argote & Miron-Spektor, 2011; Nerkar & Roberts, 2004), suppliers with firsthand market experiences would be better positioned to overcome learning constraints (Spyropoulou et al., 2018). Market experience offers a foundation for productive knowledge exchanges, increasing the supplier's alertness to the NPD implications of its customer's tacit knowledge inputs and enabling effective analysis and incorporation of acquired knowledge in the NPD project (Chetty et al., 2006). Without market experience and prior learning of social, economic, and other requirements of the marketplace, initial increases in CIC and associated knowledge exchanges are less likely to result in new products that meet market expectations (Spyropoulou et al., 2018). The supplier's lack of market-specific knowledge undermines interfirm knowledge exchanges, reducing opportunities for identifying promising ideas and incorporating customer knowledge in the NPD work (Choquette, 2019).

However, a high level of market experience reinforces the negative effect of heightened customer involvement on the supplier's new product performance. The accompanying information overload necessitates effective evaluation of the customer's knowledge inputs (Cui & Wu, 2016). Yet, given the rigidity of the supplier's mental models, high market experience negatively influences the supplier's ability to effectively filter a wide range of available ideas and knowledge (Ener, 2019). As the supplier's market experience increases, it integrates acquired knowledge about the market environment into its existing mental models, which in turn shapes its behavior toward new learning opportunities. These mental models (e.g., pertaining to target-market product needs and strategies for competitive advantage) become more rigid as past experiences accumulate (Assadinia et al., 2019). The rigidity of the supplier's mental model reduces its learning ability by not only hampering the effective filtering of large volumes of customer inputs stemming from intensive CIC but also clouding its judgment of new information. In contrast, a supplier with little market experience is less likely to dismiss meaningful customer knowledge for not aligning with mental model abstractions. The supplier would be better able to accommodate heightened CIC's continuous knowledge inputs from the customer and filter them, free from the constraints of experience-based knowledge (Ener, 2019), to the benefit of its new product performance. Thus:

H5 Market experience has a steepening effect on the inverted U-shaped relationship between CIC and supplier new product performance, such that the relationship becomes more positive for initial increases in CIC and more negative for subsequent increases beyond the threshold.

Methods

Sampling and data collection

The target population for our study is Chinese manufacturing firms that trade directly with foreign customers. This is a suitable empirical setting to assess the customer involvement–new product performance relationship for three reasons. First, China's manufacturing- and exporting-led economy has grown significantly since it joined the World Trade Organization in 2001. China's exports reached US$3.548 trillion in 2021, accounting for 12.1% of global exports (World Bank, 2022). As China is the largest international trade country, Chinese manufacturing firms' main customers are overseas. Second, latecomer firms from emerging markets face a liability of foreignness in international markets arising from a lack of local knowledge and experience (Murray et al., 2011). Chinese manufacturers require foreign business customer involvement in NPD to be successful in the markets they target worldwide. Third, as learning the particular requirements of international customers and deploying these to innovate are highly complex undertakings for Chinese firms, many manufacturers have chosen to establish and maintain formal innovation collaborations (i.e., co-development) with their business customers in foreign markets (Fu et al., 2022).

The unit of analysis in this study is the collaboration in the form of CIC for a new product project between a supplier and its international business customer. Given the lack of publicly available data on interfirm collaborations of Chinese firms with their international customers (Lukas et al., 2001), and in line with prior work on involvement (e.g., Morgan et al., 2018; Storey & Larbig, 2018; Zhang et al., 2015), we collected data using survey procedures. With the help of a leading China-based market research firm, we identified and developed our sampling frame of 900 senior managers (e.g., vice presidents, chief executive officers, managing directors). We used certain criteria to identify qualified supplier firms. First, the firms should be operating in the manufacturing sector. As such, we excluded firms operating in services industries. Manufacturers tend to have high innovation and NPD collaboration rates, enabling them to incorporate evolving market requirements (Pemartín et al., 2018). Second, the manufacturers should have overseas customers with whom they (1) have had ongoing business exchanges for a minimum period of three years, (2) do not have any affiliation (e.g., headquarters, sister subsidiaries, Chinese partners overseas), and (3) have been jointly involved (in terms of effort, time, and invested resources) in new product projects that had recently been completed. Here, we emphasized "completed" new product projects because of how we conceptualize and assess CIC and new product performance.[6]

To ensure variability, we asked a third of the targeted suppliers to focus on their interaction with a customer from North America, another third Western Europe, and the final third South-East Asia. The informants then randomly selected their first-, third-, or fifth-largest customer in the region, in terms of dollar value of sales, that had been involved in co-development in a NPD project linked to their country-market. Pre-study interviews with senior managers of Chinese manufacturing firms suggested that, in addition to discussions with a range of customers about new product conceptions and development, a large customer in the market would typically be involved in the co-development process.

To limit potential problems associated with common method bias and causal inference, we introduced a time lag between measurement of the predictor (i.e., customer involvement), moderators (i.e., social capital dimensions and market experience), and control variables and that of the criterion variable (i.e., new product performance) (Spyropoulou et al., 2018). In the absence of theoretical guidelines for the temporal separation needed for the effect of customer involvement on supplier new product performance, we followed Carbonell and Rodríguez Escudero (2019) and chose a six-month interval. The pre-study interviews confirmed the appropriateness of this time lag. At time 1 (t_1), we asked respondents to focus on a recently developed product that had been in the market for at least six months (Im et al., 2013) and to respond to questions pertaining to the predictor, moderators, and controls. After two reminders, we received 574 completed t_1 surveys, for a response rate of 63.77%. Six months later, at time 2 (t_2), we reminded the t_1 respondents of both the focal new product and the customer's market they selected to complete the t_1 questionnaire and asked them to complete a questionnaire pertaining to our new product performance criterion variable. After two reminders, we received 217 usable responses, for a response rate of 37.80% at t_2.

To reduce concerns about key informant competence, we captured respondents' knowledgeability (on a scale ranging from 1 = "not at all knowledgeable" to 7 = "very knowledgeable") of their firm's relationship with the identified customer, as well as their confidence in answering the questions (on a scale ranging from 1 = "not at all confident" to 7 = "very confident").

[6] Following previous studies (e.g., Cui & Wu, 2016), we consider CIC across the overall NPD effort, as reflected in items such as "This customer's involvement constituted a significant portion of the overall product development effort." In addition, accurately assessing market-based new product performance requires that a new product makes it, and is suitably exposed, to the marketplace. The fact of completion does not guarantee performance for the firms in our sample. The mean value for supplier new product performance is 4.645 (out of 7), with a standard deviation of 1.138.

Respondents scoring 4 or below on either question, in the t_1 or t_2 questionnaires, were eliminated (Katsikeas et al., 2009). The two-questionnaire means for the knowledgeability and confidence questions were 6.42 and 6.34, respectively.

We first developed an English version of the survey questionnaire and then employed a skilled linguist and native speaker to translate it into Mandarin. Next, we converted the Mandarin version back into English using another professional native-speaker translator, to ensure the original meanings were retained. Both translators were experts in the subject matter covered. We deployed the Mandarin version of the survey in our study.

In designing our survey, we followed recommended steps to minimize common method bias ex ante (Podsakoff et al., 2003). First, we followed a systematic approach in developing the survey instrument. For example, we adapted existing measures and confirmed the clarity of the scales and instructions in pre-study interviews with 12 top managers of Chinese manufacturing firms responsible for foreign customer relationships and with five academics with extensive knowledge of interfirm collaborations. These interviews also confirmed the appropriateness of using senior managers as key informants. The pre-study interviews served to inform our survey procedures, whereas the field interviews (Web Appendix A) helped deepen our knowledge on the topic. Second, although the nonlinear main effect, moderation effects, and deployment of the temporal separation made it extremely difficult for informants to predict links among the study constructs, we structured the questionnaire to avoid speculation. For example, when the anchors allowed, we placed items of different constructs together within general topic categories.

Measures

Our measures came from established scales. Appendix Table 5 lists the measurement items and scale anchors and values for item loading, average variance extracted (AVE), and composite reliability (CR). We adapted the five-item measure of *supplier new product performance* from Cui and Wu (2016) and Menguc et al. (2014). Here, managers indicated the extent to which the new product achieved certain objectives (e.g., return on investment, sales, market share) during the first year of its life in the customer's marketplace. Using perceptual measures to capture new product performance is acceptable, as studies addressing the subjective–objective data debate have found a high correlation between perceptual and objective performance measures (Boso et al., 2013; Dess & Robinson, 1984). Moreover, objective performance data are not widely available across markets, industries, and units of analysis (Morgan et al., 2018). Exceptions would likely involve a single-industry study (e.g., pharmaceuticals) in a developed market (e.g., United States) using a specific firm-level, market performance metric (e.g., sales). Thus, CIC work has used perceptual performance measures extensively to date (e.g., Cui & Wu, 2017; Morgan et al., 2018).

Our five-item measure of *CIC* came from Cui and Wu (2016). We adapted the seven-item measure for *trust* from Li et al. (2010) and Narayanan et al. (2015) and the five-item measure of *shared vision* from Tsai and Ghoshal (1998). The six-item measure of *social interactions* came from Carey et al. (2011) and Lavie et al. (2012). Following the international management literature (e.g., Gaur et al., 2018), we captured *market experience* as the natural logarithm of the number of years since the firm first exported to the customer's market (i.e., foreign-country experience) (Rickley, 2018).

We included several controls in this study as potential sources of heterogeneity. We measured *supplier size* as the number of employees, *supplier age* as the number of years since the supplier was established, and *number of markets* as the number of countries to which a firm is exporting. Firms that are larger and export to various markets may have more resources at their disposal for NPD, and established firms tend to be less innovative due to organizational inertia (Cui & Wu, 2016). We also controlled for *relationship age*, as exchange history is positively related to outcomes of interfirm collaborations (Li et al., 2010; Noordhoff et al., 2011). We capture relationship age as the number of years the supplier has been doing business with the identified customer. We controlled for *years left in contract* (on a scale ranging from 1 = "less than a year" to 7 = "there is no time limit"), as the fewer years left in contract, the less likely partners are to co-develop new products, thereby reducing the effectiveness of CIC. We also controlled for *supplier sales performance* (in tens of million CNY), as high-performing suppliers can account for the effect of CIC on new product performance. We included *supplier R&D expenditure* (approximate R&D expenditure in tens of million CNY) as it is associated with the ability to develop new products (Cui & Wu, 2017). Finally, given possible differences across different types of customers, we controlled for *customer type* (manufacturer or distributor) using a dummy variable. While manufacturer customers likely use the focal product in their own manufacturing, distributors mainly handle products for the general market.

We captured another set of controls using established items and assessed them on 7-point scales. We used measures from Lavie et al. (2012) to capture *joint innovation efforts*, as shared experiences through previous collaborations can influence the outcomes of the current collaboration (Hoang & Rothaermel, 2005). We captured *knowledge complexity* with a single item taken from Simonin (1999). When knowledge is highly complex, learning new knowledge is more difficult for a firm, thus increasing the challenge of developing new products. We tapped supplier *absorptive capacity* using Jansen et al.'s (2005) measure that captures the supplier's learning capability. Firms with greater absorptive capacity are more capable of incorporating external knowledge and, as such, could be better able to developing successful new products (Storey & Larbig, 2018). We controlled for *market uncertainty* and *technological turbulence*, captured with items adapted from De Luca and Atuahene-Gima (2007) and Jaworski and Kohli (1993), as they may make NPD more challenging (De Luca & Atuahene-Gima, 2007). To control for *supplier dependence* and *customer dependence*, we used Fang et al.'s (2008) scales. Prior work has demonstrated that power dynamics influence interfirm knowledge exchanges and, thus, new product performance (Fang, 2008).

We computed *cultural similarity* between the supplier's and customer's countries of origin in two steps. First, we measured cultural distance using Kogut and Singh's (1988) model based on Hofstede's (1980) four dimensions of culture (i.e., power distance, individualism, masculinity, and uncertainty avoidance). Second, we computed cultural similarity by subtracting cultural distance values from the theoretical maximum value for distance (i.e., 6) (Basuil & Datta, 2015). We controlled for cultural similarity because it boosts the effectiveness of interfirm collaborations by allowing better knowledge exchanges (Li et al., 2010). Finally, we controlled for *tenure* to capture any effect of work experience (i.e., number of years of experience in the focal supplier) on new product performance.

Measure validation

Examination of the distribution of our data reveals that the explanatory variables—namely, CIC, trust, shared vision, social interactions, and market experience—are nonnormally distributed. To validate our measures, we conducted robust confirmatory factor analyses using nonnormal estimators, including maximum likelihood robust, elliptical, and heterogeneous kurtosis estimation. These estimators consistently produced congruent results. Here, we focus on the outcomes derived from maximum likelihood robust estimation.

All items displayed high loadings—ranging from 0.62 to 0.87 (at $p=0.01$)—on their pre-identified constructs, after we removed one poorly performing item from trust (loading below 0.60). The goodness-of-fit indices suggest the measurement model fits our data well ($\chi^2_{(df=314)}=481.12$; RMSEA = 0.050 $_{(90\%CI=0.041;\ 0.058)}$; CFI = 0.98; IFI = 0.98; NNFI = 0.98; SRMR = 0.066). CRs for all the latent constructs exceed the 0.70 benchmark, indicating strong convergent validity. In addition, the AVE for each construct surpasses the 0.50 benchmark, with scores ranging from 0.51 to 0.69, further supporting convergent validity. All constructs exhibit strong discriminant validity. First, AVEs are larger than the corresponding squared inter-construct correlations. Second, pairwise chi-square difference tests confirm that the model with the *f* coefficient set as free performs significantly better than the model with *f* fixed at 1. Table 3 reports the descriptive statistics and correlations between all constructs.

Despite our efforts to minimize common method bias using procedural steps, such as the six-month temporal separation, we conducted a post hoc check for this bias in our data. We employed Lindell and Whitney's (2001) marker variable test, selecting the single item "How often do you use public transportation" as the marker variable (Sichtmann & Diamantopoulos, 2013). This variable is not theoretically related to our study variables, and its correlation with the dependent variable in our model is negligible ($r=0.012$). We constructed an adjusted correlation matrix, which confirmed that all unadjusted correlations maintained their size and pattern of significance, suggesting that method bias is unlikely to affect our results. In addition, the use of Gaussian copula terms, as discussed in the next section, further mitigates common method bias concerns (Sande & Ghosh, 2018).

Analysis and results

Model estimation

To examine our hypotheses, we estimated a series of regression models to account for potential sources of endogeneity bias. In our conceptualization, the exogenous regressor, CIC, may be influenced by our set of moderators: trust, shared vision, social interactions, and market experience. CIC may be an endogenous rather than a fully exogenous regressor. Thus, our hypotheses testing needs to partial out potential effects of these moderators on CIC. To do so, we used a three-stage residual-based approach, widely employed in interfirm partnerships research (e.g., Poppo et al., 2016), to correct for this bias. In the first step, we regressed CIC against our moderators to obtain predicted values for CIC, as follows:

$$\mathrm{CIC} = \beta_0 + \beta_1(\mathrm{Tr}) + \beta_2(\mathrm{SV}) + \beta_3(\mathrm{SI}) + \beta_4(\mathrm{ME}) + \zeta \qquad (1)$$

where Tr is trust, SV is shared vision, SI are social interactions, and ME is market experience.

As our explanatory variables are nonnormally distributed, we used STATA for all regression models and obtained *p*-values with 10,000 iterations of bootstrapping. The results showed that CIC is significantly related to trust ($\beta=0.357$, $p=0.000$), shared vision ($\beta=0.215$, $p=0.001$), social interactions ($\beta=0.231$, $p=0.000$), and market experience ($\beta=0.162$, $p=0.010$; adjusted $R^2=0.405$; $F=37.767$, $p=0.000$). These results confirm the positive relationship between the moderators and CIC, justifying the use of residual-based modeling to correct for this specific source of endogeneity bias. We then obtained residuals for CIC that are free from the influence of the moderators, using the equation:

$$\text{CIC}_{\text{residual}} = \text{CIC} - \text{CIC}_{\text{predicted}}. \tag{2}$$

In the final step, we regressed supplier new product performance against $\text{CIC}_{\text{residual}}$ and a vector of control variables. Furthermore, to explore the potential curvilinear effect of CIC on supplier new product performance and the moderating role of trust, shared vision, social interactions, and market experience, we included the quadratic term $\text{CIC}_{\text{residual}}{}^2$ and the moderators, along with all relevant interaction terms. To prevent collinearity, we mean-centered the variables before computing the interactions:

$$\begin{aligned} \text{SNPP} =& \beta 0 + \beta_1(\text{CIC}_{\text{residual}}) + \beta_2(\text{CIC}^2_{\text{residual}}) + \beta_3(\text{Tr}) \\ & + \beta_4(\text{SV}) + \beta_5(\text{SI}) + \beta_6(\text{ME}) + \\ & \gamma_1(\text{CIC}_{\text{residual}} \times \text{Tr}) + \gamma_2(\text{CIC}^2_{\text{residual}} \times \text{Tr}) + \\ & \gamma_3(\text{CIC}_{\text{residual}} \times \text{SV}) + \gamma_4(\text{CIC}^2_{\text{residual}} \times \text{SV}) + \\ & \gamma_5(\text{CIC}_{\text{residual}} \times \text{SI}) + \gamma_6(\text{CIC}^2_{\text{residual}} \times \text{SI}) + \\ & \gamma_7(\text{CIC}_{\text{residual}} \times \text{ME}) + \gamma_8(\text{CIC}^2_{\text{residual}} \times \text{ME}) \\ & + \beta_{\text{Controls}}(\text{Controls}), \end{aligned} \tag{3}$$

where SNPP is supplier new product performance.

Although the absence of common method bias, use of time-lagged data, inclusion of several controls, and use of a weighted average approach that accounts for measurement error all alleviate concerns about endogeneity bias (Ullah et al., 2018), our explanatory variables may be correlated with the error term of supplier new product performance, introducing an endogeneity problem. To address this potential bias, Park and Gupta (2012) recommend including Gaussian copulas—an instrument-free approach—to model correlations between potentially endogenous regressors and the regression error term. Therefore, we included $CIC_{\text{residual}}{}^* = \varphi^{-1}[H(CIC_{\text{residual}})]$, $Tr^* = \varphi^{-1}[H(Tr)]$, $SV^* = \varphi^{-1}[H(SV)]$, $SI^* = \varphi^{-1}[H(SI)]$, and $ME^* = \varphi^{-1}[H(ME)]$ as additional regressors in Eq. 3. Here, φ^{-1} represents the inverse of the cumulative distribution function, and H($\text{CIC}_{\text{residual}}$), H(Tr), H(SV), H(SI), and H(ME) represent the empirical cumulative distribution function of $\text{CIC}_{\text{residual}}$, Tr, SV, SI, and ME, respectively. We used the REndo package in R (Gui, 2019) to compute the Gaussian copulas of $\text{CIC}_{\text{residual}}$*, Tr*, SV*, SI*, and ME*. Significant copula coefficients would indicate endogeneity bias (for the nonsignificant results, see Table 4). No separate copula terms are required for interaction or quadratic terms (Papies et al., 2017).

Both Kolmogorov–Smirnov and Shapiro–Wilk tests confirmed the nonnormal distribution of our potential exogenous regressors, a prerequisite of using the Gaussian copulas approach. The full estimation model is as follows:

$$\begin{aligned} SNPP = & \beta 0 + \beta_1(CIC_{residual}) + \beta_2(CIC^2_{residual}) + \beta_3(Tr) + \beta_4(SV) + \beta_5(SI) + \beta_6(ME) \\ & + \gamma_1(CIC_{residual} \times Tr) + \gamma_2(CIC^2_{residual} \times Tr) \\ & + \gamma_3(CIC_{residual} \times SV) + \gamma_4(CIC^2_{residual} \times SV) \\ & + \gamma_5(CIC_{residual} \times SI) + \gamma_6(CIC^2_{residual} \times SI) \\ & + \gamma_7(CIC_{residual} \times ME) + \gamma_8(CIC^2_{residual} \times ME) + \beta_{Controls}(Controls) \\ & + \alpha_1(CIC^*_{residual}) + \alpha_2(Tr^*) + \alpha_3(SV^*) + \alpha_4(SI^*) + \alpha_5(ME^*) + \zeta. \end{aligned} \tag{4}$$

Hypotheses testing

In our STATA regression analyses, we followed the statistical composite approach and created an aggregate-level indicator for each construct using standardized item loadings as the weights. This approach considers reliability and measurement error, limiting the contribution of items with greater measurement error and smaller standardized loadings. We also standardized our data before model estimation. Model 1 in Table 4 provides regression estimations for the control variables. Model 2 presents the main-effect results using the residual-based approach. Model 3 reports the residual-based regression estimations for the full model from Eq. 3, and Model 4 reports the more robust, endogeneity-corrected estimations for the full model from Eq. 4. We use Model 2 to examine the main-effect hypothesis and Model 4 to test the moderation hypotheses. For each model, we also report (Table 4) the highest variance inflation factor (VIF) to verify that multicollinearity is not an issue in our regression analyses.

Main effects To test H1, which predicts an inverted U-shaped relationship between CIC and supplier new product performance, we first verified that the coefficient for the quadratic term $\text{CIC}_{\text{residual}}{}^2$ is negative (Model 2: $\beta_2 = -0.261$, $p = 0.000$; Model 4: $\beta_2 = -0.206$, $p = 0.005$). To validate the presence of an inverted U-shaped relationship in our data, we conducted two additional tests proposed by Lind and Mehlum (2010). First, using regression coefficients from Model 2, we confirmed a significantly positive slope at the low end (CIC_{Low}) of our data range ($\text{Slope}_{\text{Low}} = \beta_1 + 2 \times \beta_{2} \times \text{CIC}_{\text{Low}} = 2.338$, $p < 0.01$) and a significantly negative slope at the high end (CIC_{High}) of the range ($\text{Slope}_{\text{High}} = \beta_1 + 2 \times \beta_{2} \times \text{CIC}_{\text{High}} = -0.889$, $p < 0.01$). The unstandardized beta coefficients,

CIC_{Low}, and CIC_{High} values used to compute the slopes appear in Web Appendix C. Second, we verified that the turning point is located within our data range. This threshold occurs at $-\frac{\beta_1}{2\beta_2}$, where β_1 is for $CIC_{residual}$ and β_2 is for $CIC_{residual}^2$. Using the results of Model 2, we observe the turning point at 0.100 (equivalent to 5.707 on a 7-point scale). Therefore, we can confirm that the inverted U-shaped relationship is present in our data range, supporting H1 (Haans et al., 2016). Model 2 shows that trust is positively linked to new product performance ($\beta_3 = 0.182$, $p = 0.046$). However, the other organizational learning facets (shared vision, social interactions, and market experience) have no direct effects.

Interaction effects According to Haans et al. (2016), two theoretically distinct types of moderation effects could occur in an inverted U-shaped relationship. First, a moderator can flatten or steepen the curve, depending on whether the coefficient of the interaction of the moderator with the quadratic term is positive or negative, respectively. Our regression results presented in Model 4 of Table 4 indicate that the coefficient for the interaction of trust with the quadratic term $CIC_{residual}^2$ is negative ($\gamma_2 = -0.196$, $p = 0.006$), in line with H2. We thus observe that trust makes the inverted U-shaped relationship between CIC and supplier new product performance more pronounced. We find a positive interaction effect of shared vision and $CIC_{residual}^2$ on supplier new product performance ($\gamma_4 = 0.335$, $p = 0.000$), confirming H3 that shared vision flattens the inverted U-shaped relationship. However, we find no support for H4 ($\gamma_6 = -0.062$, $p = 0.532$), which predicts that social interactions flatten the inverted U-shaped relationship. As per our H5, which suggests market experience steepens the inverted U-shaped relationship, we find a negative interaction effect of market experience and $CIC_{residual}^2$ on new product performance ($\gamma_8 = -0.281$, $p = 0.002$).[7]

We validated the nonsignificant result for H4 by using G*Power to compute the statistical power of our regression. Our full model with 40 explanatory variables, a sample size of 217, and a Type I error probability of 0.05 achieved a power of 0.999 (1 – β error probability), sufficient to safely reject the null hypothesis.

[7] Our conceptualization of market experience as the number of years in the customer's market was informed by Argote and Miron-Spektor's (2011) notion of task-specific experience. Nonetheless, given the complexity of market experience as a construct, we used alternative measures to check the robustness of our findings. We included "international experience diversity" (based on our control variable, number of markets; Rickley, 2018) and "export intensity" (composite metric involving the ratio of export sales to total sales; Gaur et al., 2018). Although the three approaches offer distinct ways of gauging supplier market experience, our regression results remained consistent across them (see Web Appendix D).

Another way a moderator can affect the inverted U-shaped relationship is to shift the turning point of the curve. Such an effect does not depend on whether the corresponding interaction term in the regression model is significant. To examine the shift in the turning point, we followed Haans et al.'s (2016) procedure. We derived the turning point for each of our moderators separately by taking the first derivative of Eq. 4 with respect to each moderator and setting it to zero. For example, taking the first derivative of Eq. 4 with respect to trust and setting it to zero yields

$$Tr' = \frac{-\beta_1 - \gamma_1 \times Tr}{2\beta_2 + 2\gamma_2 \times Tr}. \quad (5)$$

As the turning point Tr' in Eq. 5 depends on the moderator trust, we took its derivative to determine how the turning point shifts as the level of trust changes:

$$\frac{\partial\, Tr'}{\partial\, Tr} = \frac{\beta_1 \times \gamma_2 - \beta_2 \times \gamma_1}{2\left(\beta_2 + \gamma_2 \times Tr\right)^2}. \quad (6)$$

As the denominator in Eq. 6 can only be positive, the direction of the shift in the turning point depends solely on the sign of the numerator. A positive value of the numerator suggests a shift to the right and a negative value a shift to the left. For our data, we computed the value of the numerator in Eq. 6 for each of our moderators separately to identify the direction of the shift. In addition, to examine whether the shift in the turning point is significant, we used the nlcom command in STATA for low versus high values of each moderator in our model. As Web Appendix E reports, in all four cases, the results are not significant, suggesting that the shift in the turning point is negligible.

Figure 2 plots our significant moderation findings. Panel A discloses how trust steepens the inverted U-shaped relationship between CIC and supplier new product performance. Panel B demonstrates how shared vision flattens, and Panel C illustrates how market experience steepens the inverted U-shaped relationship.

Additional analyses

As part of our post hoc analyses, we focused on the nonsignificant association of social interactions with the inverted U-shaped link between CIC and new product performance. We sought to gain deeper insight into this finding by considering market experience a potential factor that could influence this moderating effect. A more fine-grained view of the role of social interactions in shaping the link between CIC and supplier new product performance would take into account the extent of the supplier's market experience. Organizational learning theory suggests that experience's interaction with context enhances an

Table 3 Descriptive statistics and correlations

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Supplier new product performance	**0.831**													
2. CIC	0.341**	**0.714**												
3. Trust	0.259**	0.578**	**0.762**											
4. Shared vision	0.129	0.485**	0.580**	**0.775**										
5. Social interactions	0.287**	0.447**	0.425**	0.297**	**0.794**									
6. Market experience	-0.003	0.063	0.106	0.120	0.058	**NA**								
7. Supplier size	0.074	-0.122	-0.064	-0.054	-0.044	0.185**	**NA**							
8. Supplier age	-0.067	-0.019	0.081	0.141*	0.033	0.636**	0.132	**NA**						
9. Number of markets	0.101	-0.006	-0.001	-0.003	0.088	0.280**	0.099	0.158*	**NA**					
10. Relationship age	-0.042	0.034	-0.026	-0.092	0.006	0.478**	0.140*	0.216**	0.125	**NA**				
11. Years left in contract	0.012	0.199**	0.160*	0.097	-0.063	0.199**	-0.139*	0.038	0.022	0.252**	**NA**			
12. Supplier sales performance	0.049	-0.007	0.032	-0.025	0.049	0.272**	0.320**	0.253**	-0.007	0.222**	-0.085	**NA**		
13. Supplier R&D expenditure	0.161*	-0.124	0.113	-0.018	0.119	0.024	0.088	0.108	0.027	-0.026	-0.062	0.003	**NA**	
14. Customer type (manufacturer)	-0.018	0.031	-0.052	-0.171*	-0.072	-0.018	-0.003	-0.031	-0.087	0.149*	-0.007	0.016	0.039	**NA**
15. Joint innovation efforts	0.266**	0.483**	0.408**	0.279**	0.377**	0.072	-0.036	-0.063	0.021	0.143*	0.208**	-0.037	0.021	0.057
16. Knowledge complexity	0.137*	0.472**	0.454**	0.430**	0.327**	0.105	-0.042	0.042	0.053	-0.093	0.153*	-0.039	-0.023	-0.106
17. Supplier absorptive capacity	0.196*	0.573**	0.568**	0.593**	0.308**	0.060	-0.104	0.026	-0.031	-0.103	0.112	-0.033	0.002	-0.062
18. Market uncertainty	0.256**	0.413**	0.432**	0.267**	0.445**	0.124	-0.039	0.043	0.042	0.030	0.027	0.097	0.098	0.018
19. Technological turbulence	0.279**	0.328**	0.443**	0.232**	0.487**	-0.003	0.077	-0.021	0.055	0.018	0.011	0.077	0.210**	-0.115
20. Supplier dependence	0.252**	0.189**	0.073	-0.068	0.332**	-0.061	0.017	-0.054	0.072	0.094	0.117	-0.148*	0.065	-0.066
21. Customer dependence	0.209**	0.199**	0.274**	0.000	0.348**	0.102	0.127	-0.068	0.102	0.059	0.122	0.038	0.165*	0.017
22. Cultural similarity	-0.049	-0.118	-0.117	-0.046	0.003	-0.047	0.065	0.015	-0.029	-0.050	0.003	-0.074	-0.051	0.110
23. Tenure	0.104	0.146*	0.167*	0.130	0.014	0.337**	0.010	0.414**	0.107	0.190**	0.283**	0.019	-0.056	0.012
24. Marker variable	0.012	0.051	0.069	0.073	0.025	0.048	0.074	0.007	-0.017	0.119	-0.028	0.157*	-0.038	-0.037
M	4.645	5.607	5.515	5.542	4.629	9.320	269.445	17.630	5.783	6.090	2.930	50.020	3.350	0.498
SD	1.138	0.774	0.722	0.895	1.088	5.254	139.994	9.734	3.443	4.086	1.362	17.480	1.220	0.501
	15	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**				
15. Joint innovation efforts	**NA**													
16. Knowledge complexity	0.311**	**NA**												
17. Supplier absorptive capacity	0.408**	0.463**	**NA**											
18. Market uncertainty	0.367**	0.385**	0.416**	**NA**										
19. Technological turbulence	0.342**	0.339**	0.323**	0.590**	**NA**									
20. Supplier dependence	0.254**	0.142*	-0.118	0.168*	0.284**	**NA**								
21. Customer dependence	0.268**	0.207**	0.017	0.263**	0.281**	0.479**	**NA**							
22. Cultural similarity	-0.083	-0.056	-0.143*	0.013	-0.042	-0.006	0.065	**NA**						
23. Tenure	-0.001	0.096	0.040	0.027	-0.031	0.035	-0.054	0.046	**NA**					
24. Marker variable	-0.001	0.015	0.057	-0.073	-0.071	-0.100	-0.088	-0.088	0.004	**NA**				
M	5.550	5.440	5.788	5.283	4.995	3.740	4.460	5.390	8.340	5.870				
SD	0.942	0.937	0.791	0.948	0.761	1.560	1.459	1.092	4.394	1.001				

$n = 217$; numbers in bold on the diagonal are the square root of the AVE. $^{**}p < 0.01$, $^{*}p < 0.05$

Table 4 Regression results

	Model 1 Controls β (SE) *p*-Value	Model 2 Main-effect model (Residual-based) β (SE) *p*-Value	Model 3 Full model (Residual-based) β (SE) *p*-Value	Model 4 Full model (Endogeneity corrected) β (SE) *p*-Value	Model 5 Additional Analysis (ME × SI × $CIC^2_{residual}$) β (SE) *p*-Value
Predictors					
$CIC_{residual}$		0.153 (0.144) *0.018*	0.112 (0.144) *0.081*	0.115 (0.148) *0.083*	0.086 (0.147) *0.189*
$CIC^2_{residual}$		-0.261 (0.149) *0.000*	-0.200 (0.157) *0.005*	-0.206 (0.161) *0.005*	-0.207 (0.157) *0.004*
Tr		0.182 (0.143) *0.046*	0.193 (0.135) *0.025*	0.209 (0.143) *0.022*	0.195 (0.141) *0.030*
SV		-0.087 (0.106) *0.298*	-0.303 (0.132) *0.004*	-0.284 (0.139) *0.010*	-0.299 (0.137) *0.006*
SI		0.014 (0.083) *0.856*	0.038 (0.094) *0.669*	0.044 (0.095) *0.628*	0.045 (0.095) *0.624*
ME		0.025 (0.109) *0.793*	0.128 (0.108) *0.179*	0.104 (0.112) *0.295*	0.037 (0.116) *0.716*
Interactions					
Tr × $CIC_{residual}$			0.045 (0.228) *0.602*	0.049 (0.241) *0.578*	0.030 (0.238) *0.733*
Tr × $CIC^2_{residual}$			-0.196 (0.174) *0.005*	-0.196 (0.178) *0.006*	-0.194 (0.176) *0.006*
SV × $CIC_{residual}$			0.060 (0.183) *0.453*	0.058 (0.186) *0.476*	0.001 (0.186) *0.985*
SV × $CIC^2_{residual}$			0.343 (0.222) *0.000*	0.335 (0.228) *0.000*	0.276 (0.266) *0.013*
SI × $CIC_{residual}$			-0.073 (0.130) *0.287*	-0.079 (0.132) *0.259*	-0.044 (0.131) *0.530*
SI × $CIC^2_{residual}$			-0.077 (0.173) *0.425*	-0.062 (0.178) *0.532*	-0.036 (0.206) *0.759*
ME × $CIC_{residual}$			-0.007 (0.166) *0.913*	-0.009 (0.170) *0.896*	-0.006 (0.185) *0.941*
ME × $CIC^2_{residual}$			-0.302 (0.223) *0.000*	-0.281 (0.229) *0.002*	-0.239 (0.239) *0.012*
ME × SI					-0.111 (0.086) *0.215*
ME × SI × $CIC_{residual}$					-0.273 (0.178) *0.006*
ME × SI × $CIC^2_{residual}$					-0.100 (0.271) *0.499*
Gaussian copulas					
CIC*				-0.009 (0.068) *0.906*	0.009 (0.066) *0.895*
Tr*				-0.012 (0.085) *0.863*	-0.018 (0.083) *0.801*
SV*				0.005 (0.091) *0.954*	0.038 (0.091) *0.639*
SI*				-0.077 (0.087) *0.299*	-0.065 (0.086) *0.379*
ME*				-0.055 (0.086) *0.450*	-0.043 (0.084) *0.537*
Control variables					
Supplier size	0.048 (0.000) *0.493*	0.058 (0.000) *0.384*	0.013 (0.000) *0.838*	0.013 (0.000) *0.842*	-0.004 (0.000) *0.944*
Supplier age	-0.190 (0.009) *0.012*	-0.184 (0.010) *0.034*	-0.151 (0.009) *0.065*	-0.139 (0.010) *0.097*	-0.161 (0.010) *0.057*
Number of markets	0.085 (0.074) *0.192*	0.104 (0.071) *0.097*	0.059 (0.068) *0.322*	0.062 (0.069) *0.308*	0.088 (0.069) *0.144*
Relationship age	-0.005 (0.020) *0.944*	-0.026 (0.021) *0.730*	-0.014 (0.020) *0.842*	-0.024 (0.020) *0.739*	0.012 (0.020) *0.871*
Years left in contract	-0.078 (0.060) *0.274*	-0.071 (0.058) *0.309*	-0.017 (0.055) *0.799*	-0.016 (0.056) *0.814*	-0.038 (0.054) *0.558*
Supplier sales performance	0.093 (0.048) *0.207*	0.091 (0.045) *0.190*	0.071 (0.043) *0.281*	0.078 (0.043) *0.243*	0.072 (0.043) *0.270*
Supplier R&D expenditure	0.139 (0.062) *0.039*	0.139 (0.059) *0.030*	0.132 (0.056) *0.031*	0.133 (0.057) *0.031*	0.116 (0.056) *0.057*
Customer type (manufacturer)	-0.008 (0.150) *0.907*	-0.052 (0.144) *0.418*	-0.050 (0.137) *0.409*	-0.054 (0.139) *0.383*	-0.063 (0.137) *0.295*
Joint innovation efforts	0.117 (0.094) *0.133*	0.119 (0.089) *0.111*	0.149 (0.083) *0.033*	0.156 (0.088) *0.034*	0.147 (0.086) *0.040*
Knowledge complexity	-0.051 (0.093) *0.504*	-0.048 (0.090) *0.518*	-0.020 (0.085) *0.776*	-0.030 (0.089) *0.685*	-0.019 (0.087) *0.795*
Supplier absorptive capacity	0.153 (0.121) *0.071*	0.135 (0.131) *0.140*	0.181 (0.126) *0.040*	0.215 (0.137) *0.025*	0.205 (0.135) *0.030*
Market uncertainty	0.079 (0.103) *0.359*	0.089 (0.099) *0.283*	0.110 (0.095) *0.165*	0.125 (0.097) *0.123*	0.104 (0.095) *0.193*
Technological turbulence	0.055 (0.128) *0.519*	-0.012 (0.125) *0.883*	-0.012 (0.118) *0.880*	-0.006 (0.120) *0.944*	0.018 (0.118) *0.824*
Supplier dependence	0.199 (0.058) *0.013*	0.191 (0.057) *0.016*	0.124 (0.054) *0.093*	0.100 (0.057) *0.202*	0.079 (0.056) *0.307*
Customer dependence	0.024 (0.060) *0.753*	-0.037 (0.060) *0.630*	0.036 (0.058) *0.624*	0.067 (0.061) *0.394*	0.057 (0.060) *0.465*
Cultural similarity	-0.038 (0.059) *0.563*	0.009 (0.057) *0.891*	-0.013 (0.055) *0.826*	-0.019 (0.056) *0.761*	0.004 (0.055) *0.954*

Table 4 (continued)

	Model 1 Controls β (SE) *p*-Value	Model 2 Main-effect model (Residual-based) β (SE) *p*-Value	Model 3 Full model (Residual-based) β (SE) *p*-Value	Model 4 Full model (Endogeneity corrected) β (SE) *p*-Value	Model 5 Additional Analysis ($ME \times SI \times CIC^2_{residual}$) β (SE) *p*-Value
Firm tenure	0.197 (0.019) *0.008*	0.141 (0.018) *0.048*	0.164 (0.017) *0.015*	0.160 (0.018) *0.019*	0.184 (0.017) *0.006*
Marker variable	0.019 (0.000) *0.768*	-0.007 (0.000) *0.907*	0.009 (0.000) *0.874*	0.018 (0.000) *0.756*	0.010 (0.000) *0.863*
F	3.095 *0.000*	4.040 *0.000*	4.965 *0.000*	4.281 *0.000*	4.488 *0.000*
Adjusted R^2	0.149	0.253	0.370	0.360	0.392
Highest VIF	1.877	2.657	3.097	3.285	3.665

ME: market experience; SI: social interactions; SV: shared vision; Tr: trust; $n = 217$; two-tailed tests

organization's ability to innovate and create knowledge (Argote & Miron-Spektor, 2011).

To examine the three-way interaction effect of market experience and social interactions on the inverted U-shaped relationship, we added three new terms to Eq. 4: ME × SI, $ME \times SI \times CIC_{residual}$, and $ME \times SI \times CIC_{residual}{}^2$. The results (see Model 5 of Table 4) lend no support for the quadratic three-way interaction effect of $ME \times SI \times CIC_{residual}{}^2$ ($\beta = -0.100$, $p = 0.499$), but they do reveal that $ME \times SI \times CIC_{residual}$ is significant ($\beta = -0.273$, $p = 0.006$). This result suggests high (low) levels of market experience compensate for low (high) levels of social interactions and that, under these circumstances, increases in CIC benefit supplier new product performance. We find a substitution effect rather than the expected reinforcing view of experience's interaction with context.

Panel D of Fig. 2 plots the three-way interaction effect of market experience and social interactions on the inverted U-shaped relationship between customer involvement and new product performance. Specifically, for the moderating role of social interactions, this panel suggests that in the absence of market experience, suppliers that are highly engaged in social interactions with their customers obtain performance benefits from higher CIC. Under a low level of market experience coupled with a low level of social interactions, however, the involvement of the customer in NPD practices has a detrimental effect on supplier new product performance.

We also tested the possibility of an alternative, mediating mechanism. The main-effects analysis revealed that trust is positively linked to new product performance ($\beta_3 = 0.182$, $p = 0.046$; Model 2 in Table 4). As the trust literature tends to frame the construct as a mediator, we investigated such a role for trust in our quadratic CIC–supplier new product performance relationship. To do so, we used a two-step process.

Step 1: For CIC to be associated with new product performance through trust, CIC must first be associated with trust. Thus, we constructed a model to assess this effect:

$$\begin{aligned} \text{Trust} = \beta 0 + \beta_1\left(\text{CIC}_{\text{residual}}\right) + \beta_2\left(\text{CIC}^2_{\text{residual}}\right) \\ + \alpha_1\left(\text{CIC}^*_{\text{residual}}\right) + \beta_{\text{Controls}}(\text{Controls}) + \zeta. \end{aligned} \tag{7}$$

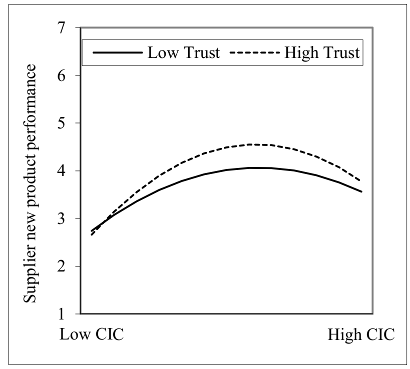
Step 2: To verify whether trust can affect new product performance, we formulated a model of the association between trust and new product performance as follows:

$$\begin{aligned} SNPP = \beta 0 + \beta_1\left(CIC_{residual}\right) + \beta_2\left(CIC^2_{residual}\right) \\ + \beta_3(Trust) + \alpha_1\left(CIC^*_{residual}\right) + \alpha_2(Trust^*) \\ + \beta_{Controls}(Controls) + \zeta. \end{aligned} \tag{8}$$

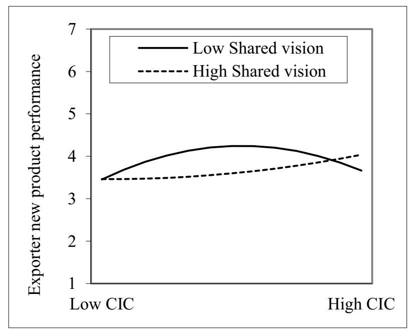
The results fail to establish the link from $CIC_{residual}{}^2$ to trust in step 1 ($\beta_2 = -0.054$, $p = 0.342$; Model 1 in Web Appendix F). In step 2, $CIC_{residual}{}^2$ enhances supplier new product performance (i.e., confirming the inverted U-shaped relationship), but the trust coefficient is not significant ($\beta_3 = 0.115$, $p = 0.212$; Model 2 in Web Appendix F). Collectively, these findings rule out trust as a mediator in our model.

Furthermore, the relative absence of poor performance cases (or the presence of possible survival bias) in our sample may undermine the generalizability of our findings (see Bello et al., 2010). We assess potential biasing influences of survival bias in our study sample in two ways. First, following the procedure recommended by Bello et al. (2010), we performed a jackknife analysis on a subset of our data that excluded the top-performing cases (i.e., 20 with scores of 6 or above). Doing so reduced the mean for new product performance from 4.645 to 4.143. The results remained consistent; CIC maintained an inverted U-shaped relationship to supplier new product performance as the coefficient for $CIC_{residual}{}^2$ was negative ($\beta = -0.186$, $p = 0.007$) and comparable to the coefficient estimated from the full sample size ($\beta = -0.261$, $p = 0.000$). We also ran an analysis excluding the 15 cases with a score of 2 or below from our data and observed consistent results ($\beta = -0.156$, $p = 0.041$). The persistence of a negative coefficient for $CIC_{residual}{}^2$ implies a similarity in the relationship between CIC and performance across both successful and unsuccessful cases.

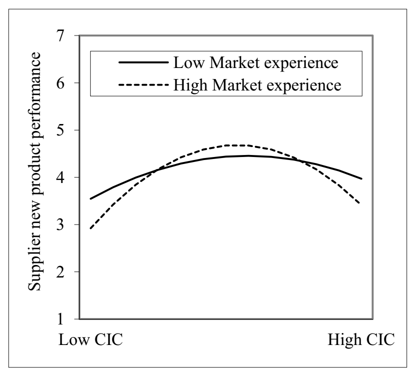
Fig. 2 Plot of moderation findings



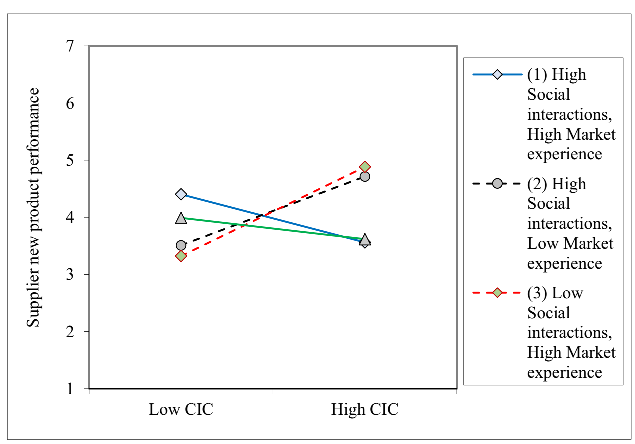
A. CIC and trust with supplier new product performance



B. CIC and shared vision with supplier new product performance



C. CIC and market experience with supplier new product performance



D. CIC, shared vision, and market experience with supplier new product performance

Second, we attempted to identify and collect new data on failed projects, namely, products that were discontinued due to poor performance outcomes in the focal customer market over the last one and half years (Bello et al., 2010). After considerable effort, we managed to obtain such additional data on 22 discontinued NPD collaboration cases, which provided a good reflection of low performance as these products performed so poorly in the customer's market that the supplier deleted them from their portfolio. The addition of these failed cases to our dataset (combined sample of 239 cases) resulted in a reduction of the overall mean score for new product performance from 4.645 to 4.310. Again, no material change was observed in the direction and significance of the links examined; importantly, the coefficient for $CIC_{residual}^2$ remained negative ($\beta = -0.180$, $p = 0.027$) and all moderating effects hold. In sum, collectively the evidence provided here indicates that survival bias does not seem to be an issue of major concern in our sample exchange relationships, thus enhancing confidence in the external validity of the study findings.

Discussion

This study develops a model to explain how and under what conditions CIC influences supplier new product performance. We found an inverted U-shaped association between CIC and new product performance, indicating that initial increases in CIC improve performance and that subsequent increases in CIC beyond a threshold cause reduced performance. We also examined whether supplier social capital dimensions and market experience moderate the outcome of CIC. The results show that, while social interactions have no effect, trust and market experience negatively and shared vision positively moderate the CIC–new product performance link. These findings are practically important. Although our field interviews (Web Appendix A) revealed managers' views on the bright and dark sides of CIC, they also showed that the managers lacked clear awareness that the moderators work differently from one another and at different levels of CIC.

Theoretical contributions

Our results make three main contributions to the marketing literature. First, our study demonstrates the relevance of organizational learning theory (Argote & Miron-Spektor, 2011) by unpacking the complexities of co-developer activities that can lead to unexploited learning opportunities. We provide new evidence that CIC enhances performance up to a certain level, beyond which the associated costs outweigh the benefits, leading to reduced performance. This inverted U-shaped relationship is important theoretically as it offers a plausible explanation for the contradictory findings in research on the market-based performance outcomes of CIC. Although the NPD literature (e.g., Storey & Larbig, 2018) suggests that CIC is a primary mechanism for learning that can enhance a supplier's performance, most studies use theory in a way that overemphasizes the linearity of the association (Morgan et al., 2018; Smets et al., 2013). By juxtaposing the potential benefits of and risks to the learning environment of collaborative innovation, in a nonlinear association with market-based outcomes (Nordman & Tolstoy, 2016), we challenge the linear view and unpack when and how CIC actually influences the supplier's new product performance.

Second, our findings extend learning theory by not only showing that social capital, as the social context mechanism of learning theory (Argote & Miron-Spektor, 2011), conditions the outcomes of CIC but also providing novel evidence of heterogeneity in the effectiveness of different dimensions of social capital in shaping the success of CIC. Considering the nonlinear link between CIC and supplier new product performance, we argue that any discussion on which dimensions of social capital are most important for the success of CIC should also consider the level of such involvement. Nevertheless, prior research on CIC and co-development alliances (e.g., Kale et al., 2000; Yeniyurt et al., 2014) has focused on either the positive or negative consequences of social capital, without examining the nexus between the level of interfirm collaboration and different dimensions of social capital.

Our findings indicate that, in interacting with CIC, trust constitutes a double-edged sword. It is beneficial as a moderator for initial increases in CIC from low levels, where it increases the supplier's willingness to proactively leverage interfirm knowledge exchanges. But, as CIC increases beyond the threshold, trust becomes detrimental as it discourages the supplier from facing up to the challenges of coordinating NPD tasks with its customer. We add to recent debates about the negative consequences of misplaced trust (Forkmann et al., 2022; Krishnan et al., 2016) by unveiling that the need to protect a trusting bond with its highly involved customer can discourage the supplier from solving NPD coordination issues. We also find that trust contributes directly to new product performance. This finding aligns with prior work that lends credence to the direct benefits of trust in enhancing suppliers' innovativeness (e.g., Carey et al., 2011). In trusting relationships, a customer is less protective of its knowledge and expertise, and a supplier is more receptive to acquiring external resources necessary for developing successful products. Still, research has also argued that positive effects of trust are contingent on other factors (Chen et al., 2013).

Our findings also offer evidence of both the bright and dark sides of the cognitive dimension of social capital. Shared vision helps the supplier manage the negative performance effect of intensified CIC beyond the threshold. A common understanding of priorities facilitates interorganizational learning by suppressing the difficulties of coordinating interdependent activities under heightened CIC. Yet shared vision is detrimental to initial increases in CIC, as a customer can take the common understanding of key facets of the new product to self-edit any nonconforming ideas with significant potential. This finding casts doubt on the efficacy of vision similarity and reinforces the importance of considering the nature of the task when examining the effects of the cognitive dimension (Tang & Marinova, 2020; Villena et al., 2011).

Contrary to the findings of Mahr et al. (2014) on the knowledge outcomes of general closeness in customer–firm ties, our findings do not support the moderating role of social interactions in the CIC–supplier new product performance relationship. Thus, we might assume that for initial increases in CIC, regular social interactions are inherently part of the project work and furnish sufficient tacit knowledge (Cui & Wu, 2017). When CIC increases beyond a threshold, social interactions—which give rise to opportunities for informal connections—could act in a way that does not undermine the formality of CIC tasks or exacerbate the complexities of coordination (Cui & Wu, 2017). Nonetheless, before firm conclusions can be made about the role of social interactions, further research is necessary to investigate whether and/or to what extent the interplay between CIC and social interactions shapes new product performance outcomes.

Third, this study contributes to theory by providing evidence that the performance relevance of CIC is also conditioned by the task experience component of organizational learning (i.e., supplier market experience) (Argote & Miron-Spektor, 2011). Prima facie, the supplier's extraction of tacit knowledge in experiences with external actors in the customer's marketplace should help its CIC-related learning (Madhavan & Grover, 1998). However, we show that market experience is not inherently a good or bad mechanism for optimizing the outcomes of co-development activities; rather, it can generate bright- or dark-side effects depending on the level of CIC. As CIC increases from low levels, market experience brings real insight and expertise to the NPD implications of customer knowledge inputs. But when CIC increases beyond the threshold, market experience is less effective, as the increased rigidity of the supplier's mental models can dampen its ability to discern ideas with market potential when sifting through the customer's wide range of transferred knowledge. Our findings also contribute to work on co-development alliances (Hoang & Rothaermel, 2005) by showing that the experience aspect of organizational learning is not limited to shared experiences through previous collaborations, but also extends to market experiences.

Finally, research on CIC has yet to consider how experience and context work together as the two main components of learning (Clark et al., 2018). Do they reinforce or substitute for each other in the case of CIC's performance relevance? Organizational learning theory suggests that the interaction between task experience of different types (direct or indirect, deep or diverse) and context (the firm's social network) enhances creativity and improves the ability to innovate (Argote & Miron-Spektor, 2011). In our study, this reinforcing view could imply that the experience of being present in the customer's marketplace enables the supplier to engage in productive social interactions with the customer that can make its involvement more effective. Against this backdrop, our finding of a negative interaction of market experience with social interaction is surprising. We demonstrate empirically, for the first time, a substitution relationship between market experience and social interactions in increasing the detrimental effects of excessive CIC (cf., Morgan et al., 2018). Thus, our study underscores the need for CIC work to extend theorizing from examining firm- and relationship-level boundary conditions separately to considering the effects of these parameters in concert.

Implications for practice

Be aware of potential drawbacks of intensified CIC in NPD Practitioners should carefully evaluate the net benefits of CIC in downstream channel relationships. As the advantages of customer collaboration in NPD increase, its potential disadvantages may also increase. When the level of CIC increases and passes a certain threshold, the supplier should be cautious of impediments to interorganizational learning in the form of NPD coordination complexities and information overload. These drawbacks deplete resources required for learning, hinder concept transformation, and reduce innovation performance (Hoyer et al., 2010; Stock et al., 2017; Storey & Larbig, 2018). As such, instead of following a "more-the-better" logic for involving business customers in NPD, suppliers should assess the effectiveness of such arrangements to anticipate and minimize undesirable outcomes. They should consider establishing an optimum level of CIC to ensure that co-developer activities never reach a turning point, which sits just above the construct mean in our study.

Use interfirm relationship dimensions with attention to social capital type and level of CIC (initial increases in CIC and subsequent increases beyond the threshold) The characteristics of supplier–customer relationships have important implications for the effectiveness of CIC activities. Specifically, managers should understand the differential effects of alternative social capital dimensions in enhancing or impeding the performance relevance of CIC. Our study finds positive effects of trust and negative effects of shared vision for initial increases in CIC and positive effects of shared vision and negative effects of trust for subsequent increases in CIC beyond the threshold. Thus, managers should consider the level of CIC when relying on different dimensions of interfirm relations, as not doing so may turn these interfirm resources into liabilities.

Do not bet overly on market experience for subsequent increases in CIC beyond the threshold Our findings indicate that market experience can improve the new product performance outcomes of CIC. Still, as the level of CIC increases, the positive role of market experience diminishes and can even strengthen the negative effect of intensified CIC. Consequently, managers should be cautious in relying blindly on experience. Suppliers can safely use market experience to identify promising customer knowledge inputs during initial increases in CIC. For heightened CIC, however, market experience may undermine efforts to accurately filter the extensive transferred knowledge. Suppliers should deploy other mechanisms, notably shared vision, to optimally identify and incorporate customers' promising inputs from among all those transferred.

Rely on market experience to make up for the lack of social interactions Our analyses show that social interactions lack a two-way moderating effect on the relationship between CIC and supplier new product performance. Still, managers should realize that market experience and social interactions have a substitutional effect, such that higher levels of social interactions make up for a lack of market experience, and vice versa. Suppliers that lack market experience but engage in social interactions with their customers can obtain performance benefits from high levels of CIC. A strategy for firms that have accumulated sufficient market experiences would be to reduce social interactions with business customers, which can be costly to organize, stage, and sustain (Noorderhaven & Harzing, 2009; Villena et al., 2011). As the supplier accrues market experiences, it can reduce the intensity from its social interactions. Managers should also be cognizant of the less favorable CIC–new product performance link when market experience and social interactions are at low or high levels. In the case of low–low, the CIC and learning strategy would lack the value-enhancing benefits of task experience or active social routines. The high–high combination appears to lend itself to conditions that can lead to what is termed "superstitious learning," or improper lessons that a firm can learn from accumulated experience (Levitt & March, 1988).

Limitations and future research directions

The limitations of our study offer several avenues for future research. First, we focus on organizational learning theory and the intersection between task experience and social context to explain the conditions under which CIC in NPD processes can improve new product performance. It would be enlightening to also consider the performance implications of involving customers in NPD from a behavioral perspective. For example, future studies might examine how a motivation–opportunity–ability (MacInnis et al., 1991) framing of channel members would shape pre- and post-CIC activities in NPD.

Second, our study does not disentangle the association between CIC and supplier new product performance for different stages of NPD. Future studies could examine the effects of CIC at various stages, such as idea generation, planning, prototyping, product development, and commercialization. Indeed, a research question that requires further investigation is how CIC interacts with different aspects of social capital at early versus late stages of NPD.

Third, our study conceptualized CIC as involvement that constitutes a substantial portion of the overall product development effort. As a result, we focus on CIC efforts that resulted in completed NPD projects and whether they were successful or not in the market. Future studies could assess the outcomes of less active and more partial customer involvement, in which customers contribute to some stages of NPD projects that may or may not lead to completion.

Fourth, our study captures the supplier's view on CIC and its association with new product performance. A fruitful avenue for future work on CIC would be to incorporate and compare the views of both the supplier and customer. Doing so may improve understanding of alternative ways of increasing the benefits and decreasing the risks of CIC activities. Fifth, our study focuses only on the consequences of CIC in the manufacturing sector, which may limit the generalizability of our findings. Future studies could examine whether and how the dynamics of CIC shape new product performance across manufacturing and service sectors. Finally, it is important to examine whether other factors mediate the link between CIC and new product performance. Examining mediation effects might shed additional light on why some studies did not find CIC to be a driver of performance.

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Data availability The data is available upon request to the corresponding author

Declarations

Ethical approval ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee, University of Leeds. Ethics reference: AREA 16-048.

Competing interests Not Applicable.

Conflict of interest The authors have no conflicts of interest to declare that are relevant to this article.

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