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The Effect of Social Capital on Different Innovations Under the Pandemic in Chinese Manufacturing Supply Chains: A Literature Review

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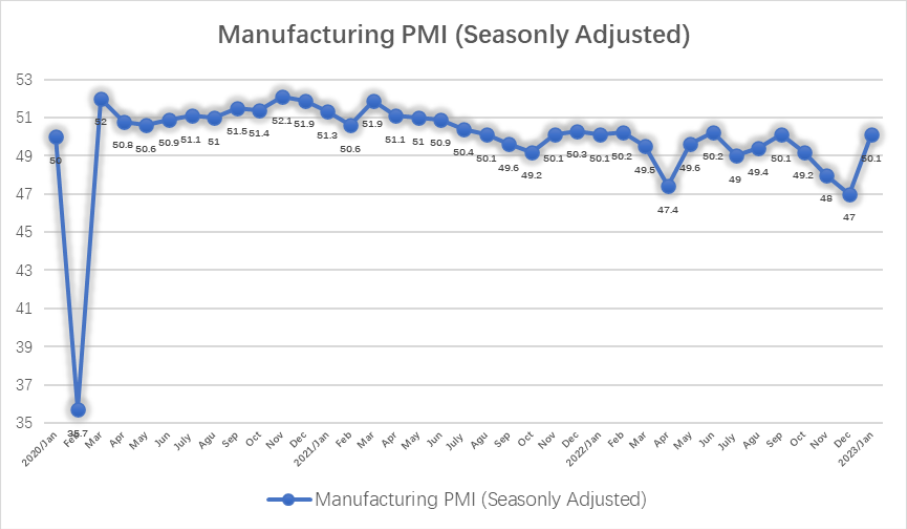
Abstract
In light of the unique social and cultural characteristics in China and the limited understanding of the relationship between social capital and innovation, this study aims to investigate the impact of social capital on product innovation and process innovation through a comprehensive review of relevant literature. The methodology employed for this study involves conducting a contextual analysis of existing literature from various databases. The results of the review confirm the positive influence of social capital, including its dimensions, in facilitating both product innovation and process innovation. The findings of this study are expected to contribute to the knowledge of scholars and manufacturers, providing them with a clearer understanding of the relationship between social capital and innovation, as well as guiding the establishment of competitive supply chains especially under the pandemic. Furthermore, this study also discusses the indicators and distinctions between product innovation and process innovation.
Keywords: Social Capital, Product Innovation, Process Innovation, Pandemic, Chinese Manufacturing Industry, Supply Chains

Introduction

The World Health Organisation (WHO) declared the unexpected coronavirus disease (COVID-19) a global pandemic on March 11th, 2020 (Cucinotta and Vanelli, 2020). The severity of the crisis is unmatched, with 94% of companies in worldwide reporting supply chain disruptions (SCDs) caused by COVID-19. Parallel to Baldwin and Tomiura (2020), the financial implications of COVID-19 alone would adversely influence the manufacturing sector in three ways under the complex and risky market environment: (i) direct supply disruptions resulting from the viral spread in East Asian manufacturing hubs, (ii) the domino effects of supply chains, and indirect demand disruptions following delayed investments and macroeconomic decline in aggregate demand. World trade fell by 32% in almost all regions, with exports from North America and Asia being hit the hardest (WTO, 2020). As the world factory, the

manufacturing sector in China has been severely negatively impacted by this unexpected pandemic.

Due to COVID-19 restrictions since 2020, various factors in Chinese manufacturing industry have led to SCDs, including manufacturing parts shortages from low-tier suppliers, slow pace to resume normal production, labour shortages, limited protective equipment, and the slow recovery of transportation network capacity (World Economic Forum, 2020). The significant economic contribution of the manufacturing sector nationwide, which is China's pillar industry and the guarantee of economic growth, has been validated by many quantitative studies. China's GDP has been severely affected by disruptions in the manufacturing supply chain. For example, at least 20 listed companies in the electronics manufacturing industry have been forced to close operations due to SCDs in the virus-affected areas, which accounted for about 6% of China's GDP decline (SHINE, 2021). These SCDs brought great tests and challenges to the manufacturing industry and confirmed China's manufacturing supply chain fragility (Chinanews, 2022), which highlights the necessity for Chinese manufacturers to explore new solutions through innovations to respond and survive the pandemic.



Source: National Bureau of Statistics of China, 2020-2023
Fig. 1. Manufacturing Purchasing Managers' Index (PMI) in 2020-2023

Production was severely constrained due to the restrictions imposed to curb the spread of the virus (Rapaccini et al., 2020; Ambrogio et al., 2022). According to the statistics published by the National Bureau of Statistics of China, the China Manufacturing Purchasing Managers' Index (PMI) fell sharply due to the impact of the COVID-19 pandemic in February 2020 (refer to Fig.1.). Moreover, after the unexpected fell in 2020, PMI in Chinese manufacturing industry still unstably fluctuated around the threshold (50), especially in 2022, which suggests that output is contracting rather than expanding, indicating a slowdown in manufacturing production activities. Additionally, in mid-February 2020, China's trade activities, corporate orders, and international transactions fell by 50% to 60%. According to a report by the former Consumer News and Business Channel (CNBC), the pandemic has prompted many multinational companies to choose to transfer their supply chains to Vietnam, Malaysia, Bangladesh, India, and other countries (CNBC, 2022). Since companies are most concerned with product innovation and process innovation (Chang et al., 2021), increasing Chinese

manufacturers start to focus on developing new products and/or optimizing the production process through innovative approaches to cope with the slowing manufacturing activities and orders decline.

Moreover, the pandemic has led to a massive global public health campaign to depress the spread of the virus by enhancing hand washing, diminishing face touching, limiting social contacts, following strict hygiene and distance recommendations, wearing masks in public and getting vaccinated. Accordingly, governments impose many interventions to prevent the spread of coronavirus by building quarantine to reduce human contacts (Al-Omoush et al., 2020). Changing habits of human behavior is widely seen as a key margin to contain the Covid-19 pandemic (Bavel et al., 2020). Policymakers and worldwide health experts appeal people to take the social responsibilities by considering the social costs of their individual actions (Bartscher et al., 2021). The Chinese government emphasised the way to achieve social ties and rational allocation of social capital through in-depth cooperation in China's manufacturing industry at the International Forum on Resilient and Stable Industries and Supply Chains (China Daily, 2022).

Despite of these social effects under the pandemic, by reviewing the previous literatures, the cooperative business activities among the supply chain partners motivate innovations in various ways (Laursen et al., 2012; Yan and Guan, 2018; Al-Omoush et al., 2022). The uncertainty caused by the COVID-19 pandemic, lockdowns and social distancing policies has led Chinese manufacturers to try to creatively address challenges with internal and external resources based on the social network of the individual and organisations (Ai and Peng, 2021; Ozanne et al., 2022). Upon revisiting previous studies, it is evident that social capital research still tends to be biased towards an organizational perspective (Cravens et al., 1996; Pagliacci et al., 2020; Randolph et al., 2020) and put less concentration on social capital in wider inter-organizational, network, innovation, or industry perspectives (Meehan and Bryde, 2014; Cho et al., 2017; Gerke et al., 2021).To fulfil this direction, the proposed study would establish a degree of collaboration between companies to develop different innovation types (product innovation and process innovation) by repositioning social capital and supply chain partners.

Literature Review

Social Capital

Social capital is a complementary concept to citizenship behavior (Gerke et al., 2021). With its origins in anthropology, sociology, social psychology, behavioral psychology, philosophy, and economics (Griffith et al., 2006). Social capital is a multi-disciplinary appeal which contains numerous conceptualizations (Min et al., 2008; Son et al., 2016). Social capital was first defined by Hanifan (1916) to contain key elements like goodwill, friendship, sympathy, participation, and social relations. But these factors of social capital did not attract scholars' attention until mid-1980s (Pisani and Micheletti, 2020). Coleman (1988) is the first to bring the term social capital into wide use. The study emphasized the functions of social capital to include the relations between actors, either persons or corporates, and facilitate certain actions within the social structure (Coleman, 1998). Meanwhile, Woolcock (1998) pointed out the definitions of social capital were grounded on different sociological traditions using common elements which contains infrastructural elements, such as social interactions and connections (Van Deth, 2003), as well as cultural elements, commonality of purpose,

norms of reciprocity, trust, civic participation, and learning (Phillips, 2016) to facilitate collective action and cooperation to reach common goals (Gerke et al., 2021).

In general, social capital includes institutions, relationships, tendencies, values, and norms that govern the behaviors and interactions between entities (Ghahtarani et al., 2020). Social capital resides in relationships that are created through exchange to provide access to resources was initially used in research related to community relationships (Nahapiet and Ghoshal, 1998; Ghahtarani et al., 2020; Jia et al., 2020). Integration of the social resources as invoked by sociologists, economists, managers, and scientists is considered as the prominent characteristic of social capital (Adler and Kwon, 2002; Li et al., 2013; Gutiérrez et al., 2011; Al-Tabbaa and Ankrah, 2016).“Social capital” speaks to all resources, including knowledge about foreign-market institutions and insight about appropriate patterns of internationalization and strategic decision-making, that can be gained through rich social networking with relations in the foreign market and a shared cognitive frame of reference with these relations (Doornich, 2018).

Social capital has been proven to be the best aggregate of valuable resources gathered and established through daily relationships and interactions between individuals and organizations (Dreyer et al., 2006; Ghahtarani et al., 2020). Likewise, the core tenant of social capital theory in the supply chain level highlights that individuals’ or organizations’ networks of relationships are valuable resources that facilitate collective actions (Alghababsheh and Gallear, 2021). From the recent study in the field of supply chain management, Al-Omoush et al (2020) defined social capital as the combined value of business relationships which is embedded in social networks linking business partners and society. Social capital resides in relationships that are created through exchange and providing access to resources (Jia et al., 2020). In this study, social capital is indicated as the cumulative of actual or potential resources that could be obtained from the network relationships of social unites of supply chains (i.e., customers, suppliers, and manufacturers.

Product Innovation

Global manufacturing is witnessing a rapid shift from manufacturing commodities to meeting customers’ growing and changing needs (Larsson et al., 2018). Despite this long-term shift, the recent COVID-19 pandemic has put manufacturers through periods full of difficulties and opportunities, forcing businesses to become more competitive and resilient by developing new products and/or services (Li et al., 2021a). Product innovation focuses on the introduction of novel features, which could add value to products and fulfil consumers’ preferences (Boleslavsky et al., 2017; Jiang et al., 2017; Li et al., 2021b). Organisations in dynamic business settings regularly introduce unique innovations that distinguish their products from their current counterparts for high performance (Uche and Continue, 2015). Product innovation facilitates organisations to sustain, expand, and consolidate their positions in the product market by addressing customers’ shifting preferences and new technological opportunities (Chen et al., 2022). Meanwhile, innovation proves crucial for high organisational sustainability and company product profitability (Li and Ni, 2018).

The significance of product innovation implies the product role as a primary contributor in terms of future market valuations and profitability involving financial or market performance (Flikkema et al., 2014; Block et al., 2015; Blichfeldt and Faullant, 2021). Novel product innovations catalyse economic growth, optimise social welfare, consolidate company competitiveness, and remain essential to organisational rejuvenation and sustainability in

dynamic business settings (Slater et al., 2014; Donbesuur et al., 2020; Boakye et al., 2022). In Chinese companies, numerous organisations are making decisions associated with the field and direction of innovation with an emphasis on product innovation amidst high customer demand, improved marketisation, and technological policy shifts (Li et al., 2007; Chen et al., 2022).

Primary studies define product innovation as development driven by the desire to improve completed product features, performance, and quality (Lager, 2002; Bergfors and Larsson, 2009). Meanwhile, Uche and Continue (2015) denoted product innovation as the development and marketing of creative notions to generate, re-design or enhance goods or services. Chinese manufacturing firms emphasise low-cost product innovation through the world-class lean manufacturing system to create something more unique than the global brands produced in China (Feng et al., 2019). Chinese manufacturing product innovation in the proposed study would be described as novel goods or services generated to satisfy external users' requirements through product differentiation, high cumulative product quality, and the manufacturing of improved products to become a fundamental source of organisational growth (Chenavaz, 2012; Pan and Li, 2016; Li and Ni., 2018; Martínez-Ros, 2019).

Process Innovation

Zairi (2010) indicated the necessity of implementing an integrated approach to the supply chain to generate successful innovation outcomes. In exemplifying the development of global supply chains within agile and responsive processes, numerous organisations exert much effort to improve customers' value through process innovation (Paton and McLaughlin, 2008; Flint et al., 2008; Kwak et al., 2018). Chang et al (2021) highlighted the necessity of optimal performance in process innovation to develop sustainable operational strategies for manufacturers. Under the negative influence of COVID-19 pandemic, the significance of advancement in process has been re-emphasized by the academics and practitioners in the manufacturing industry.

Process innovation characterises developments driven by the following in-house production goals (mitigating production costs, increasing yields and recovery rates, and encouraging eco-friendly productions), which include high-quality functional deployment and re-engineered business processes for low production costs and material consumption (Pérez et al., 2019). Innovative processes emphasise the introduction of new company production or service operation elements for high production efficiency and low production costs (Martínez-Ros, 2019). Wittfoth et al.'s (2022) empirical outcomes implied the need for process innovation to perform effective cost reduction under the innovation dynamics theory to lay the foundation for a functional product at the beginning of the technology life cycle.

Supply chain management studies acknowledge the essentiality of a process-based approach in business management to analyse which processes, sub-processes, and activities are contained in each process and how these processes should interconnect rather than isolate the activities in conventional functional silos (Yoon et al., 2016). Process innovation entails effective supply chain re-designing and re-engineering by focusing on resolving operational and procedural issues for optimal managemental practices, network development, and distribution channels (Chapman et al., 2002; Kwak et al., 2018). In line with Yoon et al (2016), supply chains with smooth operating processes potentially offer optimal management techniques through best practices or pathways.

Utterback's (1975) seminal paper on process development models denoted process innovation as the cumulative development of the overall (production) process, such as the systems employed to generate products or services: process equipment, manpower, task specifications, material inputs, work, and information flow. Chang et al. (2019) went on to expand this connotation as the introduction of unique elements, such as novel management and production techniques and innovative technologies in organisational production and management operations. León-Ledesma and Satchi's (2019) research disclosed that the creation of novel production approaches has catalysed company production possibilities and adjustments. Similarly, process innovation enhances the organisational competence to develop, optimise, utilise, reconfigure, and re-group their resources and capabilities for production enhancements or novelty, thus rendering it a key source of competitive advantage (Chang et al., 2015).

In line with Bena et al. (2021), high innovative abilities render it easier for enterprises to adjust their production processes when business conditions undergo market shifts. Notably, innovation ability in optimizing process is a primary catalyst of organisational performance through this mechanism. The process innovation in this study with regards to Chinese manufacturing companies depend on adopting technologically novel or optimised approaches to create or enhance operational production processes and survive volatile market environments through cost reduction or quality improvement.

Differences and Connections between Product and Process Innovation

As reviewing the past literatures, studies on the centralisation-innovation link, which did not emphasise the shortcomings and variations between product and process innovation, have failed to identify the importance of innovation types adopted by organisations (Bergfors and Larsson, 2009; Liang and Zhang, 2012; Fonseca, 2014). Table 1 presents the variances between product and process innovation based on multiple factors.

Table 1
Differences between Product and Process Innovation

Differences	Product Innovation	Process Innovation
Innovative Activities	Focus on the activity outcome	Focus on the activity process
Driving Force	Effectiveness	Efficiency
Characteristic	Market-centric, customer-oriented	Internal focus, technology for production or marketing purposes
Visibility	Easy to notice and observe	Difficult to notice and observe
Knowledge	Open, accessible, and comprehensible, external, autonomous	Limited, internal, system, implicit, complex but stable
Strategic	Differentiation	Low-cost, high-quality, minimal risk, better yield
Time	Short-term	Long-term

Product innovation prioritised the activity outcome while that of process emphasised the activity process (Chang et al., 2021). The effectiveness-driven element underlying production innovation is primarily influenced by market requirements and external customers. Meanwhile, the efficiency-driven counterpart is impacted by product needs and internal customers. Product innovation is market-centric and customer-oriented, whereas process innovation depicts an internal focus on the technologies that produce or market a product or service (Un and Asakawa, 2015; Martínez-Ros, 2019). Moreover, product innovation is tangible for companies and consumers while that of process is less visible and palpable to stakeholders (Chang et al., 2015).

Past understanding of how businesses could become process innovators remains constricted although the potentiality for open innovation to develop product-oriented enhancements with external knowledge sources is undeniable (Aliasghar et al., 2019). Product innovations, which could be perceived by customers in the external environment, are typically comprehensible. Thus, firms must integrate customer feedback with product design and manufacture. This innovation concerns external and autonomous knowledge, which renders the knowledge easier to understand albeit with constant changes. On another note, process innovation relies on internal and system knowledge, which is more implicit and complex yet stable. It is more challenging to reverse-engineer process innovation compared to its product counterpart following the prolonged development period, which is implicit and systematic in nature (James et al., 2013; Terjesen and Patel, 2017; Aliasghar et al., 2019).

Product innovation emphasises a differentiation strategy, whereas a low-cost strategy potentially complements process innovation. Following the process innovation characteristics, which identify internal operations, the operational level of a specific process relatively differs from a product innovation strategy to establish business approaches, such as low risk and high yield to management (Li et al., 2009; Chang et al., 2015; Liu et al., 2022a). The subsequent development of organisational operations could facilitate shifts that enhance quality or minimise expenses through efficiency and effectiveness for long-term competitive benefits (Pisano and Shih, 2012; Frishammar, 2012; Aliasghar et al., 2019; Chai et al., 2020).

The possible interconnections should not be disregarded despite the notable gap in distinguishing these two innovation types. From scholarly perspectives, innovation denotes the degree to which a company operates with its supply chain partners to generate novel products through process-based shifts (Cao and Zhang, 2011; Saleem et al., 2020). Martínez-Ros (2019) similarly characterised the essentiality of all innovative activity types as catalysts of competitiveness and smart productivity. Firms that overlook the pivotal role of process innovation could adversely impact the development of market strategies as the outcomes prove less tangible to customers (Chang et al., 2015). Organisational managers must regard both product and process adjustments, which are heavily interdependent with substantial implications on the company marketing strategy (Chang et al., 2015; Uche and Continue, 2015). For example, novel products that could be developed from current production plants through process innovation minimise production costs (Li et al., 2007; Bergfors and Larsson, 2009). Given the importance of process innovation as a catalyst for product innovation, this study proposed the equal valuation of product and process by integrating both innovation types through successful organisational engagement rather than prioritising either one following distinctive company structure requirements (Fonseca, 2014).

Methodology

The content analysis refers to an inference about any type of text to tell whether its production process is effective and trustworthy. To make systematic analyse literature objectively in quantitative ways, the content analysis was selected as the research method in this study. The aim at adopting the content analysis to review literature in this study is to reveal the implicit information, clarify and assess the essential primary facts and developing trends to provide intelligence predictions for the revolution of product and process innovation with their indicators.

For this study, papers were selected based on the English-language academic journals and conference articles published between 2000 and 2022. This review was concentrated on one single language. The database was from Scopus, Science Direct Journal, and Google Scholar to systematically review literature. Description of review results, descriptive analysis, thematic categorization, and specific industry application are the standards of searching articles. The process of reviewing is shown in Table 2.

Table 2
Process of the Review

Steps	Numbers of the Literatures	Process
State Research Problem and Confirm Keywords	>300	Defined research topic of social capital, product innovation, process innovation, Chinese manufacturing supply chain.
Searching Articles	312	Searched articles in the database of Scopus, Science Direct Journal, and Google Scholar with keywords.
Screening	301	The search included both journal and peer-reviewed conference publications to illustrate the history of developing the topic and new findings.
Exclusion	249	The subject regions of the database focused on the field of supply chain management, supply chain risk management, economics, logistics, industry engineering, social sciences, and decision science.
Inclusion	109	Searched Sequence with Article Inclusion Standard: a) Full-text articles published in journals only. b) The article should include the research subject: product innovation, process innovation, social capital. c) Conclusions of the paper should indicate responses to the stated problem or research questions.
Critical and Comprehensive Content Selection	53	Based on synthesis and comparisons, reviewing thorough all articles after screening, papers not related to objectives were excluded.
Final Article Assessment	56	Decided the articles to do the investigations.

Result and Discussion

Journal Classification

Based on the objectives and topics of this study, to meet the inclusion standard shown in Table 1, a total of 53 literatures are rejected. Table 3 indicates the classification of the 56 final assessed articles according to the different journal. These 56 papers punished in 41 journals. Five journals are collected three times, nearly 30% of the total quantity, which names Journal of Business Research, International Journal of Production Economics, Production and Operations Management, European journal of operational research, International journal of operations & production management separately.

Table 3
Journals Distribution

Journals Distribution	**Journal of Business Research**	3
	International Journal of Production Economics	3
	Production and Operations Management	3
	European journal of operational research	3
	International journal of operations & production management	3
	Research policy	2
	Supply chain management: An international journal	2
	Academy of management journal	2
	The Journal of Technology Transfer	2
	Industrial Marketing Management	2
	Information & Management	1
	International business review	1
	Best Practice	1
	Energy Procedia	1
	Harvard Business Press	1
	Industrial and corporate change	1
	Decision Sciences	1
	Computers in Industry	1
	Logistics research	1
	MIT sloan management	1
	International Journal of Information Management	1
	International journal of physical distribution & logistics management	1
	CSCMP Explores	1
	Technological Forecasting and Social Change	1
	Journal of Cleaner Production	1
	Research in organizational behavior	1
	Materials Today: Proceedings	1
	Journal of Strategy and Management	1
	Economics	1
	R&D Management	1
	Technological Forecasting and Social Change	1
	Procedia Economics and Finance	1
	Journal of operations management	1
	Expert Systems with Applications	1
	Academy of management review	1
	International small business journal	1
	Social Science & Medicine	1

	International Research Journal of Social Sciences	1
	Business Horizons	1
	Asia Pacific Business Review	1
	Journal of Economic Surveys	1
	Total	**56**

Analysis of the Social Capital Dimensions Classification

By revisiting the relevant literature, social capital is measured in different ways, depending on the level of the analytical goals and the range of interest (Gallaher et al., 2013; Zhou et al., 2018). Social capital may be categorized into two different groups based on the previous studies (Jia et al., 2020). The first is based on the network viewpoint, which uses its concepts of bonding, bridging, and linking to describe social capital (Doerfel et al., 2013; King et al., 2019; Cofré-Bravo et al., 2019). Some scholars identify bridging and bonding social capital (also known as external and internal social capital) as the dimensions of social capital (Zhou et al., 2018; Chowdhury et al., 2020). The other is based on the social structure approach, which uses structural, relational, and cognitive capital to define social capital in the organization level (Akram et al., 2016; Jia et al., 2020).

Given that the social structure of interactions among supply chain parties (such as suppliers or consumers) is the primary focus of this study, relational, cognitive, and structural capital are adopted as the sub-dimension of social capital. Another reason for adopting theses three dimension is that the cognitive, structural, and relational aspects of social capital in a given network have a range of effects on how effectively networked businesses innovate (Cappiello et al., 2020; Gerke et al., 2021). Innovation is becoming more of a collective responsibility among networks of organizations rather than just one (Bonomi et al., 2020; Dagnino et al., 2015). In accordance with the existing literature, this study has divided social capital into three dimensions to evaluate the social capital of Chinese manufacturing enterprises.

Relational Capital

Relational capital, which is created through a history of interactions, typically emphasised the goodwill existing between actors in early organisational research (Granovetter, 1992; Randolph et al., 2020). Behaviours and social drives were impacted by social unite connections (Nahapiet and Ghoshal, 1998; Jia et al., 2020). In Wu and Chiu (2018), relational capital denotes joint resources that enable organisations to interact with partners through goodwill, collective bonds, and prosocial behaviour expectations under the social capital theory, which depicts the relational networks among companies and participants to ascertain essential collaborative behaviour (Carey et al., 2011; Son et al., 2016; Zhang et al., 2020).

It is strategically vital for sustainable relationships among supply chain participants to extend corporate social accountability amidst COVID-19-induced interruptions. The supply chain partners in a trustworthy and mutually-advantageous relationship could offer multiple resources to alleviate the adverse implications of such disruption given their cooperation amidst unforeseen circumstances based on the lead time, expenditure, and credit (Jia et al., 2020). From the suppliers' perspective, Zhu and Lai (2019) examined corporate social accountability and the importance of establishing relational connections together with individual trust with suppliers in developing economies to deter supply- and production-oriented interruptions. Alghababsheh and Gallear (2021) further implied relational capital as

buyers' and suppliers' goodwill based on repeated interactions. This research employed the attributes of relationships with essential supply chain partners as relational capital in the Chinese manufacturing sector amidst the current health crisis.

Cognitive Capital

Cognitive capital was incorporated into characteristics resembling a shared paradigm with a common perspective of shared goals and adequate means of acting within a social unite (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998) in previous organisational works. For example, organisational research assessed cognitive capital with collective languages, codes, and visions on personal grounds (Nahapiet and Ghoshal 1998; Sun et al., 2012). In other words, cognitive capital implies a set of assets requiring further examination in the social capital mainstream despite its prevalence in strategy-oriented settings (Ghahtarani et al., 2020).

It is deemed crucial to harness a collective network goal and vision among supply chain stakeholders' cooperation concerning diverse social unites. Deriving such cognitive advantages would assist actors in comprehending common goals and augmenting their capacity for knowledge internalisation and application when communicating with one another (Nambisan and Baron, 2010; Yan et al., 2019). In the current research context, cognitive capital was established as a developing social capital dimension given that the resources offered collective representations, interpretations, and systems of meaning amongst the stakeholders (Gerke et al., 2021).

The cognitive dimension proves intangible given its relevance to interpretations of a shared reality, unlike its other counterparts. Collective representations, interpretations, viewpoints, and connotations at personal or collective levels denote the fundamental aspect of cognitive capital (Nahapiet and Ghoshal, 1998; Meehan and Bryde, 2014; Pisani and Micheletti, 2020; Alghababsheh and Gallear, 2021). Cognitive capital is implied as cognitive schemes and systems of meaning that depicted collective vocabulary and narratives embedded in the supply chain partnership of Chinese manufacturers.

Structural Capital

In line with Baker's (1990) proposition, social capital implies the resource elicited from specific social structures by actors in pursuing their interests, thus asserting the essentiality of network structures. Similarly, Colman's (1998) depiction of social capital was naturally incorporated into the relations structure between (organisational) actors. In network development, structural capital contains all connection patterns with actors that illustrate stakeholders' presence, frequency, and strength of social interactions in supply chain management (Alghababsheh and Gallear, 2021). Overall, structural capital induces advantageous and shared actions with concrete roles, social networks, rules, procedures, and precedents (Pisani and Micheletti, 2020).

Structural capital denotes a neutral means of internalising network configuration concerning density, connectivity, and hierarchy and relationship patterns based on social links (Nahapiet and Ghoshal, 1998; Adler and Kwon, 2002; Carmona-Lavado et al., 2010; Fandiño et al., 2019). In Alghababsheh and Gallear (2021), structural capital catalysed fundamental assessment practice factors, such as establishing goals, monitoring progress, auditing, and offering feedback to align suppliers' behaviour with buyers' standards. Thus, structural capital highlights the presence, frequency, and degree of social interactions between suppliers and buyers (Alghababsheh and Gallear, 2021). Empirically, structural capital among partner

companies establishes high-frequency interactions among partners and various links for reliable and diverse knowledge exchanges (Cui and Wu, 2016; Eiteneyer et al., 2019; Jia et al., 2020). Various network connections between organisations and suppliers are pivotal for mutual interactions and development (Zhang et al., 2020).

Structural social capital is highlighted as the network configuration between organisational members in terms of strength and number of ties following (Gerke et al., 2021). Lau et al (2018) outlined structural capital as the configuration of links prevalent among relevant parties. Structural capital implied the neutral configuration of connections in a social structure to be evaluated from social ties (Villena et al., 2011; Chen et al., 2018; Jia et al., 2020) to derive insightful knowledge (Meehan and Bryde, 2014; Jia et al., 2020).Given that companies in China struggle to recover from the disruption induced by COVID-19, relevant studies asserted that optimal market systems and institutional structures could minimise adverse impacts through financial shifts (Zhou et al., 2014; Chen et al., 2018). The facilitation of personal and organisational actions potentially improves the actors' capacity to elicit advantages based on social structures, networks, and memberships (Davidsson and Honig, 2003; Luo et al., 2012; Chen et al., 2018; Jääskeläinen et al., 2020)

The Uniqueness of Chinese Innovations

In line with Feng et al (2022), the innovativeness of Chinese cities palpably demonstrated spatial heterogeneity and agglomeration attributes. The innovation strategy instigated by market shifts has transitioned from emphasising technology-oriented introductions and gradual enhancements to the internal or endogenous developments of sophisticated technologies (Li et al., 2007), which aims to transform 'manufactured in China' to 'created in China' (Haour and Zedtwitz, 2016) and diminish the regional disparities in China's innovative competence (Yang et al., 2012; Liang et al., 2022). The value of technology is not often visible lurking until they are commercialised through the development of optimal business models (Massa et al., 2017; Snihur et al., 2021; Jin et al., 2022). In this vein, Shi et al (2022) outlined the presence of positive and workable innovation activities in China through (i) technological innovations and applications and (ii) the establishment of scientific and technological ownership and intellectual property rights to convert empirical outcomes into socially-productive forces.

Similar to the connotations of innovation, which define innovation as "the adoption of an internally-generated or externally-acquired device, system, policy, programme, process, product, or service that is new to the adopting organisation" (Damanpour, 1991; Golgeci and Ponomarov, 2013), organisational competence in terms of regular innovations and updates relies on how firms coordinate their processes, procedure, productions, and structures and stimulates employees towards knowledge integration and generation for creation purposes (O'Reilly and Tushman, 2008; Lisboa et al., 2011; Al-Hakimi et al., 2021). Regarding the supply chain management field, Kwak et al.'s (2018) study in the supply chain management field denoted supply chain innovation as an intricate process that generates information-processing and novel logistics services by leveraging technological and process innovations, offering solutions to customer requirements, and determining improved processes.

From production- and competition-oriented perspectives, innovation in the supply chain conventionally emphasised (i) constant re-generation and category extensions of the product and service span and (ii) the discovery and formation of new approaches in production, supply, and distribution processes (Lee et al., 2018; Liu et al., 2022b) for a competitive edge in the market. Multiple scholars outlined innovation as an organisational tendency to

encourage experimentation, novel notions, brainstorming and creative thinking for new product development and process enhancement (DeTienne et al., 2015; Shan et al., 2016; Saleem et al., 2020; Afraz et al., 2021).

The specific manifestations of innovation, a pivotal organisational behaviour, differ based on numerous aspects of business activities. Chang et al (2021) categorised innovation into product innovation and process innovation following past scholars. Both product and process innovation activities stem from the technological innovation domain in distinguishing them from non-technological innovations: organisational or business innovations performed in companies (Damanpour, 2010; Martínez-Ros, 2019). Likewise, most business managers and academics emphasised product and process innovation to represent technological innovation in supply chain management (Golgeci and Ponomarov, 2013; Wang et al., 2019; Chang et al., 2021; Gerke et al., 2021; Ge et al., 2021).

With regards to competitive advantages, open innovation could minimise time-to-market, distribute product innovation risk, and enhance new product quality (Usman and Vanhaverbeke, 2017; Lv and Qi, 2019). Innovation denotes novel or optimised products (goods or services) and processes, creative marketing techniques, or newly-established business approaches in workplace practices and organisation or external relations (Larsson et al., 2018). Product and process creativeness either increase efficiency through improved performance or elevated end-customers' satisfaction levels (Roy et al., 2004; Seo et al., 2014; Kwak et al., 2018).

Specifically, product innovation aims to generate improved products for competitive advantages in terms of high quality and environmental-friendliness (Pan and Li, 2016; Wang et al., 2019). Process innovation implies production cost reduction, which results in shifts or updates in production functions that facilitate businesses to price their products at competitive rates (Lambertini and Orsini, 2015). This study would emphasise the product and process innovations that represent technological innovation following their implications on organisational performance.

The Impact of Social Capital on Product Innovation

The positive relationship between social capital with its dimensions and product innovation has been highlighted and examined by previous literatures as shown in Figure 3. Bergfors and Larsson (2009) proposed that knowledge creation through the cooperation networks occurs in product innovation as product development projects facilitated information stimulation and accumulation in the general domain. Organisational members' product technology knowledge is interconnected in the synergistic supply chain product innovation for product innovation goal attainment, unlike the general collaboration between supply chain partners (Park and Yoon, 2017; Lv and Qi, 2019). Mazzola et al. (2016), who highlighted scholars' oblivion in analysing the new product development effects from external parties, affirmed the significance of relational embeddedness in novel product development.

Close rapport catalyses suppliers' and customers' knowledge acquisition and creation and innovative product discovery and development (Soosay et al., 2008; Jer et al., 2017; Zhu et al., 2019). Najafi-Tavani et al (2018) highlighted the emphasis placed by early works on the essentiality of partnering with suppliers, customers, competitors, and universities or research institutes for innovative organisational product development, specifically using tacit knowledge. As early adopters, companies or supply chains with higher innovation levels are more technically intricate, take higher risks, and perform more integrations with supply chain partners: Samsung, Microsoft, and Apple (Kwak et al., 2018).

By establishing strong lines of communication and fostering close interactions, the firm builds a foundation of trust with its deeply involved partners. This trust plays a crucial role in avoiding fruitless new product development (NPD) efforts, streamlining project timelines, reducing workload, and ultimately shortening the overall NPD cycle time (Zhu et al., 2019). Empirical outcomes from Cappiello et al (2020) implied that trusted partners could explicitly engage in novel product development projects to minimise project timeframes and workload for acceleration purposes.

For the three dimensions of social capital, the integration of organisational resources with social capital is an asset that improves employees' interactive flow towards product innovation (Camps and Marques, 2014; Fandiño et al., 2019). Lv and Qi (2019) underscored the significance of integrating supply chain partners and harnessing the potential of relational, cognitive, and structural capital. They emphasized the benefits of exploiting the complementarity and coordination of innovation resources among partners. This integration approach involves collaborating with multiple partners across various stages and elements of collective product innovation. Ozgun et al (2022) similarly discovered the pivotal role of three social capital dimensions in optimising communication and cooperation and encouraging resource-sharing and integrations for positive effects on product innovation.

Based on the review calculation depicted in Table 4, the relational capital, cognitive capital and structural capital each have a constructive influence on facilitating product innovation (Soosay et al., 2008; Camps and Marques, 2014; Lee et al., 2018; Fandiño et al., 2019; Lv and Qi, 2019; Cappiello et al.,2020; Ozgun et al.,2022). In the proposed study, product innovation would denote the innovation of novel outputs and services launched in the market through promoting the social capital embedded in the collaboration networks between supply chain partners to fulfil customers' needs and expectations concerning Chinese manufacturing enterprises.

Table 4
The Review Summary of Social Capital Dimensions on Product Innovation

Reference	**Social Capital**		
	Relational Capital	*Cognitive Capital*	*Structural Capital*
Soosay et al (2008)	√	√	
Bergfors and Larsson (2009)			√
Pérez-Luño et al (2011)	√		√
Camps and Marques (2014)	√	√	√
Mazzola et al (2015)			√
Ojha et al (2016)	√	√	
Yi et al (2016)	√		
Jer et al (2017)	√		
Thompson (2018)	√		√
Najafi-Tavani et al (2018)	√		√
Lee et al (2018)	√	√	√
Lv and Qi (2019)	√	√	√
Fandiño et al (2019)	√	√	√
Zhu et al (2019)	√		√
Setini et al (2020)	√	√	√
Cappiello et al (2020)	√	√	√

Al-Omoush et al (2022)	√	√	√
Farzaneh et al (2022)	√	√	√
Ozgun et al (2022)	√	√	√

The Impact of Social Capital on Process Innovation

Innovative supply chains must possess a sound understanding of supply chain management activities and collaboratively innovate with vendors, which necessitates the adoption of appropriate and advanced technologies to support the overall supply chain process (Lee et al., 2011; Jangga et al., 2015; Kwon et al., 2016; Pal et al., 2022). As an introduction to cross-innovation and the integration of distinctive innovation themes, collaborations potentially produce novel and useful entities (Wang, 2016) and accelerate technological innovation enhancements in China (Bai et al., 2020).

Cooperation also enables companies to increase technological innovations owing to the collaborative exchange of skills across organisations or even nations with sophisticated technologies, including China (Pai et al., 2012; Pérez et al., 2019). Based on Najafi-Tavani et al (2018), collaboration with research institutions and suppliers is a key factor influencing process innovation capabilities. Collaborative competition was also positively associated with efficient process innovation (Chai et al., 2020). As Table 5 presents previous literature has extensively highlighted the positive impact of social capital with its dimensions on process innovation, primarily attributing it to the formation of social networks through collaborative efforts (Conroy and Deller, 2020; Cappiello et al., 2020; Setini et al., 2020; Corrêa et al., 2021; Al-Omoush et al., 2022; Fakhimi and Miremadi, 2022).

For example, relational ties play a crucial role in facilitating collaborative innovation networks by promoting trust and enabling the seamless exchange of knowledge between channel partners to achieve greater innovativeness in processes (Najafi-Tavani et al., 2018; Ramírez-Solis et al., 2022). To capitalize on market opportunities or explore new products and processes in a rapidly evolving environment, organizations need to prioritize the following key aspects: discovering new solutions, developing new knowledge, and reconfiguring their existing operational capabilities. These objectives can be accomplished by effectively leveraging flexible and agile structural capital (Farzaneh et al., 2022). Effective innovation processes require cooperation and information sharing Thompson (2018), which are dependent on a high level of mutual trust and understanding that extends beyond language, encompassing cognitive capital such as shared values, culture, vision, and objectives (Sánchez-García et al., 2023). The cognitive capital, specifically the alignment of approaches among top executive managers, holds significant importance in the innovative process especially in China (Ding et al., 2023). The compatibility of their perspectives and approaches is essential for fostering innovation within an organization.

Social capital substantially improves company performance in internal processes where a chain of activities gains cohesion and fluidity through transparent and positive rapport among employees, thus rendering processes more efficient for companies (Hasan et al., 2020). From an external perspective, the synergy of collaborative efforts, drawing on the social capital embedded within cooperation networks of supply chain partners, combined with external process creativity, results in the development of innovative market solutions and favorable profit outcomes (Lyu et al., 2023). Consequently, social capital serves as a catalyst for process innovation by promoting advancements in both internal and external processes (Conroy and Deller, 2020; Hasan et al., 2020; Setini et al., 2020).

Under the pandemic, social capital initiatives through specific alliances and signing collaboration agreements have saved knowledge flow time and costs among companies and minimised the risks associated with information asymmetry (Lyu et al., 2022) for organisational process enhancements. The pivotal role of social capital, characterized by strong networks and high levels of trust, is evident in enhancing the survival rate of businesses (Ebert et al., 2019; Conroy and Deller, 2020; Al-Omoush et al., 2022). This is achieved through a reduction in transaction costs and an increase in the flow of information, particularly in the context of process innovation in taking-risks (Conroy and Deller, 2020).

Table 5
The Review Summary of Social Capital Dimensions on Process Innovation

Reference	**Social Capital**		
	Relational Capital	*Cognitive Capital*	*Structural Capital*
Pérez-Luño et al (2011)	√		√
Camps and Marques (2014)	√	√	√
Huang et al (2015)		√	
Kratzer et al (2017)	√	√	
Thompson (2018)	√		√
Najafi-Tavani et al (2018)	√		√
Setini et al (2020)	√	√	√
Conroy and Deller (2020)	√		√
Cappiello et al (2020)	√	√	√
Corrêa et al (2021)			√
Ramírez-Solis et al (2022)	√		
Ozgun et al (2022)	√	√	√
Farzaneh et al (2022)	√	√	√
Al-Omoush et al (2022)	√	√	√
Sánchez-García et al (2023)	√	√	

Conclusion

Under the unstable market environment and policy innovation support in China, the current supply chain management could change to accommodate operational needs post-innovation adoption (Beltagui et al., 2020). Companies must internalise customer needs and design and product manufacture and incorporate advanced technologies to improve product development efficiency and commercialisation by considering the variations of innovation types to adopt distinct administrative skills (Martínez-Ros, 2019). Notably, China has pragmatically invested considerable energy in technological innovation and digital enhancements in alignment with national plans following the high sales of manufactured goods and services compared to other nations (Chen et al., 2022). The entire process of technological innovation integrates innovative design and research, market intelligence, and active managerial participation to establish innovative production processes or develop innovative products (Ibrahim et al., 2012; Lee et al., 2018).

Based on previous research, this study proposes the positive impact of social capital on product innovation and process innovation as the major finding. Taking China's manufacturing industry as an example, this study further explores the impact of these social

factors on innovation activities from a practical perspective, especially under the outbreaks of COVID-19 pandemic. This study conducts that social capital could motivate novel outputs and services launched in the market through collaborations between Chinese manufacturing supply chain partners. Meanwhile, Chinese manufacturing companies would depend on adopting technologically-novel or optimised approaches to create or optimize process of innovation and survive volatile market environments through cost reduction or quality improvement. All these collaborative and innovative solutions in this study provide the guidelines in how to manage and motivate innovation activities in the product and process level for supply chain managers in manufacturing enterprises not only in China but also in worldwide.

This study re-examines the literature on social capital and its connection to supply chain management, providing insights for future researchers to explore more effective approaches in building competitive supply chains and mitigating risks during a pandemic. However, certain limitations exist, as this study primarily adopts a theoretical perspective and further empirical research is needed to investigate the dimensions of social capital and its impact on product/process innovation. Additionally, future investigations should also consider exploring other types of innovation, such as management innovation, to broaden the scope of inquiry.

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