Innovation in Food Processing Supply Chains: The Role of Social, and Cognitive Capital Development

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Abstract: In supply chains, social attributes, such as trust, and commitment, are key drivers of efficiency performance. In the agriculture industry in developing countries like Vietnam, social capital may have a greater role when other formal systems are not in place. This study empirically tests the mediating role of supply chain absorptive capability as a complementary asset to leverage social, and cognitive capital to enhance innovation performance. This research examined small food producers using a standard questionnaire and captured 85 responses in Vietnam. The findings showed that social capital plays a more significant role in enhancing absorptive capability, highlighting the need for a structural resource network in developing regions. Food processing firms benefit from the direct and indirect influence of absorptive capability. Absorptive capability acts as a catalyst in enhancing cognitive, and social capital for improving innovation outcomes, such as new product development. The food producers should not just stop at sharing and capturing information, but move forward to deploy new ideas and learned knowledge. The results urge agricultural businesses to establish networks with supply chain partners, who can significantly impact the development of new ideas, and quickly exploit new knowledge to accommodate resources for sustainable agricultural strategies.

Keywords: Knowledge Management, Supply Chain Management, Innovation

1. Introduction

Organizations compete based on the capabilities they can accumulate across their supply chains. Although firms face resource scares, and knowledge deficits (Tunisini, Harrison, & Bocconcelli, 2023), however, some outperform others due to their abilities to absorb, transform, and apply external partners' knowledge in supply chains (Horvat, Dreher, & Som, 2019; Malhotra, Gosain, & Sawy, 2005). In operations, and strategic management research, efforts to understand the relationships between these performance improvements have typically focused on firm-based, and industry-based research. Due to the unpredictable and turbulent business environment, the dynamic of supply chain knowledge depends on the linkages between the knowledge network, and synchronization among members (Arenas, Díaz-Guilera, Kurths, Moreno, & Zhou, 2008; Simatupang, Wright, & Sridharan, 2002). This study argues that the interrelationship between social, and cognitive capital, and a firm's absorptive capability can leverage external knowledge from suppliers, and customers to enhance competitive advantage and innovation performance. It can serve as an alternative explanation that may inform an enhanced understanding of the dynamic of this phenomenon.

Social capital is captured from the goodwill that exists between SC partners highlighting trust, cooperation, friendship, respect, and reciprocity in interactions. Effective networking allows firms to build high-quality ties that enable the transfer of knowledge (Horvat et al., 2019), the building of new knowledge, and faster, and more comprehensive learning (Loermans, 2002). Cognitive capital represents alignments among organizational actors about business visions and shared cultural values (Tsai & Ghoshal, 1998). Literature suggests that cognitive capital can be developed when supply chain partners share a common understanding of business norms, and technical terminologies, align business visions, and conduct joint workshops to identify issues, and opportunities (De Carolis & Saparito, 2006).

This study posits that absorptive capability (APC) mediates the relationship between social and cognitive capital and performance based on congruence theory. The concept of the APC is an emergent dynamic capability that facilitates better capturing, disseminating, and utilizing external knowledge to support their operations and sustain firms' competitiveness. Supply chain absorptive capability refers to abilities to capture, disseminate, and apply knowledge of markets and know-how from supply chain partners, to apply in enhancing final product quality and reducing costs (Ramanathan & Gunasekaran, 2014).

According to the congruence theory, cognitive capital derived from supply chain collaborative efforts can enhance tangible social-economic satisfaction when supply chain partners align, and achieve common

objectives, culture, and business practices. Organizational goal congruence facilitates knowledge-sharing practices that mitigate opportunistic behaviors among supply chain partners (Dyer & Singh, 1998), thus leading to more collaboration. In this sense, goal congruence is a useful supply chain coordinating mechanism that leads to superior outcomes (Roh, Min, & Hong, 2011).

Vietnam's agricultural industry is less structured, characterized by high transaction costs, and poor public, and private institutions (Ba, de Mey, Thoron, & Demont, 2019). Social capital can emerge from a network of cooperatives and unstructured traders. The agricultural industry in Vietnam plays a fundamental role in the country's economic growth, contributing 13 percent of GDP, and 29 percent of employment in 2021 (Van Huong et al., 2021). Vietnam's policies are highly appreciated in motivating to promote potentials, and advantages of the agricultural sector, which turns Vietnam from a recipient of food aid to a food exporting country. Agri-food in Vietnam includes mainly SMEs, who act as elements of cohesion in agricultural processes in which the activity is carried out. The agri-food supply chains serve international, and local markets through innovation and the management of multiple value chains. Vietnamese consumer needs are not limited to food safety, and quality, but increasingly include innovation, sustainability, competitive pricing, and value for money.

This current study addresses the above, in the Vietnamese agricultural context, by examining relationships between social, and cognitive capital, and firms' absorptive capability, and its impacts on performance. While literature indicated that social capital can bring the focal company long-term benefits (De Carolis & Saparito, 2006; Phadnis, 2024), others assert that supply chain managers must examine the stage of development, and identify facilitating factors in designing their supply chain operations. This study investigates the following questions:

- To what extent do social, and cognitive capitals affect the supply chain's absorptive capability?
- How do these knowledge dimensions, and supply chain absorptive capability impact innovation performances?

This study provides a better understanding of how knowledge from supply chain partners in the agricultural context (e.g. farmers, and cooperatives) contributes to absorptive capability and innovation performance. For operations managers, this empirical study highlights the importance of leveraging suppliers', and customers' knowledge in enhancing innovation development, and performance. A comprehensive picture of facilitating factors associated with supply chain absorptive capability can help smaller food producers allocate resources to enhance innovation performance, thus staying competitive. Furthermore, by investigating the APC and social networks in an emerging agricultural context, this study shed different views on research and practice areas.

Theoretical background, and research hypotheses

The paper introduces the theoretical background, highlighting the mediating role of supply chain absorptive capability and social capital knowledge literature.

1.1 Absorptive Capability - APC

A firm's absorptive capability refers to abilities to recognize and obtain external knowledge (Aboelmaged & Hashem, 2019; Kurniawan, Hartati, Qodriah, & Badawi, 2020). From an economic stand, a firm can recognize the value of new, external information, assimilate it, and effectively apply it for commercial purposes (Cohen & Levinthal, 1990). Literature is divided into four basic building blocks: acquisition, assimilation, transformation, and exploitation. In a supply chain context, partners find and exchange knowledge from the internal, and external environment, such as their customers, and suppliers. Furthermore, accessing novel information about markets, and products/services encourages the organization to be involved more in supply chain collaboration, and partnerships, thus creating further knowledge (Ramanathan & Gunasekaran, 2014). In the context of agricultural supply chains, farmers often add complementary knowledge about materials, and processes that can be combined with the buyer´s knowledge for further processing foods.

When agri-food firms combine farmers' knowledge, and their expertise as a strategic resource, the nature of internal combination makes these resources a "hidden" competitive advantage that cannot be easily imitated. APC measures knowledge acquisition, assimilation, transformation, and knowledge exploitation (Jiménez-Barrionuevo, García-Morales, & Molina, 2011). This is particularly important when farmers use specialized or unique resources. The social capital created among farmers, and buying firms (food processors) represents collaborative activities and can transform, and implement new ideas, thus enhancing absorptive capability (Ye & Kankanhalli, 2013), and innovation performance. In the environmental context, famer usage of sustainable materials can be an innovative idea. Supply chain partners, like food producers, can utilize the farmers'

specialized know-how in such green projects to remodify their existing processes, leading to better innovation measures, such as frequencies of new products, reduced time to market, etc. Thus, this study proposes that:

Hypothesis H1. A supply chain absorptive capability has a positive influence on innovation performance.

1.2 Social Capital and Innovation Performance

Social capital theory suggests that an organization can generate benefits from the knowledge captured within an organizational network (Tsai & Ghoshal, 1998). Operations management literature contends that social capital among different partners in a supply chain represents stages and levels of capturing, dissemination, and using of such creative ideas as knowledge, and information. Social capital can emerge between customers and product designers. Firms nowadays pay attention to understanding customer experiences, perceptions, demands, expectations, and preferences (namely, customer knowledge) that can be effectively leveraged by R&D teams to enhance innovation performance. Customer insights have been a critical factor for many industries to keep up the trends, and meet dynamic customer needs. Customer insights enable Zara to replenish products rapidly driven by customer demand and also offer frequent assortment rotation of products within 2 weeks of fulfillment (Aftab, Yuanjian, Kabir, & Barua, 2018). In 2015, timely knowledge created from the network with customers innovated Zara's pink scarves. 500,000 pink scarves were dispatched, and sold within 7 days later, in more than 2,000 Zara stores globally (Roll, 2020). The social capital created by collocated designers, and other members of the supply chain like the buying team, merchandising team, pattern-makers, and suppliers enhances lead time and responsiveness. This capital is from co-locating them to enable cross-functionality, and high coordination, increase product knowledge, and streamline the product design decision-making process. The team can use standard frameworks, and process mapping which can quickly be communicated across the supply chain (Phadnis, 2024; Roll, 2020). These capabilities, in return, disseminate the newly obtained knowledge and provide opportunities for creating innovative processes resulting in future market share, and revenues. Accordingly, this study proposes that:

Hypothesis 2. A manufacturer's social capital has a positive effect on innovation performance.

1.3 Cognitive Capital and Innovation Performance

Cognitive capital emerges when supply chain partners align their visions, and develop shared cultural values. Congruency refers to "the degree to which the needs, demands, goals, objectives, and/or structure of one component are consistent with the demands, goals, objectives, and/or structure of another component" (Nadler & Tushman, 1980). Without a common understanding between these partners (e.g. quality, and technological concepts), or lack of business vision, and top management support. Toyota shares technological understanding with suppliers to enhance supply chain quality. When the company discovered that some suppliers did not understand its technological innovations, they quickly shared an information system to give the supplier access to necessary knowledge of Toyota's process. This shared understanding enabled Toyota and the supplier to collectively improve the process, thus enhancing performance and creating benefits for the supplier. It also allowed the supplier to become a valued knowledge partner of Toyota, rather than merely operating as a low-cost vendor (Dyer, 1996).

After COVID-19, farmers continue to command the deepest trust, driven by expertise, and demonstrating shared values around caring for the planet. A green, and sustainable environment can be the shared value, and visions that have deepened consumer trust in the food supply chain – retailers and food service operators have been the key beneficiaries (Berti & Mulligan, 2016). Ensuring sustainable food production systems, and implementing resilient agricultural practices become important drive plans for many actors in the agri-food supply chains. Collaboration in this sphere enhances mutual understanding, a shared vision of green, and safety in food production systems. Cognitive capital plays an important role in enhancing production and maintaining ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding, and other disasters, and that progressively improve land and soil quality.

Furthermore, farmer's knowledge could facilitate the process of sensing the new niche market. Through its understanding of the product's nature and local niche market, thus creates new markets. Cognitive social capital is created when farmers and food producers share their understanding of the new product and new materials. This connection can emerge some collaborative ideas on new markets and potential demands, which directly influence performance such as market share. Therefore, this study proposes that:

Hypothesis 3. A supply chain cognitive capability exerts a direct positive effect on innovation performance.

1.4 Mediating Roles of Absorptive Capability (APC) Between Social, and Cognitive Capital, and Performance

The role of social, and cognitive capital, and knowledge created have been discussed in the above sections concerning innovation performance. Previous sections discuss the influences of social and cognitive capital on performances. This study suggests that the influence of newly created capital on innovation performance can be even greater when organizations enhance their absorptive capabilities. APC indicates the degrees or levels of implementation, and exploitation of new knowledge, and organizational resources. The accumulated knowledge from social networks and alignments with supply chain partners enhances organizations' ability to design more efficient and innovative products, and processes that contribute to improving quality, flexibility, and delivery, and reducing cost (Cousins, 2005; Ketchen Jr & Hult, 2007).

The APC could be a possible means to strengthen the relationship because the buying firm benefits from Absorptive capability such as quality improvements. With social capital gains from customer insights, Zara enhanced supply chain integration to support 2-week innovation delivery (Aftab et al., 2018). The intensive communication and joint workshops between designers and operations improve the quality of the final products. Literature shows that social capital creates pressures that can eventually enhance supply chain quality through better integration and more collaborations (Chu, Yang, Lee, & Park, 2017; Quibria, 2003). Cognitive capital gained from aligning corporate strategies and business cultures enhanced VW's supplier quality significantly in Brazil's automobile industry (Marx, Zilbovicius, & Sergio Salerno, 1997; Nguyen, Onofrei, & Truong, 2020).

Food producers often handle customers' innovative feedback, and suggestions to keep updated with the market trends. This capital and knowledge created will likely guarantee customer acceptance and market fit (Mansor, Yahaya, & Okazaki, 2016; Tarhini, El-Masri, Ali, & Serrano, 2016). On the other hand, customers who have been consulted and engaged in the designing and production stages can directly benefit from new or improved products or services, thus continuing the collaboration, and knowledge sharing. APC facilitates innovation and provides linkages to customers' and suppliers' knowledge, which will further influence the process and product innovation stages; thus enhancing quality improvements, and cost reductions on the buying firm's side (Malhotra et al., 2005; Saenz, Revilla, & Knoppen, 2014). Therefore, this study proposes the following hypothesis:

Hypothesis 4a,b. APC mediates the positive relationship between social (a), and cognitive (b) capital, and innovation performances

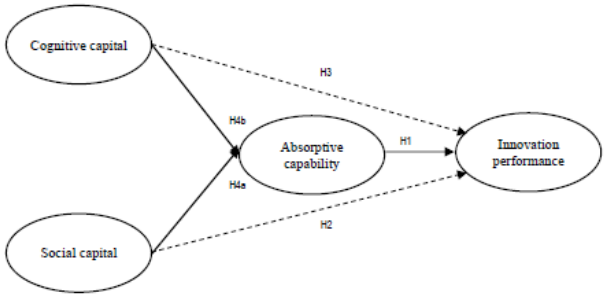

Figure 1: Research model

2. Research Methodology and Analyses

2.1 Research Design

This study employed a survey among food producers in Northern Vietnam. The original survey was in English, translated to Vietnamese using back-translation to ensure consistent use of the scales. Several changes have been adjusted to reflect better local practices after pilots with local experts in the Vietnamese Food Science and Technology Association. Table 1 indicates company profiles and characteristics. The questionnaire was sent via email to the members of the association and got 85 completed, and useable responses. The majority of the

samples were small, and medium-sized companies (90%). Firms included in the survey were mainly local (without foreign direct investment, FDI) and heavily import-oriented for their equipment and materials. These firms came from seven major agricultural products such as vegetables, fruits, cassava, meat, etc.

Table 1: Survey respondent profiles and characteristics

Industry	Frequency	Percent	**Size**	Frequency	Percent
Rice	5	5.9	Large	9	10.6
Vegetables and fruits of cultivation products	22	25.9	Medium	22	25.9
Meat and meat products	6	7.1	Small	54	63.5
Seafood and processed products	4	4.7	**Export Orientation**	85	100.0
Agricultural products (cassava, tea, cashew, coffee)	13	15.3	FullyExport	5	5.9
Drinks (juice, bottled water)	2	2.4	LittleExport	19	22.4
Sweet and candy	4	4.7	Local	41	48.2
Other processed foods	29	34.1	Significant	20	23.5
Foreign Direct Investment - FDI	85	100.0	**Import Orientation**	85	100.0
Dominant_FDI	2	2.4	FullyImport	5	5.9
Full_FDI	9	10.6	LittleImport	23	27.1
Local	67	78.8	Local	39	45.9
Small_FDI	7	8.2	SignificantImport	18	21.2
Total	85	100.0	Total	85	100.0

2.2 Research Constructs Development

Table 2 provides research constructs, questionnaire items, and their statistics. Supply chain absorptive capability includes questions related to the capability of obtaining, acquiring, and applying new knowledge (Cao & Zhang, 2011). Social and cognitive capital constructs were derived from existing literature (De Carolis & Saparito, 2006; Menor, Kristal, & Rosenzweig, 2007). Cognitive capital reflects firms' ability to share common language and codes; developing a common understanding of the same concepts such as quality, and delivery (Menor et al., 2007). Innovation performance was measured based on the number, frequency, and market share of new products (Chen, Lin, & Chang, 2009; Sadikoglu & Zehir, 2010).

This study employed several methods to check the reliability, validity, and consistency of the model. Cronbach's alphas indicated good results [0.82-0.89], which were above 0.60, the threshold value (Hair, Black, Babin, & Anderson, 2010). The confirmatory factor analysis indicated four unique constructs with good model fit indices ($\chi 2/df$ =1.46) and a moderate fit with RMSEA = 0.075. The CFA indicates in Table 3 acceptable discriminant validity.

Table 2: Constructs means, and reliability measures

Research construct measurements	**Estimate**	**Means**	**SD**
Coginitive capital - This organization and its partners have ...			
common understanding about what activities are best for our relationship.	0.680	4.81	1.19
shared objectives and visions.	0.758	4.60	1.16
share common language and codes (e.g. special vocabulary, abbreviation, and technical terms).	0.806	4.86	1.11
common understanding about the same concepts (e.g. good, fast, quality and safety).	0.899	5.11	1.24
similar behavioral rules and norms.	0.936	5.05	1.21
Social capital			
Establishing networks with suppliers and customers has had a significant impact on developing new ideas for our organization	0.885	5.36	1.17
I have an informal network among customers, suppliers and competitors	0.813	5.11	1.18
I consider that our future is related to other firms in the area	0.774	5.11	1.21
My organization has received considerable information about products and markets from local institutions	0.639	4.98	1.25
Absorptive capability			
Application of external information to our business contributes to our profitability	0.926	5.41	1.20
We convert external information directly into new business applications to be used on our business	0.991	5.32	1.16
Employees on our business record and store newly acquired knowledge for future reference	0.764	5.42	1.19
Our business regularly considers the consequences of changing market demands in terms of new products and services	0.537	5.42	1.25
Innovation performance			
Frequency of new products introduction.	0.921	4.59	1.17
Speed of introducing new products.	0.978	4.71	1.16
Number of new products.	0.881	4.81	1.17
Percentage of total sales stemming from new products.	0.773	4.76	1.13

Notes: χ2 = 152; df = 110; χ2/df = 1.38; CFI = 0.961; GFI = 0.931; RMSEA = 0.068. Note: SD: Standard Deviation; RMSEA=Root Mean Square Error of Approximation, GFI=Goodness-of-fit Index, CFI=Comparative Fit Index. The scale format for each of these measures was 1=strongly disagree to 7=strongly agree.

Table 3: Correlation matrix, and construct validity measures

Research measurements	CR	AVE	MSV	ASV	[1]	[2]	[3]	[4]
[1] Cognitive capital	0.90	0.70	0.14	0.09	**0.808**			
[2] Social capital	0.89	0.57	0.33	0.11	0.270**	**0.724**		
[3] Absorptive capability	0.88	0.64	0.59	0.18	0.220**	0.244**	**0.783**	
[4] Innovation Perf.	0.87	0.69	0.11	0.03	0.063*	0.068*	0.335**	**0.811**

Note: Diagonal elements in (bold-underlined) are the square root of the average variance extracted (AVE) between the constructs and their measures. Off diagonal elements are correlations between constructs. MSV – Max shared variance, and ASV – Average shared variance. For discriminate validity, AVE should be greater than off-diagonal elements. ** Correlation is significant at 0.001.

2.3 Hypothesis Testing

The model was tested using a structural equation model (SEM) in AMOS software. The sample size is slightly small compared to the rule of thumb around 100 cases for SEM analysis(Wang & Wang, 2012); however, considering the normally distributed data in this study, a ratio of 5 to 10 cases per variable may be sufficient. Besides, all the major indexes such as the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA) indicate good model fit, thus the model can be considered valid (Schermelleh-Engel, Moosbrugger, & Müller, 2003; West, Taylor, & Wu, 2012). Table 4 provides the results of the hypotheses among the research constructs. Supply chain absorptive capability has a positive impact on innovation performance measures (H1 accepted). Both social and cognitive capital influenced positively and significantly on APC.

Table 4: Results of the hypothesis testing

Research impacts		Estimate	S.E.	C.R.	P
Cognitive	=> Absorptive	0.306	0.138	2.21	0.027
Social	=> Absorptive	0.562	0.116	4.832	***
Absorptive	=> Innovation Perf	0.324	0.105	3.092	0.002

χ2 = 165.83; df = 113; χ2/df = 1.46; CFI = 0.95; NFI = 0.94; RFI = 0.84; RMSEA = 0.075. Note: S.E = Standard Errors;

P = *** Correlation is significant at 0.001.

2.4 Mediating Roles of APC

The influences of social, and cognitive capital can be directly, and indirectly via APC. This study employs structural equational models with boot-trapping procedures, recommended by (Mallinckrodt, Abraham, Wei, & Russell, 2006) to test for such mediation effects. Bootstrapping can be useful in this case with a relatively small sample size as it does not rely on assumptions of normality (Nevitt & Hancock, 2001). Table 4 provides outcomes of the direct effects with, and without the mediator. The test of the indirect effects between the Cognitive capital → APC → Innovation performances was significant (β = 0.058, p = 0.02). Since both direct and indirect relationships were significant, the mediation is partial. On the other hand, Social capital → APC → Innovation performances were significant (β = 0.205, p = 0.05), and fully mediated.

Table 4: Results of the mediating role of APC

Mediating factor - APC	Direct with mediator	Indirect	Mediation
Cognitive capital and InnPerf	0.215*	0.058*	Partial
Social capital and InnPerf	0.362	0.205*	Full

Note: ** significant at 0.01

2.5 Theoretical and Practical Implication

This research argued that supply chain absorptive capability, and innovation performance in an agricultural context can be influenced differently. Drawing upon the knowledge-based view, this study confirmed that both social and cognitive capital are important sources of developing supply chain absorptive capability. Development of social networks, and exchanging knowledge among supply chain partners may not be not enough for innovation performances. The results from this study show that managers should pay more attention to the application, and exploitation of newly learned knowledge. The accumulated capital created by the collaboration, shared business visions, and technological knowledge among farmers, producers, and customers become important resources for innovation development. In addition, supply chain partners, farmers, traders, and food processors should align their business vision, and goals to facilitate better collaboration, and innovation performance. The empirical results provide support to the argument of the importance of APC in enhancing social, and cognitive capital from supply chain partners to enhance agricultural innovation performance.

These results confirm the previous literature mainly in operations management that social, and cognitive capitals are key components for enhancing absorptive capability, and innovation performance (Ali, Hussin, Haddad, Alkhodary, & Marei, 2021; Aribi & Dupouët, 2015). It provides evidence that absorptive capability further enhances the impacts of social knowledge created by exploitations, and dissemination (Scuotto, Del Giudice, & Carayannis, 2017; Tortoriello, 2015). Recent literature indicates that food security and cleaner food supply chains are the top drivers for innovation in supply chains (Mehmood, Ahmed, Viza, Bogush, & Ayyub, 2021; Sharma, Mangla, Patil, & Liu, 2019). This study contributes to this important area of research by highlighting the mediating role of firm's supply chain absorptive capability in enhancing social and cognitive capital. This concept provides additional aspects of collaborative efforts among supply chain partners in jointly capturing, and applying knowledge in developing new products, and services, and improving processes (Cao & Zhang, 2011; Phadnis, 2024; Ramanathan & Gunasekaran, 2014). These results support previous research on social, and cognitive capital and their associated trust that facilitates higher absorptive capability (Ali et al., 2021; Malhotra et al., 2005). APC plays a significant role as "business intelligence" in connecting the dots and enhancing collaboration through organizational boundaries.

3. Limitations and Future Research

The results of this study are subject to several limitations. First, this study was conducted for small food producers, and cooperatives in Vietnam, thereby it has limited generalizability power. Therefore, it is recommended to explore findings in other types of industry sectors other than the agricultural processing industry.

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