A Theoretical Exploration for Supply Chain Leagility Capability: From the Dynamic Capabilities View

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Abstract
Given the growing emphasis on the need for supply chain leagility to sustain competitive advantage, this study explores the impact of the relationship between supply chain competence and supply chain leagility on performance of the firm in the global competition context. This study articulates the antecedents and moderators for supply chain leagility capability. We develop a conceptual model based on the dynamic capability view and suggest employing a survey methodology. The expected findings specify that leagility capability could be realized by developing four specific competencies: supply chain integration competence, IS Support for partnership management competence, IS planning competence, TMT behavior integration competence and employee competence. In addition, the model suggests that supply chain leagility capability will be more effective when firms face greater uncertainty. This study contributes to the growing body of conceptual and empirical literature on supply chain leagility and adds to the understanding of the complexity of supply chain competence.

1. Introduction

Companies are undergoing a revolution in terms of implementing new capabilities in response to the challenges and demands of the twenty-first century. A capability is the strategic application of a firm’s competences [44]. Businesses in the twenty-first century have to overcome the challenges of rapidly satisfying various demands of customers for products. To this end, leanness and agility capabilities have become necessary for the success of global supply chains, however, their impacts on firms are different [12]. A leanness capability is important for enabling firms to develop lean supply chains in order to get their products to consumers faster at a minimum total cost [20] [50] [59] [61]. An agility capability, on the other hand, is critical for enabling firms to design agile supply chains which are responsive to customers’ unique and rapidly-changing needs [28] [68]. Though both capabilities are important, a global supply chain with either a leanness or agility capability alone may still lose competitive advantage by not having the other.

The present market demands a more robust strategy inheriting the salient features of both lean and agile principles. For this purpose, Naylor et al. [47] coined the term “leagility” capability, which incorporates both leanness and agility capabilities. A leagility capability is defined as the combination of the lean and agile paradigms within a total supply chain by positioning the decoupling point so as to best suit the need for responding to a volatile demand downstream yet providing level scheduling upstream from the suppliers [71]. The decoupling point is in the material flow streams of a supply chain to which the customer orders penetrate [39] [40]. Compared to other single functional capability, a leagile supply chain could simultaneously reduce lead time and satisfy demand variety [39] [40] [64]. By utilizing this capability, a global supply chain will retain a lean process upstream and adopt an agile process downstream [39] [40] [47].

The concept of leagility capability has attracted interest from scholars in the last two decades. Prior studies have focused in two streams. First, scholars have examined the existence of this capability in the industry [40] [64] [78]. The growing interest of the leagile supply chain implementation in vast fields of manufacturing environment can be found from the work of Naim et al. [46], Bruce et al. [11], and Csillag [19]. They pointed out the applications of the leagile principles in the textile and telecommunication industries. Chan and Kumar [16] study all kinds of aspects of leagile supply chain modeling and bring up its application in the current manufacturing environment. Therefore, the leagile supply chain is not merely a theoretical concept but can be implemented in industry. Second, researchers have compared leagile supply chains with agile and lean supply chains [64]...
They have summarized the product characteristics, the important features of the corresponding production, and logistics processes for each supply chain, which could assist both researchers and practitioners in assessing their strategic fit in supply chain management [40] [63].

However, knowing the existence or characteristics of the leagility capability is clearly not enough. Compared to lean or agility capability, leagility capability can achieve the combined advantage. But there are more barriers to realize the hybrid capability as well, i.e. coordinating upstream lean process and downstream agile process. Thus, for the organizational supply chain management, how to develop its leagility capability is an important issue. In addition, organizations develop this capability so as to improve their performance. But whether the impact of this capability is limited to certain conditions is unknown. Without knowing the constrained conditions, the capability may not contribute to the performance thoroughly. Hereby, the purpose of the present study is to provide a theoretical exploration of this capability within the context of global supply chain. It focuses on the antecedents and moderators of supply chain leagility capability. Specifically, two research questions will be addressed:

1) What are antecedents to the global supply chain leagility capability?

2) Which factors moderate the effect of the supply chain leagility capability?

We answer the questions as follows. We first review the prior literature, paying particular attention to concepts of global supply chain challenges, supply chain leanness, agility and leagility capability. The theory of dynamic capability is introduced to provide a theoretical background. Our main framework relevant to dynamic capabilities within the global supply chain context is proposed. Finally, we provide a discussion on the implications of the proposed framework and present the concluding remarks of the present study.

2. Theoretical Background

2.1. Global Supply Chain Capabilities

The context of the present study is a global supply chain. A supply chain is viewed as the coordination of resources and the optimization of activities across the value chain to obtain competitive advantage [28] and is a set of value-adding activities that start from upstream suppliers to downstream customers [4]. The trend of technological, economical and cultural globalization facilitates the emergence of global supply chains. More and more corporations are establishing global supply chains, and organizations are realizing that global opportunities and global challenges are interrelated [4]. Compared to a local supply chain, a global supply chain provides more opportunities as well as substantial challenges. One kind of challenge comes from the diversity of customers’ needs. The supply chain in the global market intends to respond to various customers’ needs in the international market quickly [4] [63]. Another kind of challenge comes from the resource. Due to global competition, how to utilize resources in the most cost-efficient manner is crucial for firms. A failure to manage global challenges and global competition could lead to lower firm performance [27]. Firms which are in this environment have to act fast in developing capabilities to overcome global supply chain competition and challenges.

In response to the challenges involved with developing a global supply chain, two supply chain capabilities have long been suggested as possible ways to improve the performance of firms with global supply chains: leanness and agility. Leanness capability is defined as a global supply chain capability that develops a value stream to eliminate all waste [20] [50] [59] [61]. The main characteristic of leanness capability is eliminating all waste. Few products made from a lean supply chain are customized. The customers of such global supply chain will receive their order quickly, since the production is already accomplished based on a forecast of demand. Thus, it is also called “ship to stock” in the operation and production literature [28] [63]. A leanness capability contributes to firm performance due to two advantages: 1) it can reduce lead times; and 2) it is cost efficient upstream with suppliers since it seldom places stock in warehouses [4] [63]. These two advantages are important when facing market uncertainty. First, lead time reduction is crucial for improving customer service and seizing the customers’ needs [6] [7]. Second, cost efficiency will gain a competitive advantage from the financial aspect. Thus, this capability is especially appropriate when the downstream demand is relatively predictable.

Agility capability is defined as a global supply chain capability which could exploit profitable opportunities in a dynamic marketplace by using the market knowledge [28] [68]. Unlike a leanness capability, a supply chain with an agility capability could respond to changes in downstream demand quickly. A global supply chain with agility capability will have the products customized to customers’ unique and rapidly changing needs [27] [63]. Since it allows customers to design products that meet their unique individual tastes, the production process only starts after the order is received. Thus, it is also called “buy to order” [28] [63]. Agility capability could lead
to competitive advantage with its customer service and flexible logistics [4] [28] [63]. By satisfying individual requirements, it could attract more customers by allowing customization. Flexible logistics is vital to the global supply chain under environmental uncertainty, since more agile supplier relationship management will lead to finding a substitution more quickly. Therefore, this capability is effective especially under the environment of low volume but high variable production [63].

As can be seen from the above discussion, both capabilities are effective for global supply chains, while each one has its limitations relative to the other. Scholars once believed that leanness and agility capabilities were distinct concepts that were not entirely compatible [32]. Recently, some researchers have begun to suggest that leanness and agility capabilities are mutually supportive [35] [40] [47]. They argue that leanness is an overarching concept that is compatible with any production system and they view agility as an interface between the production system and the market. Hence they conclude that employing both strategies within an organization can be beneficial [35]. Therefore, they suggest that leanness and agility can be combined by using decoupling point strategically [40]. The decoupling point is in the material flow streams of a supply chain to which the customer orders penetrate [39] [40]. The capability of a combination of leanness and agility capability is known as leagility, which could suit the need from downstream while provide level scheduling from upstream efficiently [47]. A global supply chain with leagility capability is called a leagile supply chain, which adopts a lean manufacturing approach upstream and an agile process responding to downstream demands. The decoupling point is set to separate the two different processes.

There is internal inconsistency within these two processes due to the underlying tradeoff between lead time reduction and demand variety satisfaction. Satisfying customized demands is usually at the expense of increased lead time. Thereupon, it leads to two barriers of realizing a leagile supply chain. First, it is difficult to coordinate the activities related to the two processes since they are not interconnected. Second, it is hard to set the decoupling point. Shifting the decoupling point towards upstream will facilitate global supply chain focus more on agility while moving it to the other end will expand lean process. For a particular global supply chain, thereby, identifying the optimum decoupling point based on the dynamic environment is essential for realizing leagility capability.

There are already studies which depict leagility capability of supply chain, yet previous research focus on the existence and characteristics of such global supply chain by comparing the lean or agile type [64] [78]. These approaches fail to explain how leagility capability is developed. Due to the barriers to attain it, leagility capability is valuable and hard to be imitated by competitors. Further, the leagile supply chain could sense and seize the environment change via the downstream process while the upstream lean process keeps cost-efficiency advantage. Thus, leagility could be viewed as a supply chain dynamic capability. In the next subsection we will introduce the theory of dynamic capability, and further utilize its framework to explore the antecedents and moderators for the supply chain leagility capability.

### 2.2. Dynamic Capabilities

A dynamic capability is defined as the ability to integrate, build, and reconfigure internal and external competencies to address the rapidly changing environment [66]. Research on dynamic capabilities is rooted in the resource-based view of the firm [5]. Resources are the stocks of available factors that are owned or controlled by the firm [3]. According to the resource-based view, a firm consists of a collection of productive resources that can be exploited to create value and advantage [77]. Competition among firms is on the basis of their own unique resources, which are valuable, rare, inimitable and non-substitutable by other resources [5] [77]. Even so, resource themselves do not create value [10] [53]. Value is created by the organization’s competence and further by capability. Competence is defined as the ability to deploy and apply resources [41] [52] and capability refers to the strategic application of competences [44]. Moreover, in order to sustain competitive advantage, Teece et al. [66] have argued that firms need dynamic capabilities. With dynamic capabilities, firms can sense and seize opportunities, particularly in rapidly shifting markets, and reconfigure the proper competence to address the emerging growth opportunity [67]. By quickly adapting environmental changes, a dynamic capability contributes to a firm’s sustainable development. There are increasing evidences that a firm’s performance can be positively affected by dynamic capabilities [49] [80]. How firms can leverage their own competence in creating and sustaining competitive advantage has been a concern for scholars.

Since the dynamic capability is important for firms’ performance, several studies have already discussed how firms establish dynamic capability by strategically developing competences. For example, Tarafdar and Gondon [65] analyze six competences--- Knowledge Management, Collaboration, Project Management, Ambidexterity, IT/Innovation, Governance, Business-
IS Linkages. All of them could facilitate the organizational capability for process innovation, which contribute to the firm’s performance. The study of Wang and Shi [76] has shown that three different competences-- IT infrastructure, Business-IT knowledge alignment and System integration have a positive impact on the dynamic capabilities of small and mid-sized enterprises (SMEs). Capability is a meta-level construct, which means that it will be underpinned by different competencies in various contexts [52]. Therefore, when studying a new type of dynamic capability, its antecedent competences needed to be carefully investigated under the new context.

The competence supporting supply chain capabilities is called supply chain competence [48]. According to the 21st Century Logistics framework, competences contributing to high supply chain performance can be grouped into three categories [8]. The first one is operational competence, which includes supply chain order fulfillment and replenishment; the second is planning competence, which focuses on information technology and systems; the last one is behavior competence, which refers to employee competence [9] [18]. Based on this framework, the supply competences underlying supply chain capability will be discussed from three perspectives - operational, information systems, and human management. According to Teece et al. [66], operational competence should be the core competence for the global supply chain leagility, which defines the fundamental business. Both information systems (IS) competence and management competence are complementary competences.

Following the dynamic capability view framework [66], the present study will examine the enablers and moderators of supply chain leagility capability. Identifying the antecedents and moderators are important to understand the leagility capability. For one thing, knowing the competence foundation for the leagility capability is the key path to achieve it. For another thing, specifying the moderator is important for managers to ascertain the application boundary for the leagility capability. Thus, we will discuss antecedents for the supply chain leagility capability from operational, information systems and management competence respectively. In the following section, we propose our theoretical framework and related propositions suggested by the theory of dynamic capability.

3. Antecedents and Moderators for Supply Chain Leagility Capability

3.1. Operational Competence

Operational competence refers to the ability of an organization to utilize its resources to support supply chain capability [48]. We suggest that supply chain integration, which is regarded as one important competence in global supply chain management, is one antecedent for leagility capability. Supply chain integration is the capability to facilitate each global supply chain partner collaboratively managing within or cross organizational processes for realizing the same target [55] [79]. The construct of supply chain integration is composed of three parts: supplier integration, internal integration, and customer integration [9]. Supplier integration means creating close ties with material suppliers; internal integration involves coordinating all the activities, such as procurement, manufacturing, and customer fulfillment; and customer integration satisfies closely with customers’ choice [18].

As discussed above, a leagile supply chain is able to exploit market opportunities in a cost-efficient manner. The supply chain leagility capability could be enhanced by utilizing supply chain integration competence. First, it enables the construction of leagile supply chain. Downstream customer integration helps a firm respond to customers’ requirements quickly while upstream supplier integration facilitates collaborating with suppliers closely in a cost-efficient way. Second, it renders both lean and agile process compatible. With an integrated supply chain, the degree of inter-organizational cooperation is visible [56]. Internal integration connects two ends into a seamless process which supporting customers’ needs. External performed work, such as retrieving materials from customers and obtaining information from customer, is linked seamlessly with internal activities for a mutually-beneficial outcome, such as manufacturing and assembling. Since both upstream lean process and downstream agile process are striving for the common goal, they will work more coherently. Thereby, we propose:

\[ P1: Supply \text{ chain integration positively affects global supply chain leagility capability} \]

Though supply chain integration competence is important, this competence itself is not sufficient to sustain the leagility capability. The main weakness is that it does not reflect the attributes of dynamic capabilities from two aspects. First, though it could closely observe the current demand, it is unable to estimate future changes. Second, it fails to benchmark competitors. Exposing to external environment will drive adopting the better practice, such as the way of supply chain integration [55]. Therefore, a global supply with only this operational competence may not be able to adapt to the dynamic environment. IS
competence provides strong support for core competence in adapting to the dynamic environment. However, supply chain leagility may not be fully actualized without management competence since its operation is carried out and is led by management team. Therefore, we need to further examine effect of both information systems and management competences.

3.2. Information Systems Competence

Information Systems (IS) competence is defined as the firms’s knowledge about IS and the way to effectively utilize IS to manage information within the firm [69]. Though IS competence itself may not contribute to the competitive advantage, appropriately leveraging it can enhance firm performance even in a dynamic environment. Prior studies have shown that IS resources are particularly useful to firms operating in rapidly changing environments [73]. Among various IS competences [51] [52] [73], IS support for partnership management and IS planning are sufficient as they are the most obvious contributions to the supply chain leagility capability.

IS support for partnership management competence refers to the ability to make contracts and build relationships by using information systems [52]. For a supply chain, its partners include upstream suppliers and downstream retailers. IS support for partnership management competence is important for leagile supply chain. First, managing contracts by information systems could facilitate collaborating efficiently with upstream suppliers, since contracts detail the procedures and responsibilities of the suppliers [3] [38]. Information systems could evaluate the performance as well, which help prevent information leakage. Second, developing value-added downstream relationships with retailers could facilitate the monitoring of the market and sensing changes in it. It will contribute to responding to the demand variety. Third, by synthesizing the information from both supplier and retailer, the global supply chain will be more visible and the decoupling point could be set based on the situation. Finally, when facing extreme environment changes, such as those after an earthquake or tsunami, alternate suppliers should be prepared in advance based on the information collected so as to have the upstream continue working efficiently. Ensuring that the partnership continuously adapts to change via information systems is one important aspect of partnership IS support for management competence [42]. Accordingly, we propose:

\[P2: IS\text{ support for partnership management competence positively affects global supply chain leagility capability.}\]

3.3. Human Management Competence

Human management competence is the ability to utilize human-related resources to support supply chain capability [48]. There are two kinds of human management competence which may facilitate supply chain leagility, which are top management team (TMT) behavioral integration and employee competence.

As defined by Hambrick [30], behavioral integration is a “meta construct” which represents the degree to which the group engages in mutual and collective interaction. This competence could recasts group process elements that were previously represented by separate constructs, such as social integration, frequency and quality of member exchange, and collaboration [15]. A behaviorally integrated TMT is characterized by a high degree of teamness [31]. Team members are more willing to open information exchange and collaboratively based solutions and decisions. Such collectively derived decisions normally
receive higher commitment and follow-up from members of the team [14].

Top management teams are responsible for balancing short-term and long-term performance by allocating resources strategically and making organizational decisions [23] [30]. Emphasis on integration facilitates top management teams participating in paradoxical decision making processes [62]. With appropriate team design and leader coaching, management could embrace paradoxical cognitions [29] [74]. This enables the global supply chain to balance both lean and agile processes. Besides, top management team with integrated behavior has the ability to establish a social control in partnership [22]. As a complementary mechanism for formal control, such as contracts, it could facilitate protecting intellectual property through communication and negotiation. Therefore, we propose:

**P4:** TMT behavior integration competence positively affects global supply chain leagility capability.

In addition to top management team, the lower level employees’ competences also contribute to the supply chain leagility capability. Employee competence indicates the ability of employee to understand the overall environment, to accomplish the task and to interact with other parties [26] [48]. A leagile supply chain requires a cost-efficient collaboration with upstream suppliers as well as a tailored satisfaction with downstream customers. Thus, the ability to interact efficiently with different suppliers and communicate effectively with various customers is crucial for leagile supply chain. In addition, understanding the overall business environment can facilitate employees to sense the changes in either upstream or downstream. If the organization only has a strong top management team but with weak lower level employees, the strategies brought up by the managers could not be carried out effectively. It is possible that the employees’ activities are not aligned with the upper managers if the employees do not have the related knowledge and capabilities. Thus the employee competences can enable the supply chain leagility through the ability of communicating with each party and enhance the supply chain operations. Therefore, we propose:

**P5:** Employee competence positively affects global supply chain leagility capability.

### 3.4. Moderators

Leagility is a unique capability which is adaptable to the dynamic change. It implies that, the more stable the external situation is, the less effective the capability is. The non-substitutable advantage of leagility capability will present in a higher degree of global uncertainty. In the dynamic international environment, there are unexpected and demanding situations which may affect the performance of firms with global supply chain. Therefore, the influence of global supply chain leagility on firm performance may be affected by global uncertainties. In this section, we make propositions regarding how uncertainties impact the effectiveness of supply chain leagility.

Three types of global uncertainties have been defined in the prior literature, which are viewed as challenge for global supply chains [43]. The most influential uncertainty is environmental uncertainty, which is defined as the degree to which the change of policy and natural environment is unpredictable [25]. In the current global supply chain, upstream suppliers may exist all over the world to provide different components. Thus, the global supply chain is much more vulnerable to even the local environment changes. For example, climate change may create price volatility in the raw material (i.e. corn) market. In beverage industry, the organization which intends to satisfy exactly customers’ demand and reduce cost simultaneously will be affected in failing to utilize the most proper material. Similarly, policy changes in one local area can have an influence on the global economy. The prices of rare earths are skyrocketing after China tightened their export in 2010.

The second type of uncertainty rises from market uncertainty, which is the degree to which the markets are composed of world-wide competitors and customers [21] [45]. Compared to a local supply chain, a global one is exposed not only to international customers but also to world-wide competitors, which enlarge the probability of encountering uncertainties [4]. The last type of uncertainty is from information uncertainty. It is the degree that the local regulations will protect the exchange information with suppliers [33] [75]. One risk of developing a global supply chain is that different countries have different sensitivity of information security, such as protecting business secrets, patents, and copyrights. Collaborating with suppliers in countries which have less protection of intellectual property can threaten a firm’s competitive advantage. Thus, we propose:

**P6:** Global uncertainty (including environmental uncertainty, market uncertainty, and information uncertainty) positively moderates the impact of supply chain leagility capability on the performance of firms with global supply chains.

Based on all the propositions and arguments, the research framework is presented in Figure 1.
4. Framework Validation and Value

In this study, we have integrated the extant literature on supply chain leagility capability and have proposed a theoretical framework for the capability development. Further, we have argued that the leagility capability will play a more important role in dynamic environments than in static environments. This framework can serve to provide guidelines to firms with global supply chains so that they can better understand the competences importance to sustain competitive advantages and survive in a dynamic environment. The proposed framework can be further tested and validated by conducting survey based quantitative analyses using the common tolls such as structural equation modeling. Once again, the study focuses on the firms with global supply chains. Appropriate respondents are suggested to be chosen from supply chain managers, logistics managers, or procurement managers based on two considerations. First, they are in a position which can provide an adequate overview of supply chain activities [60]. Second, they have knowledge about the content of research topics. A self-assessment could be conducted to test their above-mentioned ability [37]. Following the procedures suggested by Churchill [17], the scale for each construct will be developed or adapted from the prior literature. Critical control variables (e.g. size) should also be considered to explicate the real effect of leagility capability.

We have finished the instrument development for the potential future study. Supply chain leagility is measured as a reflective construct. As shown as Figure 2, it is reflected by two constructs: upstream leaness and downstream agility. The construct global uncertainty is captured by three sub-constructs: information uncertainty, market uncertainty and environmental uncertainty, which is as shown in Figure 3. For each construct, we develop the measurement items adapted from previous literature.

We are now conducting the pretest for the model and test the validity of the measurement. Despite that this framework is not tested empirically, the present study fills a significant theoretical research gap in the literature related to exploring IS competence underpinning supply chain capability, thus making important theoretical and practical contributions.
Theoretically, our study has contributed the literature from two perspectives. First, although leagility has been mentioned in previous studies, its development to supply chain management by organization is largely missing. Leveraging theories from other disciplines, i.e. management and information systems, allows us to investigate the enablers, moderators of this capability systematically from a new angle. The present study is one of the initial efforts to extend the understanding of the concept of leagility in the global supply chain management context, as well as explore the way to realize it. Second, we articulate a framework which delineates the competencies contributing to firm performance through supply chain leagility capability. It enriches our theoretical understanding of how capabilities can be acquired through supply chain management. In addition, it suggests that the global uncertainty acts as a moderator between a leagility capability and organizational performance offers a theoretical estimation of its potential effects.

Practically, this study provides the practical path to advance the leagility capability. In terms of the view from decision makers, this study answers the question that why firms with global supply chain need the leagility capability and how they could develop it. It reveals the value of supply chain competence in supporting supply chain capability and firm performance. Further, the influence of supply chain leagility capability is conditioned by the degree of global uncertainty. Thus, this study provides a comprehensive understanding for supply chain leagility capability, including its enablers, and moderators. Hence, firms with global supply chains in the environment with a high degree of uncertainty can utilize the resources toward the creation of operational, IS and management competencies in order to gain competitive advantage. Insights from the proposed framework will facilitate managers to have a strategic plan for the achievement of supply chain leagility.

5. Reference


