

# The Roles of Dynamic Capabilities and Supply Chain Resilience in Enabling Supply Chain Performance with Disruption Considerations

*Research-in-Progress*

Shih-Jung Juan

Eoo-Tsong Lin

## Abstract

*Along with the globalization and the multi-level complication of a supply chain (SC), the possibility and frequency of SC disruption occurring increase in the volatile environment, which badly affect SC performance (SCP). After literature review, we find that dynamic capability (DC) and SC resilience (SCREC) seem to be the solutions for enabling SCP with disruption considerations. In this research, we will examine DC as antecedents, SCRES as mediator, SCP with disruption considerations as dependent variable to fill the research gap regarding the relationships among the three, and to help a firm find out which DCs are needed for enabling SCP with disruption considerations.*

**Keywords:** Supply Chain Disruption, Dynamic Capability, Supply Chain Resilience, Supply Chain Performance

## Introduction

With increasing environmental uncertainty and globalization, organizations must now more than ever obtain competitive advantages to achieve success. Competition no longer exists merely among organizations but among SCs (Wu et al., 2014), so organizations must factor in the capacities of upstream suppliers and the needs of downstream customers to rapidly respond to external volatility. In this process, SCs have the key role. Moreover, SCs are more complex as they include multilevel suppliers or customers, increasing their vulnerability. Dynamics of the external environment, such as technical progress, changing customer needs, political considerations and economic factors, increase the possibility of SC disruption. When SC disruption emerges, it is crucial to understand which capabilities a focal firm or a SC must have to remedy the disruption. This study focuses on SCP with disruption considerations, rather than SC disruption alone, so its key target is SCP during or following SC disruption, and the antecedents of SCP with disruption considerations are the main focus.

Based on a literature review, two capabilities are proposed. First, SCRES demonstrates its importance in the disruptive situation. Second, from dynamics view, DC is a solution of environmental volatility. When SC disruption occurs, resilience is the most important factor for survival, so SCRES is closer to SCP with disruption considerations than DC. Rojo et al. (2018) note that a hierarchy of firm capabilities is composed of operational routines and DCs. The former is operational functions of the organization, and

the latter is modifications of operational routines. They are related in that operational capabilities are the visible outcome of DCs (Liu et al., 2013). DC is a value-creating strategy that can improve operational capability; and over the long-term, it is an evolutionary process supporting an organization's growth. Juttner and Maklan (2011) note that SCRES consists of four capabilities: SC flexibility, SC velocity, SC visibility and SC collaboration (SCC); and of these flexibility, velocity and visibility are included under "agility". Therefore, SCRES include SC agility (SCA) and SCC. Liu et al. (2013) consider SCA as an operational capability. Likewise, SCRES is assumed to be an operational capability. Accordingly, we reasonably assume that the DC of a focal firm would be the most influential factor of its SCRES.

Several studies find that SCA significantly affects a firm's financial or operational performance (Tse et al., 2016; Chan et al., 2017; Martinez-Sanchez and Lahoz-Leo, 2018; Liu et al., 2013; Al-Shboul, 2017; Gligor and Holcomb, 2012). Similarly, Wu et al. (2014), Panahifar et al. (2018) and Pradabwong et al. (2017) demonstrate that collaboration supports a firm's performance. DC is a factor widely applied to explain variances in performance across competing firms (Liu et al., 2013). To date, given the sparseness of literature on how DC affects SCRES, only Lee and Rha (2016), who regards SC ambidexterity as resiliency of SC, examine the effect of DC on the resiliency of SC. In fact, Lee and Rha (2016) do not focus on the effect of DC on SCRES, but on SC ambidexterity. Moreover, it is unclear whether DCs can directly improve organizational performance. Wilden et al. (2013) find that DCs can directly influence organizational performance only when organizational structure is more decentralized, self-managed, and has local autonomy, or it is under a more competitive environment. In other words, the performance effects of DCs are contingent on organizational structure and competitiveness of the market.

According to resource-based theory and knowledge-based theory, DCs are divided into resource-based dynamic capability (RBDC) and knowledge-based dynamic capability (KBDC). In this study, RBDC, KBDC, SCA, SCC and SCP with disruption considerations contain complex concepts. According to Teece (2007), RBDC is formed by a framework, consisting of sensing, seizing and transforming capability. In addition, literature review shows that absorptive capability (AC) (Zahra and George, 2002; Liu et al., 2013), knowledge management process capability (KMPC) (Cantor et al., 2014) and organizational learning capability (Wu and Chen, 2014; Rojo et al., 2018) can define KBDC. Because agility includes flexibility, velocity and visibility according to Juttner and Maklan (2011), agility is extended to the SC context as SCA. We assume that SC flexibility, SC visibility and SC velocity can form SCA. SCC is reflective by four dimensions, including sharing common goals, incentive alignment, information sharing and communication, and joint activities (Pradabwong et al., 2017). SCP with disruption considerations is formative by financial and non-financial measures (Wu et al., 2014).

In this study, we explore the roles of two DCs of the focal firm, including RBDC and KBDC, as well as SCRES, comprising SCA and SCC, to see how they enable SCP with disruption considerations, combining SCP and SC disruption, to fill the research gap among these three. Furthermore, KBDC, SC velocity and SCP with disruption considerations are all first proposed as newly conceptualized constructs, and SCA is re-conceptualized, showing the uniqueness of this research model.

## **Literature Review and Research Hypotheses**

We develop the research model by combining the three research streams of SCRES, DC and SCP with disruption considerations. In this section, we propose our research model, literature review and research hypotheses.

### ***Research Model Development***

In this study, we explore the capabilities of successful SC in a dynamic environment. A competitive SC must have resilience to disruptions or vulnerabilities and the focal firm must have sufficient DC to deal with environmental uncertainty. Thus, we combine RBDC with KBDC and SCRES to reduce the impact of SC vulnerability and SC disruption. This can enable an effective model of SC risk management that achieves better SCP with disruption considerations. In this research model, DCs of the focal firm, including RBDC and KBDC, are antecedents; SCRES, consisting of SCA and SCC, are mediators; SCP with disruption considerations of the focal firm is a dependent variable. We describe the research model as Figure 1.

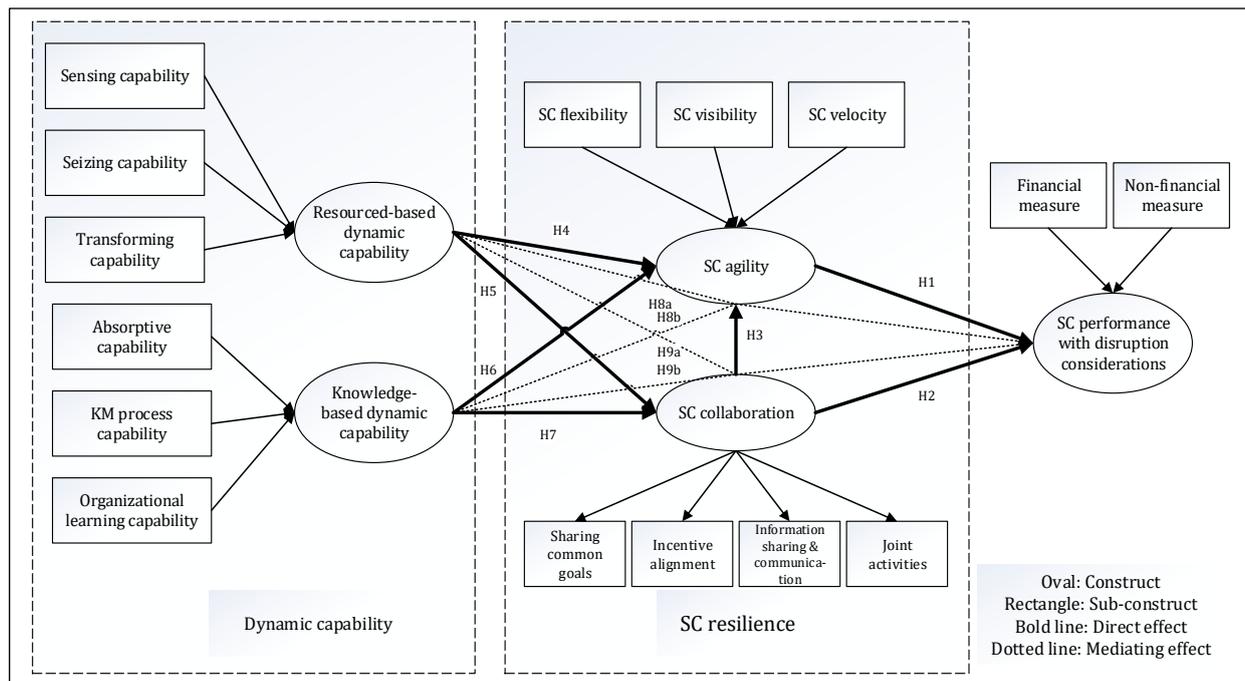


Figure 1. Research Model

### Development of Hypotheses

#### Supply Chain Resilience and Supply Chain Performance with Disruption Considerations

Some SCs recover from risk events more effectively than other SCs, which leads to concern about SCRES (Juttner and Maklan, 2011), though there are few empirical studies of SCRES. Juttner and Maklan (2011) note that “SCRES addresses the SC’s ability to cope with the consequences of unavoidable risk events in order to return to its original operations or move to a new, more desirable state.”

Chan et al. (2017) note that agility helps deliver value to customers, face changes readily, value human knowledge and skills, and form virtual partnerships. To survive in a volatile business environment, firms should not only be agile themselves but should also be agile within their SC relationships (Tse et al., 2016). Chan et al. (2017) contended that a firm’s level of SCA represents the strength of the interface between the firm and its markets. Swafford et al. (2006) define SCA as the capability of the SC to adapt or respond quickly to a dynamic and unpredictable business environment. An agile SC enables its member firms to be more market-sensitive, more capable of synchronizing supply with demand, and better able to achieve shorter cycle times, so SCA is widely considered to be the most critical success factor in today’s competitive marketplace (Chan et al., 2017). Tse et al. (2016) regard SCA as a firm’s ability to transform the threats of market uncertainty and SC disruption into competitive opportunities by increasing visibility in inventory and demand levels, and satisfying customer needs with speed and flexibility. This is in line with the view of Juttner and Maklan (2011). Accordingly, we consider SCA to form by the three dimensions of flexibility, visibility and velocity.

Upton (1997) defines flexibility as “the ability to change or adapt with little penalty in time, effort, cost or performance.” Swafford et al. (2006) posit that flexibility in a firm’s SC process derives from co-alignment of its range and adaptability dimensions. Swafford et al. (2006) propose that SC process flexibilities include procurement/sourcing flexibility, manufacturing flexibility and distribution/logistics flexibility in a firm’s internal SC. Rojo et al. (2018) note that SC flexibility refers to the ability of a SC to react to changes in the environment. Researchers have suggested which dimensions SC flexibility should include, and we here adopt the model of SC flexibility proposed by Moon et al. (2012). A flexible SC can be not only a reactive capability, but also perform a strategic role (Rojo et al., 2018). In uncertain environments, firms can develop a competitive advantage by using flexibility to handle uncertainty and dynamics better than their rivals (Rojo et al., 2018).

Williams et al. (2013) define SC visibility as the access to high quality information that describes various factors of demand and supply. Scholars assume that the critical factors accelerating SC visibility are an automatic system and closer relationships between the SC partners. There is agreement that the resulting SC visibility is useful for high quality of information sharing (Papert et al., 2016; Wei and Wang, 2010; Williams et al., 2013).

Though speed is critical in SCs to sustain competitive advantage, there is currently little consensus over a definition of SC speed. Chan et al. (2017) note that the speed of a firm's response to key SC outcome measures reduces manufacturing lead-times, increases new product introductions, and improves customer service. Speeds pertinent to SC management (SCM) include customer response speed (Chiang et al., 2015), purchasing decision-making speed (Kaufmann and Gaeckler, 2015) and product launch speed. Here we combine the SC velocity concept suggested by Chan et al. (2017) and two specific SC speed constructs proposed by Chiang et al. (2015) and Kaufmann and Gaeckler (2015) in our SC velocity construct.

The SC Operations Reference (SCOR) model measures SCP by monitoring and diagnosing overall SC health using APICS (2017). To improve SCP measurement, Beamon (1999) proposes a new framework for SC performance measurement including three key elements of strategic goals: resource, output and flexibility. Wu and Chang (2012) using the balanced scorecard propose SC performance measurement in the e-SCM context. Wu et al. (2014) further categorize organizational SCP measurement into finance and non-finance in a complementary manner.

SCA reflects the complex coordination and integration among different channel members, which enable firms to change SC practices in response to market changes (Liu et al., 2013). Due to the growing need for timely and cost-effective means of product and service delivery, SCA is necessary for superior firm performance (Liu et al., 2013). SCA mediation between antecedents and firm performance is evidenced with significant impact by Chan et al. (2017), Liu et al. (2013), and Gligor and Holcomb (2012). Even focusing on the effects of disruption, we still argue that SCA is a determinant of SCP. Accordingly, we propose the following hypothesis:

H1, SCA has positive impact on firm's SCP with disruption considerations.

There are several important reasons for inter-firm collaborations, for example, sharing the cost of large investments, spreading risk, and accessing complementary resources (Wu et al., 2014). Firms may collaborate to access resource combinations or improve capabilities (Pradabwong et al, 2017). Liao, Hu and Ding (2017) note that collaboration is a significant process that leads to value-creation opportunities in SCM. SCC targets mutual benefits and profit maximization for the SC members through a well-coordinated plan and delivery of offerings (Pradabwong et al, 2017). Prior research has identified SCC in various ways, generally concerned with the relationship, the process and mutual benefits gained from collaborating with SC partners (Pradabwong et al, 2017). Angerhofer and Angelides (2006) propose "a collaborative SC model" that includes stakeholders, business strategy, processes, enabling technology, topology and levels of collaboration.

In a collaborative SCM, transacting partners (e.g. suppliers and their customers) exchange and integrate information to make strategic or tactical joint decisions (e.g. supply and demand forecasts) (Panahifar et al., 2018). Trading partners with a higher level of collaboration can achieve better operational performance (Panahifar et al., 2018). That collaboration supports a firm's performance is found by Wu et al. (2014), Panahifar et al. (2018) and Pradabwong et al. (2017). We also assume that SCC is a precursor of SCP despite SC disruptions. Therefore, we postulate:

H2, SCC has positive impact on firm's SCP with disruption considerations.

Most SCC approaches encourage sharing information (Panahifar et al., 2018). The results of improved information sharing include improved coordination for faster response, increased agility and greater flexibility (Panahifar et al., 2018). SCA requires a firm to closely supervise the legally separate but operationally interdependent partners to maintain a close and coordinated relationship (Liu et al., 2013). This means that SCA refers to how well a firm collaborates with its channel partners in executing SC practice (Liu et al., 2013). Thus, better SCC leads to higher SCA. Gligor and Holcomb (2012) find that SC coordination, cooperation and communication are the determinants of SCA. Accordingly, we propose the following hypothesis:

H3, SCC supports SCA.

### **Dynamic Capability of the Focal Firm and Supply Chain Resilience**

Liu et al. (2013) note that “DCs are defined as the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments and achieve new and innovative forms of competitive advantage.” The DC perspective is a widely applied paradigm to explain how performance varies across competing firms (Liu et al., 2013). DCs emphasize the importance of change in the capabilities that support firm-specific resources, and they focus particularly on the development of these resources. Because DCs include both tangible and intangible resources of a firm, we refer to them as resource-based dynamic capabilities (RBDCs). RBDCs include three clusters of activities: sensing, seizing and transforming capabilities (Teece, 2007). Sensing refers to scanning, perceiving, absorbing, and interpretive activities of organization. Seizing refers to the ability of organization to make timely decisions in order to develop new opportunities. Transforming is the ability of organization to reconfigure organizational resources timely and efficiently for matching the changed environment. RBDCs are generated and based only on the combination of these three capabilities, so we can consider RBDCs as a strategic integrating capability.

However, SCA is one type of operational capability (Liu et al., 2013), and in the firm capability hierarchy proposed by Rojo et al. (2018), DC is higher than operational capability. Thus, after a focal firm makes a strategic decision, this strategy would modify operational process. Vanpoucke et al. (2014) reveal that supplier integrative capability (i.e. RBDC) significantly influences process flexibility. Moreover, Dubey et al. (2018) show that SC connectivity is a predictor of SC visibility, while Zhang and Cao (2018) find that inter-organizational systems are a predictor of SCC. Hence we regard SC connectivity and inter-organizational systems as one type of assets within SC and propose the following hypotheses:

H4, A firm’s RBDC supports SCA.

H5, A firm’s RBDC supports SCC.

A DC with intangible resources such as knowledge is also a source of competitive advantage. From the organizational learning perspective, recognizing the new external knowledge from SC partners is a very important process within knowledge acquisition. Furthermore, an organization utilizes the knowledge management (KM) system to organize and disseminate useful knowledge among its employees. And the organization continues to learn through external challenges. In this study, we formulate KBDC with AC, KMPC and organizational learning.

Zahra and George (2002) consider AC as “a DC pertaining to knowledge creation and utilization that enhances a firm’s ability to gain and sustain a competitive advantage”. KMPC is the ability of an organization to acquire, create, transfer, integrate, share and apply knowledge related resources and activities across functional boundaries to generate new knowledge. It should be recognized that organizational learning as a group-based learning approach originates from individual learning (Wu and Chen, 2014).

An organization with knowledge-based dynamic learning capability will generate collective memory that is embedded in the processes and culture of the organization. Therefore, an organization with KBDC would make better strategic decisions in response to a changing environment than its competitors. These effective strategies will in turn support their SC operations and executive factors such as SC flexibility, SCA and SCC. Liu et al. (2013) find that AC has a significant effect on SCA, while Rojo et al. (2018) show that both operational AC and organizational learning are the determinants of SC flexibility. Cantor et al. (2014) show that the KM process is a predictor of joint planning with suppliers. Accordingly, we propose the following hypothesis:

H6, A firm’s KBDC facilitates SCA.

H7, A firm’s KBDC facilitates SCC.

### **Mediating Effects**

According to the hierarchy of firm capabilities proposed by Rojo et al. (2018), because DC pertains to the high-level strategic capability of a firm, SCA and SCC are the ordinary operational capability of a firm. When SC disruption occurs, DC can affect SCP only through SCRES because a system without the

element of resilience cannot prevent or cope with the results of a disruption (Ponomarov and Holcomb, 2009). Moreover, SCA and SCC are both elements of SC resilience. Therefore, we postulate the following:

H8a, SCA mediates the association between RBDC and SCP with disruption considerations.

H8b, SCA mediates the relatedness between KBDC and SCP with disruption considerations.

H9a, SCC mediates the association between RBDC and SCP with disruption considerations.

H9b, SCC mediates the relatedness between KBDC and SCP with disruption considerations.

## **Research Design**

We conducted survey to collect research data. PLS-SEM is the analytical tool for data. The analysis unit is focal firm. As described below, the questionnaire mostly was mostly adopted from previous studies apart from two items of SC velocity and one item of seizing capability, which were self-developed by authors.

### ***Measurement***

The questionnaire consists two parts. The first part is the basic data of firm and respondent; the second part includes five constructs i.e. RBDC, KBDC, SCA, SCC and SCP with disruption considerations using a 7-point Likert scale (ranging from 1 = strongly disagree to 7 = strongly agree). We considered their sub-constructs and the indicators of these constructs and selected the unambiguous constructs without overlapped sub-constructs to become our constructs.

SC flexibility adapts the scale from Rojo et al. (2018). SC visibility uses the scale from Dubey et al. (2018). SC velocity adapts the scales from Chiang et al. (2015), and Kaufmann and Gaeckler (2015), together with supply chain speed construct self-developed from Kaipia (2008) and adapted from Lee and Rha (2016). SCC uses the scale from Pradabwong et al. (2017). RBDC uses the scale from Lee and Rha (2016). AC adapts the scale from García-Morales et al. (2007). KMPC uses the scale from Wu and Chen (2014). Organizational learning capability uses the scale from Rojo et al. (2018). SCP with disruption considerations adapts the scales from Wu et al. (2014).

### ***Sample Design***

Many industries in Taiwan are transforming into multinational corporations with increasingly international contacts and thus face increasing risk of SC disruption. For the context of this study, B2B manufacturing firms are more appropriate to be the subject. We investigated B2B focal firms from the 2018 list of manufacturing firms published by the Taiwan Stock Exchange Corporation (TSEC) and over-the-counter-listed (OTC) Corporation. For the pilot phase, we obtained the 2018 list of public companies published by the TSEC available online and extracted manufacturing firms. A total of 630 manufacturing public companies received emails with an online questionnaire hyperlink. There are a total of 30 respondents for analysis in the pilot phase.

### ***Survey Procedures***

The survey has three stages, including the pretest and pilot test of the questionnaire and the formal survey. In the pretest stage, the questionnaire was evaluated by five professors from four universities of Taiwan and the upper managers of three manufacturing firms to confirm its surface validity. In the pilot survey procedure, 30 samples were used to assess the questionnaire. After CFA analysis, the item with the highest factor loading from every first-order sub-construct of three original second-order constructs (i.e. KMPC, SC flexibility and SC velocity) was selected to reflect these three first-order sub-constructs. This completed the formal questionnaire. In the formal survey procedure, the final questionnaire is our measurement instrument.

## **Conclusion**

In this research, we first propose the research model to examine the effects of firm's DCs and SCRES on firm's SCP with disruption considerations. Until now, there still is research gap between DCs and SCRES. This research can make up for this research gap. Furthermore, we re-conceptualize SCA. SC velocity and KBDC are also new conceptualized constructs. This research will enrich SCM literature. On the other

hand, we anticipate that the result of this research can enhance the SCM of a firm, increase the capabilities to cope with the events of SC disruption and in turn achieve the competitive advantage of a firm's SC.

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