CHAPTER-5

HYPOTHESES DEVELOPMENT

The current chapter discusses the proposed relationships based on literature review, literature gap and study objectives. The current chapter has been segmented into: logistics capabilities and their inter-relationships; supply chain capabilities and their inter-relationships; logistics capabilities and supply chain capabilities; supply chain capabilities and supply chain resilience; supply chain resilience and supply chain performance.

1. LOGISTICS CAPABILITIES AND THEIR INTER-RELATIONSHIPS

The present study follows Mentzer et al. (2004)’s classification of logistics capabilities for developing hypotheses concerning the inter-relationship between various logistic capabilities and for relationship between logistic capabilities and supply chain capabilities.

1.1 Demand Management Interface Capability and Supply Management Interface Capability:

Demand Management Interface Capability ensures that the customer’s requirements are suitably fulfilled and hence it is also known as customer focus capability (Esper et al., 2007, Morash et al., 1996; Bowersox et al., 1999). The primary aim of such a capability is to satisfy the product/service requirements of a particular customer niche while also providing other value added services (Morash et al., 1996). Conversely, supply management interface capability focuses on the supply side and emphasizes on the efficient management of various processes related to the supply of raw materials (for e.g. optimizing cost at various stages; Lowson, 2003). Such a capability enables a firm to eliminate waste by efficiently managing time and resource
allocation and thereby facilitates the supply chain to meet the requirements of its customers (Morash et al., 1996). Hence supply management interface capability has a positive impact on demand management interface capability. Accordingly, we hypothesize that:

**H1: Supply management interface capability is positively related with demand management interface capability.**

### 1.2 Information Management Capability:

This capability focuses on gathering, analyzing and then distributing routine as well as strategic information both in and out of the organization through the application of relevant technical and non-technical infrastructure (Mentzer et al., 2004). Earlier studies in supply chain have repeatedly acknowledged the importance of sharing timely and relevant information in aiding better decision making (Zhao et al, 2002; Klein et al., 2007; Swafford et al, 2008).

As such a capability (i.e. information management capability) facilitates effective information sharing, it helps a firm to better manage its downstream operations to provide differentiated products and services to its customers (Morash et al., 1996). Sharing information regarding customer’s requirements or market trends with their suppliers can help to manage its upstream operations also. This facilitates better planning and scheduling of raw materials from suppliers to the firm and that of finished goods from firm to its customers (Li et al., 2006). This helps a firm to build healthy and transparent relationship with its suppliers and customers. Thus information management helps a firm to better manage its demand side and supply side operations. Based on this we hypothesize that:
H2: Information management capability is positively related with demand management interface capability.

H3: Information management capability is positively related with supply management interface capability.

1.3 Integrated Supply Chain Logistic Capabilities

Integrated supply chain logistics capabilities aim to unify the logistics capabilities of individual firms at a supply chain level (Gligor and Holcomb, 2012). It aims for integration of all logistic capabilities both within and outside the firm so as to extend the focus from a firm, as a competitive unit, to its supply chain (Greis and Kasarda, 1997). Higher levels of integrated supply chain logistic capabilities are characterized by increased logistics-related communication, greater coordination of the firm’s logistics capabilities with those of its suppliers and customers, resulting in a seamless connection throughout the entire supply chain (Stock et al. 2000). Effective integration of logistic capabilities in a supply chain yields a number of operational benefits, including reduction in costs (Nooteboom, 1992), lead time (Liu et al., 2005) and risks (Clemons et al., 1993).

1.4 Supply Management Interface Capability and Integrated Supply chain Logistic Capabilities

Supply management interface capability aims for smooth flow of raw materials from suppliers to manufacturer with reduced lead times and costs resulting in a streamlined production process (Frohlich and Westbrook, 2001). Hence supply management interface capability ensures that all
logistics capabilities and related processes are well integrated (Gligor and Holcomb, 2012) in a supply chain. Consequently we hypothesize that:

H4: Supply management interface capability is positively related with integrated supply chain logistics capabilities.

1.5 Demand Management Interface Capability and Integrated Supply chain Logistic Capabilities

Demand management interface capability ensures that a firm can suitably manage various issues on the demand side (e.g. distribution). With timely distribution of finished products to warehouses, wholesalers and distributors; a firm is able to improve its sales, customer services, and service levels (Seidmann and Sundararajan, 1997) and customer satisfaction (Kim, 2009). This results in improved integration of logistics capabilities and processes, across the supply chain, through optimal inventory usage and reduced waiting times in supplying finished goods to the market (Kim, 2009). Consequently, demand management interface capability helps in integration of logistics capabilities (Gligor and Holcomb, 2012) in a supply chain. Therefore, we hypothesize that:

H5: Demand management interface capability is positively related with integrated supply chain logistics capabilities.
1.6 Information Management Capability and Integrated Supply chain Logistic Capabilities

As information management capability aims to share information effectively both internally and externally, it helps in a timely and seamless flow of information across the supply chain. The consequent information sharing between partners is extremely important for co-ordination of activities and resulting integration of logistics capabilities in a supply chain (Gligor and Holcomb, 2012). Therefore, we hypothesize that:

H6: Information management capability is positively related with integrated supply chain logistics capabilities.

1.7 Cooperation Capability and Coordination Capability: Moderating roles

Cooperation Capability ensures that interests of the supply chain members are effectively aligned (Gligor and Holcomb, 2012). Coordination capability enables the alignment of various interdependent logistics activities thereby enhancing customer value (Langley and Holcomb, 1992; Mentzer et al., 2004). Such capabilities act both internal and external to a firm. Internally, cooperation capability ensures that interests of employees, managers etc. of the firm are aligned; externally this capability ensures the alignment of interests of its supply chain members. Similarly, coordination capability entails the alignment of actions of various business functions within a firm. Externally, coordination capability aligns the activities of suppliers and distributors with the firm.

As these capabilities focuses on proper alignment of interests and actions, the firms which want to enhance these capabilities often face challenges due to absence of relevant knowledge about their partner’s resources and motives (Geanakoplos, 1992; Gulati and Khanna, 1994). Gligor and
Holcomb (2012) traced cognitive limitation of the partners as the reason for coordination problems. They suggested that due to cognitive limitations, partners don’t have the proper knowledge of each other’s abilities, skills, strengths and weaknesses. As a result, alignment of their respective actions often becomes difficult. Also, partners in a supply chain may not be interested to align their logistics activities with those of the firm. These, in turn, influence the relationship between each of the logistics capabilities and integrated supply chain logistic capabilities because this relationship is contingent upon the alignment of interests and actions. This shows that greater the cooperation and coordination capability (i.e. greater the alignment of interests and actions), stronger is the relationship between the logistics capabilities and integrated logistic capabilities in a supply chain (Gligor and Holcomb, 2012). Hence it can be inferred that cooperation and coordination capability moderates the relationship between logistics capabilities and integrated supply chain logistic capabilities. Accordingly we posit the following:

**H7a:** Cooperation capability positively moderates the relationship between demand management interface capability and integrated supply chain logistics capabilities.

**H7b:** Cooperation capability positively moderates the relationship between information management capability and integrated supply chain logistics capabilities.

**H7c:** Cooperation capability positively moderates the relationship between supply management interface capability and integrated supply chain logistics capabilities.
H8a: Coordination capability positively moderates the relationship between demand management interface capability and integrated supply chain logistics capabilities.

H8b: Coordination capability positively moderates the relationship between information management capability and integrated supply chain logistics capabilities.

H8c: Coordination capability positively moderates the relationship between supply management interface capability and integrated supply chain logistics capabilities.

2. SUPPLY CHAIN CAPABILITIES AND THEIR INTER-RELATIONSHIPS

Supply chain capabilities (viz. flexibility, velocity, visibility and collaboration) are required for developing supply chain resilience (Juttner and Maklan, 2011). However these supply chain capabilities are also inter-related.

Collaboration is often referred to as a partnership process where entities work together to share resources and achieve common goals. Business firms usually don’t possess all the required resources and creation/development of these resources, many a times, is also not feasible. Hence there is a need for firms in a supply chain to collaborate with one another in order to ensure uninterrupted access to resources (Ulrich and Barney, 1984; Zacharia et al, 2004). Collaboration is also needed in the supply chain because the absence of collaboration in a supply chain impedes the development of other supply chain capabilities and adversely impacts the unison between the supply chain partners (Cao and Zhang, 2011). Similarly, other supply chain capabilities cannot
develop unless supply chain visibility provides the much needed information related to the events and activities at different points (e.g. manufacturer-wholesaler interface, retailer-customer interface etc.) of the supply chain (Francis, 2008).

Therefore it can be said that of the four formative capabilities viz. flexibility, velocity, visibility and collaboration; collaboration and visibility are fundamental capabilities that are critical for developing other supply chain capabilities, understanding their inter-relationships (Cao et al., 2010) and also for ensuring optimal supply chain performance (Fiala, 2005).

2.1 Supply Chain Visibility and Supply Chain Collaboration

Visibility is referred to as the capability of being perceived by the eye or mind (Juttner and Maklan, 2011). Francis (2008) defined supply chain visibility as the “identity, location and status of entities transiting the supply chain, captured in timely messages about events, along with the planned and actual dates/times for these events” (p.182). Supply chain collaboration, on the other hand, is a partnership process where two or more independent firms work closely to plan and execute supply chain operations toward common goals and mutual benefits (Cao and Zhang, 2011; Stank et al., 2001; Sheu et al., 2006).

As supply chain visibility ensures that every supply chain member has access to requisite information of supply chain operations; it is a necessary ingredient to ensure collaboration in supply chain. This is because partners jointly execute and plan more effectively in the presence of relevant information (Min et al., 2005; Fawcett et al, 2007). Accordingly we hypothesize that:

**H9: Supply chain visibility is positively related with supply chain collaboration.**
2.2 Supply Chain Collaboration and Supply Chain Flexibility

Flexibility is defined as the capacity to bend without breaking and considered as an essential part of resilience (Peck, 2005). Supply chain flexibility ensures that the deviations caused by a disruption are effectively mitigated through timely responses (Skipper and Hanna, 2009). Supply chain flexibility ensures readiness of a supply chain with regards to alternate courses of actions and aims for flexibility in resource planning so as to minimize any adverse impact on supply chain operations during a disruption. This requires a unified and coordinated effort of all the supply chain partners. Since supply chain collaboration is about unification of efforts of all the supply chain partners, one can infer that supply chain collaboration is a pre-requisite to achieve supply chain flexibility. Therefore, we hypothesize that:

H10: Supply chain collaboration is positively related with supply chain flexibility.

2.3 Supply Chain Visibility and Supply Chain Flexibility

Business priorities are governed by temporal as well as spatial dynamics. Therefore, depending on the requirements posed by the changing context, firms alter various aspects (levels and configurations; Juttner and Maklan, 2011) of their operational activities (For example, seasonal fluctuations in demand or unexpected disruptions necessitate a change in production levels of various firms constituting a supply chain). Supply chain flexibility aims for developing these alternative states or configurations to which the supply chain might move in the event of a change/disruption. For developing such configurations, supply chain members must have information about the events and happenings in the supply chain. Without access to such
information, it will not be possible for them to align their resources and reformulate strategies in the event of a disruption (Skipper and Hanna, 2009). Accordingly we hypothesize that:

**H11: Supply chain visibility is positively related with supply chain flexibility.**

### 2.4 Supply Chain Collaboration and Supply Chain Velocity

Velocity signifies “speed of motion, action, or operation, rapidity and swiftness” (Juttner and Maklan, 2011, p. 247) with which a supply chain can react to market changes/events. This speed to react to market changes largely depends on the “glue that holds supply chain members together” i.e. supply chain collaboration (Richey, 2009). This is because the more connected the supply chain members are, the more effectively the entire supply chain will be able to respond to market changes. Accordingly, we hypothesize that:

**H12: Supply chain collaboration is positively related with supply chain velocity.**

### 2.5 Supply Chain Visibility and Supply Chain Velocity

While supply chain visibility aims to enable the supply chain members to have timely access to requisite information of happenings and events in a supply chain; supply chain velocity is concerned with increasing the speed of response of the supply chain to market changes. The ability to respond to market changes largely depends on the effectiveness of information sharing between supply chain members (Zhou and Benton, 2007). With information availability, supply chain members can quickly make tactical to strategic choices regarding their resources. Hence
improved visibility in supply chains helps supply chain members for fast decision making. Accordingly we hypothesize that:

**H13:** Supply chain visibility is positively related with supply chain velocity.

### 2.6 Supply Chain Flexibility and Supply Chain Velocity

Supply chain flexibility focuses on development of alternate states and configurations in order to ensure uninterrupted supply chain operations during a disruption; while supply chain velocity is mainly concerned with the pace of adaptation/transformation (Stevenson and Spring, 2007). As stated earlier, supply chain collaboration and supply chain visibility are inherent supply chain capabilities while supply chain flexibility and supply chain velocity are specially required in the event of a disruption for response and recovery. Hence supply chain flexibility and supply chain velocity are necessary for resilience. Although the speed of recovery is important during a disruption, more important is the knowledge of optimal configurations for the supply chain that actually govern and guide the recovery process. Hence in this regard flexibility acts as an antecedent to velocity. Therefore, we hypothesize that:

**H14:** Supply chain flexibility is positively related with supply chain velocity.

### 3. INTER-RELATIONSHIPS AMONG LOGISTIC CAPABILITIES AND SUPPLY CHAIN CAPABILITIES
As stated earlier, supply chain capabilities (viz. flexibility, velocity, visibility and collaboration) are required for developing supply chain resilience (Juttner and Maklan, 2011) and logistic capabilities are required for developing supply chain capabilities. Extant literature suggests that there is a need for integration of supply chain logistics capabilities before the same can be harnessed to develop supply chain capabilities (Christopher and Peck, 2004; Chopra and Sodhi; 2004; Faisal et al, 2006; Gligor and Holcomb, 2012; Tang and Tomlin, 2008; Li et al., 2009). Since collaboration and visibility are prerequisite for developing other supply chain capabilities (viz. flexibility and velocity), the present paper now explores the relationship of integrated supply chain logistic capabilities with supply chain collaboration and supply chain visibility.

### 3.1 Integrated Supply Chain Logistics Capabilities and Supply Chain Collaboration

The terms integration and collaboration, have been used interchangeably in the supply chain literature (Rosenzweig et al., 2003; Simatupang and Sridharan, 2005; Stevenson and Spring, 2009). However Cao and Zhang (2011) state that integration is more process focused (Flynn et al., 2010) and aims for unification at the operational level, while collaboration is a broader term that puts more emphasis on governance through relational means in addition to governance through contract means (Nyaga et al., 2010). Collaboration therefore combines both process and relationship focus in its conceptualization (Cao and Zhang, 2011). Since logistics are a subset of supply chain, integrated supply chain logistic capabilities, which aim at the unification of logistics capabilities in a supply chain, should serve as an antecedent to supply chain collaboration. Accordingly we hypothesize that:
H15: Integrated supply chain logistic capabilities are positively related with supply chain collaboration.

3.2 Integrated Supply Chain Logistics Capabilities and Supply Chain Visibility

Integrated supply chain logistics capabilities aim for unification of various capabilities and functions both within and outside the firm (with both the suppliers and the customers). Greater unification and increased connectivity enables the supply chain members to have the relevant information about the critical aspects of the chain (Tan et al., 1999).

Supply chain visibility has been viewed as the degree to which supply chain partners have access to both operational and managerial information related to the supply chain (Barratt and Oke, 2007; Wei and Wang, 2010). Thus integrated supply chain logistic capabilities automatically enhance supply chain visibility through unification of capabilities and fluidic exchange between supply chain partners. Accordingly, we hypothesize that:

H16: Integrated supply chain logistic capabilities are positively related with supply chain visibility.

4. INTER-RELATIONSHIP AMONG SUPPLY CHAIN CAPABILITIES AND SUPPLY CHAIN RESILIENCE

4.1 Supply Chain Collaboration and Supply Chain Resilience

Collaboration is a process where multiple entities work in a unified manner to achieve some common goals. In a supply chain, it is necessary to align the activities, routines and processes of
individual firms in a synchronized manner to reap the benefits of collaboration. Particularly, in
the event of a disruption, resilience in a supply chain cannot be achieved unless all the
participating firms in a supply chain collaborate and respond in a synergistic manner (Juttner and
Maklan, 2011; Ponomarov and Holcomb, 2009). This indicates that supply chain collaboration is
a pre-requisite for supply chain resilience. Accordingly, it is proposed that:

**H17: Supply chain collaboration is positively related with supply chain resilience.**

4.2 Supply Chain Visibility and Supply Chain Resilience

Supply chain visibility ensures transparency in the supply chain through timely information flow
across all directions. As a result, the individual firms in a supply chain are well informed of the
important events and activities throughout the supply chain (Francis, 2008). The ensuing
information exchange in a timely manner influences the event readiness of each and every
member (Juttner and Maklan, 2011) thereby making the supply chain more resilient. Therefore,
particularly in the case of a disruption, a supply chain can quickly recover to a better state of
performance provided all the members in the chain have adequate visibility. Hence it is
hypothesized that:

**H18: Supply chain visibility is positively related with supply chain resilience.**

4.3 Supply Chain Flexibility and Supply Chain Resilience

Sheffi and Rice (2005) argued that flexibility imparts an organic capability in supply chains
which helps in detection of disruption and emergency planning. It is hence the ability to
encounter, resolve and, when appropriate, exploit unexpected emergencies (Juttner and Maklan,
2011). One can therefore infer that the enhanced flexibility in supply chain will make it more
resilient to disruptions. Consequently we hypothesize the following:
H19: Supply chain flexibility is positively related with supply chain resilience.

4.4 Supply Chain Velocity and Supply Chain Resilience

Manuj and Mentzer (2008) identified three forms of velocity in the context of supply chain risk: the rate at which a risk event happens, the rate at which losses happen and how quickly the risk event is discovered. Smith (2004) and Juttner and Maklan (2011) identified another form of velocity in the context of resilience: the speed with which a supply chain can recover and respond to a disruption. This underscored the importance of velocity at all phases of a risk event: before, during and after the supply chain disruption. Hence this suggests that a higher level of supply chain velocity will make a supply chain more resilient by increasing the speed to recover from a disruption. Accordingly we hypothesize that:

H20: Supply chain velocity is positively related with supply chain resilience.

5. SUPPLY CHAIN RESILIENCE AND SUPPLY CHAIN PERFORMANCE

Supply chain performance refers to performance of various processes included within the firm’s supply chain function. Examples of measures specifically used to assess supply chain performance of a firm include supplier performance (Davis, 1993), customer satisfaction (Christopher, 1994), inventory costs, number of on-time deliveries, product availability performance and customer response time (Beamon, 1999). Christopher and Peck (2004) underscored resilience as the capability that enables a supply chain to move to a better state of performance when faced with a disruption. Therefore supply chain resilience is a dynamic
capability that enables a firm to respond to environmental uncertainties in an appropriate manner and perform optimally during disruptions (Teece, 2007). Hence as a dynamic capability, supply chain resilience leads to positive performance outcomes. Hence, we posit that:

**H21: Supply chain resilience is positively related with supply chain performance.**

Fig. 5.1 summarizes the proposed hypotheses in a theoretical model.

The next chapter discusses the research methodology and other statistical tests.

![Figure 5.1: Theoretical Model](image-url)