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The structural impact of supply chain management teams

Supply chain agility development in multidivisional firms

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Abstract

Purpose – In today's constantly evolving global business environment, multidivisional firms (MDFs) require an organizational structure for supply chain management (SCM) that facilitates the development of supply chain agility. This research aims to investigate what structural elements of an MDF's SCM team contribute to supply chain agility.

Design/methodology/approach – A two-sample field study was conducted. Four MDFs with top-performing supply chains (Sample 1) were first studied to identify agility-supporting structural elements. Then, quantitative data from 35 MDFs with contrasting levels of supply chain agility (Sample 2) were collected to test the theoretical propositions advanced from Sample 1 findings.

Findings – The results reveal four structural elements that exert a positive impact on an MDF's supply chain agility: hierarchical position of the divisional top supply chain executive, scope of divisional supply chain operations, hierarchical position of the top supply chain executive at the headquarters and scope of SCM coordination by the headquarters.

Originality/value – First, this study provides a comparatively comprehensive understanding of the SCM organization structure in MDFs. Second, this study is one of the first to provide empirically supported theoretical insights about the linkage between an MDF's organizational structure for SCM and supply chain agility.

Keywords Organizational structure, Supply chain management, Field study, Supply chain agility, Production and operations management, Multidivisional firms, Organization design theory

Paper type Research paper

1. Introduction

A multidivisional firm (MDF) is organized based on divisions, each being self-contained with its own functional hierarchy, responsible for day-to-day operating decisions, and guided as well as controlled by strategic and financial targets from the headquarters (Hoskisson *et al.*, 1993). Because the multidivisional form is one of the most-used management models (Jones, 2005), and supply chain agility is emerging as a strategic means to create competitive advantages and superior performance (Christopher *et al.*, 2004; Gligor *et al.*, 2015; Li *et al.*, 2017), how MDFs can develop supply chain agility deserves investigation.

In seizing opportunities and responding to changes/disturbances, agility is a critical feature of best value supply chains, which are most likely to prosper in a dynamic landscape

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(Lee, 2004; Ketchen and Hult, 2007; Li *et al.*, 2015; Whitten *et al.*, 2012). As the benefits of agility have become generally acknowledged, there is increased investigation of how firms develop supply chain agility (Swafford *et al.*, 2006; Braunscheidel and Suresh, 2009; Gligor and Holcomb, 2012; Gligor *et al.*, 2013). Acknowledging that the capability of responding to changes can be either hindered or facilitated by the organizational structure, several researchers have investigated the impact of certain aspects of organizational structure on a firm's supply chain agility (Nahm *et al.*, 2003; Wieland and Wallenburg, 2013). However, how MDFs design their supply chain management (SCM) organization to foster and facilitate supply chain agility has not been addressed. The structural complexity of MDFs has not been considered in prior research. Previous studies have not examined how supply chain agility is impacted by a MDF's structural choices for SCM organization at the headquarters, within and across business divisions. This paper contributes to an understanding of this structure–agility linkage.

To date, researchers have taken the perspective of dynamic capabilities in their efforts to understand supply chain agility and have found that supply chain agility is embedded in bundles of organizational practices/routines (Blome *et al.*, 2013; Li *et al.*, 2015, 2017). However, two fundamentally important questions remain largely unanswered. The first relates to how firms structure their SCM organization for arranging and governing organization routines to institutionalize supply chain agility. Current research remains in a comparatively incipient stage, focusing on identifying what processes/routines are underlying supply chain agility, and tells us little about how these processes/routines are created, arranged, governed, sustained, and renewed (Braunscheidel and Suresh, 2009; Gligor *et al.*, 2013). Management scholars have proposed that organizations should design an appropriate structure as organization context to institutionalize organization processes/routines for dynamic capabilities (Anand *et al.*, 2009; Teece, 2007). In the absence of appropriate organization structures as organization context, processes/routines for agility will not take the form of a dynamic capability (Wieland and Wallenburg, 2013). Therefore, to provide a deep understanding on how MDFs cultivate organizational practices/routines for supply chain agility, we need to investigate its SCM organization structure.

The second question pertains to the configuration theory; it is the unique pattern of structural elements that are posited to be maximally effective (Doty, 1990; Doty *et al.*, 1993; Meyer *et al.*, 1993). Configurations are viewed as internally congruent patterns of organizational elements that are held together in a mutual dependence that is difficult to disturb (Whittington and Pettigrew, 2003). Configurations can be situated at multiple levels of analysis, depicting patterns common across individuals, groups, departments, organizations or networks of organizations (Meyer *et al.*, 1993). This perspective of configuration is in line with the nature of an MDF's SCM organization, which is a unique multi-level structural pattern that relates chosen structural factors with each other across business divisions and the headquarters in an MDF (Roh *et al.*, 2017). In the past, SCM-related practices were generally under the direction and control of various departments within the firm (e.g. purchasing, manufacturing, marketing and logistics), and their activities were rarely coordinated. Such fragmentation allowed responsibility to be diffused, which often led to duplication and waste and impeded mission accomplishment (Christopher and Ryals, 2014; Kim, 2007). As a solution, over time, SCM in MDFs has emerged as a discipline serving as an impetus towards cross-functional consolidation, and MDFs have been motivated to reconfigure the structural elements for their SCM organizations to support this level-across and boundary-spanning consolidation (Roh *et al.*, 2017; Swink *et al.*, 2013). However, little research has been done on the configuration of SCM structural elements in MDFs and its effects on supply chain agility.

Our investigation used a field study methodology involving qualitative data and quantitative data via two samples. Qualitative data provide rich insights into the organizational structure in the MDF, while quantitative data increase reliability and validity. The field study started with an exploratory investigation of four cases (Sample 1). We interviewed supply chain executives from four industry-leading MDFs for establishing our emergent structural elements in the development of supply chain agility, which led us to introducing our theoretical propositions. The second sample involved 35 MDFs with disparate performance in supply chain agility. Quantitative data collected from these firms were analyzed to test theoretical propositions advanced from Sample 1 findings. It was through this two-sample design that we were able to introduce our emergent theory while potentially mitigating any bias concerns from using only successful MDFs as found in Sample 1 with a more diverse range of MDFs in Sample 2. With this method, we identified measures, whereby researchers can design studies to better understand relationships between structural configuration, on the one hand, and realization of supply chain agility on the other hand. As such, this study provides a foundation for theory building that links a MDF's organizational structure to its supply chain agility.

In the following sections, we further characterize the supply chain agility concept. Based on extant literature, we discuss indications of a linkage between a MDF's organization structure for SCM and its supply chain agility. We then present the empirical investigation involving four MDFs (Sample 1), culminating in a grounded set of propositions that comprise a theory about the structure-agility linkage. Subsequently, we describe an in-depth data analysis using data from 35 MDFs (Sample 2) to test hypotheses reflecting the propositions. Our findings are discussed in terms of theoretical and practical implications, limitations and future research.

2. Theoretical background

We begin this research following the theory-building approach advocated by Eisenhardt (1989). This involves a justification of our concept of supply chain agility. It also leads us to assert the possibility that the organizational structure for SCM in MDFs is linked to the firm's supply chain agility.

2.1 Conceptualization of supply chain agility and the theory of dynamic capabilities

The notion of agility has been studied by operations management, logistics, information systems, strategy and knowledge management researchers, resulting in a rather extensive literature. Building on the literature, we define a firm's supply chain agility as the capability of a firm to reconfigure supply chain (supply chain) resources to respond to changes in a timely manner (Lee, 2004; Li *et al.*, 2008). The premise for this definition is that supply chain agility is a dynamic capability. This premise is in line with the emerging consensus in the more recent studies, which take the theory of dynamic capabilities as the theoretical lens for understanding supply chain agility (Blome *et al.*, 2013; Li *et al.*, 2009, 2017).

Dynamic capabilities are viewed as the abilities to reconfigure a firm's resources in the manner envisioned and deemed appropriate by the firm's principal decision makers for addressing a rapidly changing environment (Zahra *et al.*, 2006). Applying this view to an SCM setting, we can see that the SCM team is at the center of developing dynamic capabilities. Indeed, the creation and subsequent use of dynamic capabilities correspond to the SCM team's ability to identify changes and, in response to these changes, give direction, substance and variety to the firm's agility initiatives.

In addition, the management and organization design literature indicate that organizational structure has an important bearing on the evolution of dynamic capabilities

by providing foundations and mechanisms for people to participate in decisional processes, as well as set up and implement routines (Jacobides and Winter, 2012; Teece, 2007). Therefore, the organizational structure of a firm's SCM team is an important factor to consider in the investigation of that firm's supply chain agility.

2.2 An MDF's organizational structure for the SCM team and its supply chain agility

For perspective on the research conducted here, we furnish a synopsis of prior studies that have proposed how firms can achieve supply chain agility. These studies raise two important issues. They all adhere to the notion that the way firms govern the interaction of supply chain routines (i.e. the governance mechanisms) can have a positive effect on supply chain agility. For example, Christopher *et al.* (2004) suggest that supply chain agility can be built when collaboration mechanisms are used to govern the interaction and integration of supply chain practices/routines. A study by Swafford *et al.* (2006) provides empirical evidence suggesting that antecedents of supply chain agility are the dynamic ways that a set of routines are coordinated to adapt supply chain operations (purchasing, manufacturing, distribution/logistics) to changes. Braunscheidel and Suresh (2009) find that mechanisms for internal integration, external integration and external flexibility impact a firm's supply chain agility. Wieland and Wallenburg (2013) show that there are communication and cooperation mechanisms that can have positive effects on supply chain agility. However, none of these studies investigates what structural features are inherent in, or underpin, these governance mechanisms that facilitate supply chain agility. In addition, none of these studies investigate the MDF's organizational structure for the SCM team and its impact on supply chain agility.

Since 1960s, the multidivisional form has become one of the most-used management models for corporations across the world (Tedlow and Ruben, 2008). A special feature of an MDF is the notion that the firm is separated into multiple semi-autonomous divisions and the corporate officers at the headquarters delegate responsibilities for daily operations and business-unit strategy to division managers. Given that MDFs are an important part of today's business environment, an MDF's organizational design for its SCM team deserves to be investigated in supply chain agility research. We conceptualize the organizational structure of SCM in the MDF to reflect this special structural feature. Figure 1 illustrates a framework with two dimensions that are useful for defining the organizational structure of the SCM team in the MDF:

- Hierarchical structure of SCM team in a business division, depicting the hierarchy of authority relationships of the SCM team in a business division.

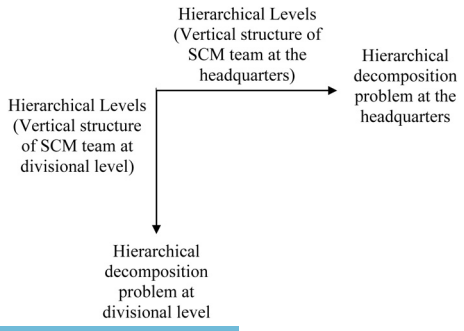

Figure 1. Supply chain management organization in the MDF

- Hierarchical structure of SCM team at the headquarters, depicting the hierarchy of authority relationships of the SCM team at the headquarters.

Considering these two dimensions of SCM organization in an MDF reveals two interrelated design problems of significant interest to both practitioners and scholars:

(1) A hierarchy problem of organizing the SCM team in the MDF divisions. SCM implies a process-focused organizational orientation. In individual MDF divisions, managers often work across functions as teams where distinct functional skills are brought together with a common process focus. Because business processes are the means whereby customer value is created, there is a strong logic in arguing that process management rather than functional management should be the focus for organizational design for SCM (Mangan and Christopher, 2005; Roh *et al.*, 2017). For an SCM practitioner, this problem could be that of structuring authority relationships across different levels in a business division in a way to support supply chain processes across functions so that agility can be achieved. For a scholar, the hierarchy problem could be one of identifying division-level structural elements that impact supply chain agility.

(2) A hierarchy problem of organizing the SCM team at the MDF headquarters. The primary task for the SCM team at this level is the coordination of SCM processes across divisions. For a practitioner, this problem could be that of forming authority relationships at the headquarters for better coordination across divisions. For a scholar, the hierarchy problem could be one of identifying structural elements at the headquarters that facilitate the development of supply chain agility.

In practice, these problems are often inseparable and require joint solution. Each of the three issues is mirrored in a bifold research approach for addressing our central research question. First, we examine those structural choices for SCM at the divisional level that facilitate supply chain agility. Second, we explore structural choices for SCM at the headquarters that facilitate supply chain agility.

Various approaches, including contingency methods and configuration methods, are candidates for developing theoretical arguments that explain a linkage between structural configuration and organizational capabilities (Child, 2005). Sinha and Van de Ven (2005) suggest that a configuration method might potentially be devised for addressing the changing nature of organizational design within and across business units.

Configuration theories draw on the holistic principle of inquiry (Doty *et al.*, 1993; Meyer *et al.*, 1993) to identify configurations (i.e. unique patterns of factors) that are posited to be maximally effective. Configurations are seen as internally congruent patterns of organizational elements/characteristics that are held together in a mutual dependence that is difficult and risky to disturb (Whittington and Pettigrew, 2003). Configurations can be situated at multiple levels of analysis, depicting patterns common across individuals, groups, departments, organizations or networks of organizations (Meyer *et al.*, 1993). In the literature, the configuration of SCM organizations in MDFs is increasingly recognized as a multi-level phenomenon, and scholars have called for empirical insights into how MDFs configure structural elements for their modern SCM organizations (Roh *et al.*, 2017; Swink *et al.*, 2013). For example, Swink *et al.* (2013) point out that as the SCM organizations in MDFs spans multiple functional, business and geography boundaries, MDFs face a degree of structural complexity that few other firms experience, magnifying the typical challenges related to how MDFs configure a right SCM organization. Roh *et al.* (2017) posit that configuration theory exemplifies the change phenomena observed when SCM organization

leaders identified needed organizational capabilities and developed organizational design initiatives (i.e. structures and processes) to build these capabilities.

Drawing on the configuration perspective, we define a structure configuration as the unique pattern that relates chosen structural factors with each other across business divisions and the headquarters in an MDF. The role that structural configuration may play in achieving supply chain agility in the MDF has not been investigated in prior studies. Next, we describe our two-sample field study.

3. Sample 1: toward a theory of the structure-agility linkage in MDFs

In this stage, we establish a linkage between organizational structure and supply chain agility in MDFs using a grounded theory approach to analyze the field study data. This approach is appropriate to explore a relatively new research area (Eisenhardt, 1989; Meredith, 1998; Voss *et al.*, 2002; Yin, 2003). We follow the methodology, advocated by scholars such as Eisenhardt (1989) and Miles and Huberman (1984), which combines elements from grounded theory (e.g. opportunistic data collection, absence of *a priori* hypotheses) with structured methods (e.g. use of case protocol, *priori* constructs and crafted research).

3.1 Sample 1 participants

Because our purpose was to understand the structural drivers of supply chain agility, we needed to narrow our potential participant pool to those firms fitting our selection criteria. Potential firms needed to be:

- MDFs with reputations for being outstanding in SCM and performance; and
- firms competing in industries where supply chain agility is a key competitive factor for success.

The research team identified ten candidate MDFs adhering to the selection criteria. According to recent reports in industry publications (e.g. *Supply Chain Management Review*) and by research agencies (e.g. Gartner Research), all ten firms enjoy reputations as being excellent in SCM and performance.

We contacted each firm by sending it a cover letter and an interview guide (available from authors upon request). Seven firms agreed to participate. In initial interviews with each, we asked the informants questions regarding their definitions on supply chain agility, the importance of building supply chain agility for their firms. This process resulted in identification of four firms that displayed a mature understanding of supply chain agility, that considered supply chain agility as a critical feature of SCM effectiveness, and that claimed high scores on the supply chain agility measurement. Therefore, although seven separate interviews were conducted, we report the details from only four firms because theoretical saturation (i.e. additional cases fail to contribute new information concerning theory building; Glaser and Strauss, 1967) was achieved with the information supplied from these four case firms. That is, consideration of each of the other three cases did not yield new information about the constructs.

Per requests from these firms, fictitious names are used to ensure anonymity. The firms are a consumer goods manufacturer (CGM), a business machines manufacturer (BMM), an industrial machinery manufacturer (IMM) and an aerospace manufacturer (AM). We maintain environmental comparability across the cases by including only producers of durable assembled products.

3.2 Sample 1 data collection

Case interviews were guided by a structured instrument with a script of well-defined, open-ended questions. Multiple interviews were conducted through telephone calls and personal visits for each firm during a four-month period. The time it took for one interview generally ranged from 60 min to 2 h. All the interviewees are director-level supply chain executives. Each interviewee has worked for his/her firm for over 10 years and has thorough knowledge about the firm's SCM at different levels from individual business divisions to the headquarters. Interviewees were assured of anonymity and were offered a copy of the final report. Major topics discussed were:

- the organizational chart of the SCM team for the firm;
- the structural choices at the divisional level that facilitate supply chain agility; and
- the structural choices at the headquarters level that facilitate supply chain agility.

All interviews were recorded and transcribed into written documents. Unclear answers were clarified through email or in follow-up questions in subsequent rounds. For each firm, documents and other data were also gathered to complement the interview process. These included procedure manuals, presentation slides and publicly available information. The three data sources for this study (structured interviews, printed materials and public data) strengthened the analysis by allowing triangulation on important issues to cross-verify insights and findings (Eisenhardt, 1989; Miles and Huberman, 1984).

3.3 Sample 1 data analysis and discussion

Data were coded and analyzed. The researchers coded the transcripts. The coding results were compared with each other. Where differences were found, the research team engaged in discussion to adjust the coding until the point where consensus was achieved. The inter-rater agreement is computed by taking the ratio of the number of agreements against the total number of items (Miles and Huberman, 1984). Upon completion of all discussion, consensus was achieved.

Following the procedure of Miles and Huberman (1984), we first conducted within-case analysis to identify the explicit and implicit organizational structure deployed by each firm. Once the within-case analyses were completed, between-case analyses were undertaken.

3.4 Sample 1 analysis and findings

The first level of analysis examined each firm individually. To describe each case, we first used the organizational chart to depict the organizational structure for the SCM team, whose accuracy was confirmed by the case firm.

Then, Table I presents a column-wise summary for each case's organizational structure for its SCM team. The summary is in terms of three structural categories: organizational boundary for SCM, organizational structure for SCM in business divisions and organizational structure for SCM at the headquarters. A row-wise examination of Table I provides a cross-case comparison for each of the characteristics. We uncovered row-wise similarities across the cases. From these similarities, we derive findings on the linkage between organizational structure for SCM team and supply chain agility in MDFs.

3.4.1 Structural choices at the divisional level that facilitate supply chain agility. Organization structure for SCM team at the divisional level governs supply chain daily operations in a specific business division/unit. All case participants asserted that two structural choices at the divisional level facilitate supply chain agility: high hierarchical

Feature	Consumer goods manufacturer (CGM)	Business machine manufacturer (BMM)	Farm machinery manufacturer (IMM)	Aerospace manufacturer (AM)
Organizational boundary for supply chain management	CGM has supply chain management teams in each of its six core business divisions as well as at the headquarters	BMM has supply chain management teams in each of its three business divisions as well as at the headquarters	IMM has supply chain management teams in each of its four core business divisions as well as at the headquarters	AM has supply chain management teams in each of its three commodity units as well as at the headquarters
Organizational structure for supply chain management at divisional level	Each of CGM's six core businesses has a product supply VP (and supporting personnel) who report directly to the business division president Under the supply VP, there are six operation units: Manufacturing, Engineering, Quality Assurance, Purchasing, Customer Service/ Logistics, and Planning The work for which they are accountable is: managing both the basic daily execution of the business (e.g., bringing innovation to market through a supply chain; ensuring adequate capacity and flexibility to support the business unit's operating strategy, etc.) and developing responsive supply chains required for business success	Each of BMM's three core business divisions has supply chain mangers that work directly with the business division president The work for which they are accountable is: managing the basic daily execution of the business (sourcing/ purchasing, distribution, production, planning, and customer service) and bringing continuous improvement to supply chain work routines in terms of three areas: quality, service, and cost	For each of IMM's core business divisions, there are two levels of supply chain management At the division level, there is a supply chain VP who reports directly to the division president. Supporting the supply chain VP, several directors oversee eight supply chain operations: sourcing, new product delivery, order fulfillment process, supplier diversity, commodity management, indirect material, planning, and logistics At the factory level, there is a director for supply chain management in charge of a supply chain management team for operations similar to the division level for that factory	For each business unit, there is a supply management director who reports directly to the VP of supply management, who is under the senior VP of supply chain integration, who reports to the CEO The supply management directors oversee day-to-day supply chain activities (purchasing, delivery, planning, production, after market service, and new product development) and lead cross-functional commodity teams for making improvements in quality/ reliability, flexibility, delivery and cost

(continued)

Table I.
Sample 1 case descriptions

Table I.

Feature	Consumer goods manufacturer (CGM)	Business machine manufacturer (BMM)	Farm machinery manufacturer (IMM)	Aerospace manufacturer (AM)
Organizational structure for supply chain management at the headquarters	At the headquarters, CGM has a global chief supply chain officer, who reports directly to the CEO A governance team, comprising 15 global process owners, reports directly to the global chief supply chain officer. Each global process owner at the headquarters leads the work of a horizontal process network (HPN), whose members are from each business division and have expertise for that process The 15 global processes are: demand planning, site integrated planning, category supply planning, distribution requirements planning, material supply management, physical distribution, customization planning and execution, artwork and initiative planning, customer service operations (order to cash), customer logistics, retail supply operations, supply network design, strategic distributor design and supply network pillar	At the headquarters, BMM has a Chief Supply Chain Officer, who reports directly to the COO, who then reports to the CEO. There are six supply chain VPs working under the chief supply chain officer. They are VP manufacturing, VP sourcing/purchasing, VP customer service, VP logistics, VP facilities and VP distribution The work for which they are accountable is ensuring that the overall process capability required for results-delivery across business divisions is in place or being developed and achieving benefits from managing supply chain processes across business divisions in a cooperative way	At the headquarters, IMM has a VP for global supply chain management, who reports directly to an Executive VP who works for the CEO The VP for global supply chain management and his/her supporters manage strategic/global sourcing, new product delivery, order fulfillment process, supplier diversity, commodity management, planning, logistics, and value assurance The work for which they are accountable is setting up the supply chain management for a global environment and managing supply chain processes across business divisions	At the headquarters, AM has a senior VP of supply chain integration, who reports to the CEO The responsibilities for the VP of supply chain integration and the 8 directors under the VP are managing supply chain processes, such as sourcing/contracting, supplier development, material planning, new program development, manufacturing strategy deployment and aftermarket coordination The work for which they are accountable is enhancing global competition by creating value through integrating supply chain processes across commodity units and restructuring processes in response to changes in the market

position of the top executive for supply chain operations and wide scope of supply chain operations managed by the SCM team.

Hierarchical position of the divisional top supply chain executive: The four cases demonstrate similarity in the placements of supply chain executives (either vice president or a director) adjacent to presidents of their core business divisions/units. This structural choice enhances the ability of the SCM department of a business division to influence behaviors of other organizational units and decision processes for reconfiguring agility-embedded routines. For example, one primary reason for CGM to set up a supply chain VP for each core business unit is to ensure adequate power for developing supply chain flexibility that is required to compete efficiently.

This structural choice has also contributed to supply chain agility by shifting the firms' SCM from function-centric to process-focused. For all four cases, work design had previously followed a serial pattern: product design first, manufacturing design second and then supply chain design. The AM director of supply management said:

> It (AM's supply chain organization) was a traditional purchasing organization where we had engineering calling out what we're going to use. Then, they would just tell us to go buy it. Now, with a supply chain executive positioned to a hierarchical level that can oversee "whole chain" processes, cross-functional teams are formed for SCM. The work-design pattern has changed into a 3D design: the concurrent design of product, manufacturing process and supply chain. The AM supply chain director commented on this change: "Now, we tell them what suppliers they need to utilize [. . .][. . .] with the right contracts with the right suppliers, we work together to improve in quality/reliability, flexibility, delivery, and cost".

Scope of divisional supply chain operations: Informants for all four cases told the research team that the scope of supply chain operations managed by the SCM team at the division level has experienced a long-term evolution from simply purchasing and logistics to end-to-end inclusion of all functions (i.e. from raw material suppliers to end customers). As Table I indicates, the scope of supply chain operations for the four cases includes, and even goes beyond, what is presented in the Supply Chain Operations Reference Model 11.0 (Supply Chain Council, 2012). The SCOR11.0 model presents six core business activities for supply chain operations: plan, source, make, deliver, return and enable.

Through enlarging the management scope of the divisional SCM teams, the four firms set up a high degree of supply chain visibility and responsiveness, thus enhancing their supply chain agility. The informant for CGM said:

> The creation of our "product supply" organization that includes manufacturing, engineering, quality assurance, purchasing, customer service/logistics, and planning provided us a comprehensive view of the supply chain and set the stage for our cross leveraging of skills as well as design and optimization changes.

This comprehensive view of supply chains enables a firm to be more alert to changes, while the stage for cross leveraging skills is the platform for supply chain responsiveness. For AM, the breadth of supply chain operations managed by the SCM teams cultivates better response capabilities. When the AM director described the impact of widening the scope of supply chain operations under the SCM teams, he said:

> We're very well integrated here. It's not like you've got to jump over various organizations or go to see somebody, a senior vice president, to get the other senior vice president to do stuff. It's under one umbrella. So, we're able to respond a little easier than we used to [. . .] Talking about slowing down or ramping up, we're pretty good in the industry. A lot of our competitors right now are still at least six months to nine. We're down to about four months in a lot of cases.

3.4.2 Structural choices at the headquarters that facilitate supply chain agility. Organization structure for SCM team at the headquarters governs SCM across business divisions. All four cases reveal that two structural choices at the headquarters facilitate supply chain agility: high hierarchical position of top supply chain executive at the headquarters and wide scope of SCM coordination across divisions.

Hierarchical position of the headquarters' top supply chain executive: To manage the supply chain departments across business divisions, each of our investigated cases created a supply chain executive highly placed at the headquarters. These executives, called either chief supply chain officer or senior supply chain VP, report directly to the CEO and provide directions to the supply chain executives at individual business divisions.

In all four cases, informants point out that the primary reason for creating supply chain executive positions at the headquarters is to enhance global competitiveness by creating value through the coordination of SCM across divisions. Under the leadership of the top supply chain executive at the headquarters, agility-embedded routines involving all business divisions can be developed in several respects. First, routines for keeping up with the best SCM practices are designed. For example, all four firms set up formal benchmarking procedures at the headquarters, performing annual benchmarking not only against current competition but also with the best firms across industries.

Second, the advent of high-level supply chain executives at the headquarters makes it possible to exploit opportunities globally through developing routines to coordinate SCM across business divisions/units. BMM said:

> As we became more and more global, we found that we couldn't have separate activities at each factory that were not connected. In order to bring them together and to take advantage of various volume purchasing opportunities, for instance, we started this movement from decentralized to centralized.

Third, this structural choice has contributed greatly to an MDF's capability to implement changes across divisions in a timely way. In each case, the firm developed standard procedures for the execution of new SCM processes at the headquarters first, then distributed them to the divisions. For example, CGM determined to move its production processes to a "produce-to-demand" base of responsiveness. This requires significant work routine changes across 150 production sites globally. Leveraging a single standard approach with people trained and executing new processes concurrently, CGM has been able to move its production volume from less than 30 per cent capable of produce-to-demand to 51 per cent in less than a year.

Scope of SCM coordination by the headquarters: The research team observed that all four case firms developed a high scope of SCM coordination across divisions. As indicated in Table I, the number of distinct SCM processes coordinated across divisions at the headquarters by each of the four firms exceeds the SCM processes listed by the Global Supply Chain Forum (Lambert *et al.*, 2005). These processes are customer relationship management, customer service management, order fulfillment, supplier relationship management, demand management, product development and customization, manufacturing flow management and return management.

A higher scope of SCM coordination across divisions enhances supply chain agility through configuring resources from individual divisions. Each division maintains unique and idiosyncratic patterns of supply chain linkages and consequently is differentially exposed to new knowledge, ideas and opportunities. In fact, this differential exposure has been put forward as one of the basic competitive advantages of the MDF, because it increases the breadth and variety of its resources. The integration of varied sources of

information at the headquarters can upgrade the firm's overall response capabilities. For GGM, this structural choice makes it possible to build mechanisms, under which "people has more resources to respond to exceptions".

3.5 Integrative model of agility-supporting SCM organization structure in MDFs

From Sample 1 case analysis, we derive an integrative model (Figure 2) to describe the connections between a MDF's structural choices for its SCM team and facilitation of supply chain agility in the firm. These structural choices are: high hierarchical position of the divisional top supply chain executive, wide scope of divisional supply chain operations, high hierarchical position of the top supply chain executive at the headquarters and wide scope of SCM coordination by the headquarters. Accordingly, we advance the following theoretical propositions:

P1. The hierarchical position of the divisional top supply chain executive in an MDF exerts a positive influence on supply chain agility.

P2. The scope of divisional supply chain operations in an MDF exerts a positive influence on supply chain agility.

P3. The hierarchical position of the top supply chain executive at the headquarters in an MDF exerts a positive influence on supply chain agility.

P4. The scope of SCM coordination by the headquarters in an MDF exerts a positive influence on supply chain agility.

Based on an analysis of the four cases, we contend that the four structural elements form constituent elements of an ideal structural configuration for SCM that is geared toward achieving supply chain agility. Configuration theorists argue in favor of there being multiple effective configurations for the relevant parameters (Miles and Snow, 1984; Sonnenfeld and Peiperl, 1988). However, our four case studies identify a single ideal structural configuration that is associated with a high degree of supply chain agility. Delery and Doty (1996) suggest that the most parsimonious configuration theory would posit a single ideal configuration that will result in maximal organizational performance. Thus, we advance a fifth theoretical proposition:

P5. Compared to MDFs with low degrees of supply chain agility, MDFs with a high degree of supply chain agility have a structure configuration for SCM characterized

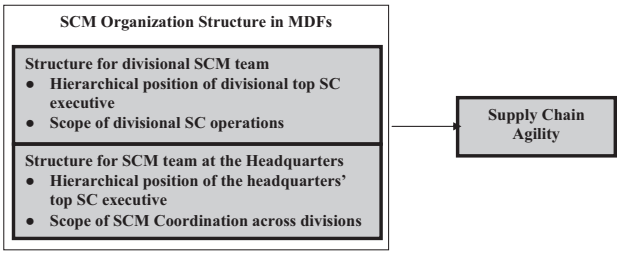

Figure 2. Agility-supporting SCM organization structure in MDFs: a proposed model

with higher hierarchical position of the divisional top supply chain executive, wider scope of divisional supply chain operations, higher hierarchical position of the top supply chain executive at the headquarters and wider scope of SCM coordination by the headquarters.

These five theoretical proposals are based on combined analysis of SCM organizational design for four case firms with high degrees of supply chain agility. To test the generality of these proposals, we move to stage two of this study, which is based on a sample of 35 case firms with contrasting levels of supply chain agility.

4. Sample 2: research proposal testing

To provide a more rigorous exploration on the effects of the four structural elements across firms with contrasting levels of supply chain agility, we continued our ground theory approach by administering a survey containing the four structural elements and supply chain agility to interviewees in a second separate sample. In this stage, we still used field study to collect data – this time, for testing the theoretical proposals advanced from Sample 1 findings. Field study or case study can be used not only for theory building but also for theory testing (Eisenhardt, 1989; Lee, 1989a). Scholars in management field have provided research examples whereby quantitative data through field study were collected and used to increase reliability and validity of their initial findings from qualitative data (Fang *et al.*, 2015; Nag and Gioia, 2012). Additionally, due to the multi-level nature of structure configuration and varying managerial terminology used in different MDFs, field study is a suitable way to collect comprehensive information on the theoretical constructs.

4.1 Sample 2 participants and procedures

The research team obtained the membership list for the local chapter of the Association for Operations Management (APICS) located in a large Midwestern city in the USA. We contacted top supply chain executives of these firms by sending a cover letter, stating the research scope and purpose to the prospective respondents. We offered the participants an executive summary of research findings in return for their participation. All participants were assured that their participation was voluntary and confidential.

In sum, a total of 35 cases were conducted for Sample 2. Firms are included in the data collection process only if they are MDFs, are manufacturers for durable products and initially agreed to participate in a larger project investigating supply chain agility, which involves several rounds of the data collection. The literature has shown that firms in different industries and with different sizes may have different visions, goals and strategies for SCM (Roh *et al.*, 2016; Wagner and Kemmerling, 2014), thus influencing how they structure their SCM organizations. Therefore, we tried to select firms with contrasting levels of industry backgrounds, revenues and number of business divisions to increase the generalizability of our findings. As Table II shows, the 35 firms represent 10 different industries, with revenue ranging from $20m to over $100bn, and the number of business divisions ranging from 2 to over 20.

To investigate the linkage between structure configuration and supply chain agility, appropriate respondents must be identified for each firm. At the initial contact, a candidate informant reads a cover letter and the interview protocol. After reading the interview protocol, if the contact person does not regard himself/herself as well-informed about the interview topics, he/she refers us to a suitable person in that firm.

SIC (2Digit)	Industry description	#	Revenue (2009) US$	#
20	Food and kindred products	5	20-500m	14
25	Furniture and fixtures	1	500m-1bn	0
26	Paper and allied products	1	1bn-10bn	18
27	Printing, publishing and allied industries	5	Over 10bn	3
28	Chemicals and allied products	4	*Total*	*35*
32	Stone, clay, glass, and concrete products	2	*# of Business Divisions*	#
33	Primary metal industries	1	2-4	21
35	Industrial, commercial machinery, computer equipment	2	5-10	7
36	Electronic equipment and components	7	11-20	4
37	Transportation equipment	7	Over 20	3
	Total	*35*	*Total*	*35*

Table II.
Profile of MDFs in Sample 2

4.2 Sample 2 data collection and measures

The data on structure configurations were collected through several rounds of interviews with informants so that we had a comprehensive and reliable picture of each firm's structure configuration for its SCM team. Each interview was transcribed into a textual document that was reviewed by informants for verification and correction. The confirmed document was then used for coding purposes. Based on the structure elements/variables identified and defined in Sections 3.4.1 to 3.4.2, measures and coding schema were developed. The research team quantifies values for the constituent elements of each firm's structure variables.

Supply chain agility. Six items adapted from the instrument developed by Swafford *et al.* (2006) were used to measure supply chain agility. The Appendix displays these items. Respondents answered on a seven-point scale (1 = incapable, 7 = extremely capable). The Cronbach's alpha is 0.79.

The hierarchical position of the divisional top supply chain executive. We counted the number of hierarchical levels between the divisional top supply chain executive to the CEO of the MDF. This positional distance ranged from 2 to 6 (*Mean* = 3.34; *S.D.* = 0.84), where low values represented higher hierarchical position.

Scope of divisional supply chain operations. Divisional supply chain operation scope was measured by the number of functional areas nested under the SCM team for engaging in the divisional supply chain operations. Participating firms oversaw a number of functions ranging from 1 to 5 (*Mean* = 3.86, SD = 1.17), where high values represented greater SCM operations scope.

The hierarchical position of the top supply chain executive at the headquarters. We counted the number of hierarchical levels between the headquarters' top supply chain executive to the CEO of the MDF. This positional distance ranged from 1 to 6 (Mean = 2.89; S.D. = 0.93), where low values represented higher hierarchical position.

The scope of SCM coordination by the headquarters. SCM coordination scope by the headquarters was measured by the number of SCM processes coordinated across business divisions by the headquarters. This number ranged from 1 to 6 (*Mean* = 2.57, SD = 1.70), where high values represented greater SCM coordination scope.

4.3 Sample 2 analysis and results

To test *P1-P4*, we conducted a correlation analysis. Data were normalized before the correlation analysis. As shown in Table III, the structure elements (hierarchical position of the divisional top supply chain executive, scope of divisional supply chain operations, hierarchical position of the headquarters' top supply chain executive and scope of supply chain coordination by the headquarters) are correlated with supply chain agility at a statistically significant level. Thus, *P1-P4* are supported.

To test *P5*, we split the sample at the supply chain agility median into low and high supply chain agility groups. Then, we conducted *t*-tests comparing means of the two groups along the four structural elements. As shown in Table IV, compared to MDFs with low degrees of supply chain agility, MDFs with a high degree of supply chain agility tend to have a structure configuration for SCM characterized with higher hierarchical position of the divisional top supply chain executive ($p < 0.05$), wider scope of divisional supply chain operations ($p < 0.1$), higher hierarchical position of the top supply chain executive at the headquarters ($p < 0.05$) and wider scope of SCM coordination by the headquarters ($p < 0.01$). Noting that the p-value for the scope of divisional supply chain operations is statistically significant only at the level of 0.1, and given that the sample size is small and the p-values for the other structural elements are statistically significant at the level of 0.05, we conclude that the *t*-test results provide evidence for *P5*. Therefore, *P5* is supported.

5. Discussion and conclusion

This study introduces a conceptual framework, develops an integrated theoretical model, and finds evidence of the linkage between a MDF's organizational configuration for its SCM team and the realization of supply chain agility. We find that MDFs, with high degrees of supply chain agility, have engaged in strategic design and use of organizational structure to facilitate the development of supply chain agility.

5.1 Theoretical implications

This study has important implications for organization design research. Organization design has been, and will continue to be, a central and enduring problem of organization science and practice. This is because the way an organization is structured determines the arrangements and procedures for doing work, affects us every day and impacts organizational performance (Sinha and Van de Ven, 2005). Organization design theories assert that a firm adopts/adapts a specific organizational structure to fit with its environment (Greenwood and Hinings, 1993; Romme, 2003). As SCM has become a strategic

Table III.
Correlation table (Sample 2)

Structural elements	Mean	SD	1	2	3	4
(1) The hierarchical position of divisional top supply chain executive	3.34	0.84	1			
(2) Scope of divisional supply chain operations	3.86	1.17	−0.34**	1		
(3) The hierarchical position of the top supply chain executive at the headquarters	2.89	0.93	0.65***	−0.42***	1	
(4) Scope of SCM coordination by the headquarters	2.57	1.70	−0.18	0.32**	−0.19	1
(5) Supply chain agility	26.26	4.83	*−0.36***	*0.33***	*−0.48****	*0.43****

Notes: ***$p < 0.01$; ** $p < 0.05$ (one tailed)

tool for firms to compete in an increasingly global and knowledge-intensive economy (Christopher and Ryals, 2014; Ketchen and Hult, 2007), the organizational structure for a firm's SCM team must have evolved so that supply chain agility, a critical feature of effective SCM, is supported. This study focuses on organizational configuration of the SCM team in MDFs, because MDFs are an important part of today's business environment, and we know little about how MDFs design organizational structure for their SCM organizations (Roh *et al.*, 2017; Swink *et al.*, 2013), particularly when geared toward improving/achieving supply chain agility.

This study introduces a framework to conceptualize organization design problems for SCM in MDF contexts. The framework delineates boundaries of the SCM team in MDF with respect to two dimensions: the hierarchical structure for the divisional SCM team and the hierarchical structure for the headquarters' SCM team. These two dimensions are useful for examining two central problems of organization design for SCM in the MDF: the hierarchical problem of organizing the SCM team in a business division, and the hierarchical problem of organizing the SCM team at the headquarters. This framework highlights directions for investigating structural problems for the SCM team in the MDF. Further, it is an important step toward understanding relationships between organizational theory and SCM practices in firms having complicated, multi-level organizational forms, as well as distinct supply chains.

This study also has important implications for supply chain agility research, which is inclined to rely on the theory of dynamic capabilities to understand supply chain agility. Applying the theory of dynamic capabilities, if supply chain agility involves a set of interrelated supply chain processes/routines that yields appropriate response to changes in a timely manner (Li *et al.*, 2015, 2017), then a logical first step is to specify structures, whereby processes/routines are supported to influence supply chain agility. Heretofore, little has been known about how differences in organizational structures influence creation, execution and renewal of agility-embedded routines. Our two-stage research design, engaging in both qualitative and quantitative data analysis, provides a richer and more in-depth understanding of the linkage between organizational structure and supply chain agility. We find that MDFs tend to enjoy high degrees of supply chain agility when there are the following structural characteristics: high hierarchical position of divisional top supply chain executives, wide scope of divisional supply chain operations, high hierarchical position of the top supply chain executive at the headquarters and wide scope of supply chain coordination by the headquarters. Moreover, previous research, although valuable, attempted to look at only individual structural elements that may facilitate supply chain

Constituent elements of structural configuration for a MDF's SCM team	Supply chain agility	*N*	Mean	SD	*t* value
The hierarchical position of the divisional top supply chain executive	Low	20	3.55	0.887	1.8**
	High	15	3.07	0.704	
Scope of divisional supply chain operations	Low	20	3.65	1.226	−1.25*
	High	15	4.13	1.060	
The hierarchical position of the top supply chain executive at the headquarters	Low	20	3.10	1.021	1.68**
	High	15	2.60	0.737	
Scope of SCM coordination by the headquarters	Low	20	1.85	1.309	−3.16***
	High	15	3.53	1.727	

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$ (one tailed)

Table IV. *t*–Test comparing low and high supply chain agility groups along structural elements (Sample 2)

agility. In contrast, our study reveals that it is through an overall structural configuration that MDFs simultaneously design and utilize varied structural characteristics of business divisions and the headquarters for SCM, which, in turn, give them authority to access and rearrange various rich resources from distinct organizational levels in developing supply chain agility.

5.2 Practical implications

Results of this study have important implications for practitioners. First, firms can use organization design as a strategic tool to gain competitive advantage through shaping dynamic capabilities. Teece (2007) point out that a firm's dynamic capabilities are inimitable. The findings from our case studies are consistent with this point. Because it is unlikely that firms can quickly or easily imitate the practices of best organizations, it may be even more important for firms without mature SCM components to spend a great deal of time and effort to ensure that their organization structures are, in fact, evolving toward high performance (e.g. superior supply chain agility).

Second, our case study results offer useful guidelines for practitioners on what structural elements are important for building supply chain agility. It is beneficial to position supply chain executives at high hierarchical positions, in business divisions and at headquarters. This structural choice gives the SCM team the "whole chain" management perspective and determines the decisional power of the SCM team in building and renewing supply chain practices/routines. The scope of divisional supply chain operations and the scope of cross-division supply chain coordination influence how extensively the SCM team can capitalize on, or mobilize, resources for timely responses to changes.

5.3 Limitations and future research

Although results of this two-stage study of multiple cases establish a theoretical linkage between organization structure and supply chain agility in the MDF, there are some inherent limitations, but also opportunities they present for future research. Through case studies in stage two, data from 35 MDFs are collected to test the five theoretical propositions developed from stage one. The data analysis results support the corresponding propositions. In future research, we may use a larger sample to conduct analyses around structural variables and additional factors that could potentially impact supply chain agility. For example, it has been acknowledged that organizational learning has positive effects on dynamic capabilities (Teece, 2007; Zollo and Winter, 2002; Zott, 2003). Dunbar and Starbuck (2006) point out that learning to design organizations and learning from designing them are equally important. Future research can explore relationships among learning, organizational structure and supply chain agility. Power may be another relevant variable. Astley and Aschdeva (1984) theorize that organizational structures provide the sources for power. In future studies, scholars can examine the interplay between organizational structure, power and supply chain agility.

Furthermore, although we diligently sought to control for response bias due to one-side views of supply chain agility, we recognize that the effect of such a bias may still persist. Future studies should collect data from the focal firm's supply chain partners (e.g. suppliers and/or customers) to ensure a balanced view. Also, because this is a cross-sectional study, we cannot comment on the effect of organizational structure on supply chain agility over time. To do that, a longitudinal study is needed.

This study demonstrates the possibility of linking organization design research to the research of dynamic capabilities other than supply chain agility. Future research can investigate how structural choices for SCM team affects a firm's resilience capability. Future

research also can examine other possible structural configuration-dynamic capability linkages, such as a linkage between structural configuration of SCM team and entrepreneurial capability.

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