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Highlights

- The links between supply chain agility, flexibilities, and firm performance were modeled.
- A survey of 141 fashion manufacturers in Asia was used to confirm the model.
- Both strategic and manufacturing flexibilities positively affect supply chain agility.
- The mediation role of supply chain agility was validated through statistical analysis.
- Incorporating supply chain agility and supply chain flexibility strengthens firm performance.

The Effects of Strategic and Manufacturing Flexibilities and Supply Chain Agility on Firm Performance in the Fashion Industry

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Abstract

Responsiveness to customers and markets is an indispensable requirement for all industries, particularly the fashion industry. The present study attempts to address this issue by employing a resource-based perspective as a lens for exploring the major antecedents and consequences of supply chain agility at both the strategic and operational levels. Drawing on a review of the extant literature, we argue that two organizational flexibility factors—strategic flexibility and manufacturing flexibility—are the critical antecedents to supply chain agility. In addition, supply chain agility, strategic flexibility, and manufacturing flexibility are all significant factors in firm performance. A conceptual framework for the arguments was developed and tested through an empirical study of selected industrial practitioners. Data from a sample of 141 garment manufacturers were analyzed using structural equation modeling. The results reveal that both strategic flexibility and manufacturing flexibility positively influence supply chain agility. However, strategic flexibility has a direct and significant influence on firm performance while manufacturing flexibility does not. Furthermore, supply chain agility plays an important role in mediating the effects of both strategic and manufacturing flexibilities on firm performance. The findings of the present study add to the understanding of supply chain management, with a focus on supply chain agility in the fashion manufacturing industry.

Keywords: Supply chain management, Supply chain agility, Strategic flexibility, Manufacturing flexibility, Fashion manufacturing industry

1. Introduction

Fashion items are unique consumer products characterized by short life cycles, high demand volatility, low sales predictability, and impulsive purchases (Moon & Ngai, 2010; Christopher, Lowson, & Peck, 2004; Bruce, Daly, & Towers, 2004). A fashion product is designed to capture the ephemeral mood of the moment; it may therefore be saleable only for very short periods of time—perhaps only months or even weeks (Christopher & Peck, 1997). The demand for such products is also highly unstable and affected by such factors as the weather, the latest movies, special events, and celebrities' choices. Furthermore, the fashion industry is huge, fragmented, extremely globalized, and affected by a myriad of economic, social, financial, and even political issues. Within this context, industrial players must take an active role in balancing the supply and the demand.

The unique characteristics of fashion products pose significant challenges to all practitioners in the industry who seek to reduce prices and increase responsivity to market demands, which requires complicated operations along the entire supply chain (Christopher et al., 2004). In particular, fashion retailers at the market frontline have the greatest difficulty in choosing the right merchandise at the right quantity to address their customers' needs and desires for the upcoming season. A solution to this problem is to stall buying decisions until the very last minute in order to secure better market "read" and deliver the right merchandise to meet the volatile market demands. In order to gain some leeway, fashion retailers often pass on the burden to upstream members—garment manufacturers and fabric suppliers—who in turn need to be much more flexible in meeting this dynamic business requirement. In such a relentless environment, managers have to develop smart supply chain strategies that emphasize speedy delivery, enhanced supply chain agility, and accelerated response times (Lee, 2004). Anyone unable to adapt to these conditions will eventually fail and be forced out of the industry.

Supply chain agility is widely considered to be the most critical success factor in today's competitive marketplace (Goldman, Nagel, & Preiss, 1995), as an agile supply chain enables its member firms to be more market-sensitive, more capable of synchronizing supply with demand, and better able to achieve shorter cycle times (Christopher, 2000). Supply chain agility is defined by Sharp, Irani, and Desai (1999) as the ability of a supply chain to respond rapidly to changes in the market, and by Ismail and Sharifi (2006) as the capability of a supply chain and its members to rapidly realign the network and its operations to meet the highly dynamic customer requirements. Many researchers agree that flexibility is an important factor influencing a firm's agility and overall performance (Barney, 1991; Sanchez, 1995; Li, Liu, Duan, & Li, 2008; Agarwal, Shankar, & Tiwari, 2006b; Gong, 2008). Adopting this perspective, we posit that supply chain agility and organizational flexibility are significantly related (Sanchez, 1995; Zhang, Vonderembse, & Lim, 2003) and that organizational flexibility is one of the most important factors in achieving superior supply chain agility and firm performance. The causal relationship is well-documented. However, most relevant studies discuss the issue in terms of the benefits involved, meaning that there is a research gap that calls for a more in-depth empirical

examination of the role of supply chain agility and the linkages to its antecedents and consequences.

The present study aims to narrow the gap through an investigation of the perspectives of fashion manufacturers in the emerging Asian market whose production operations take place primarily in China or other countries in the region. These respondent firms were chosen for two reasons: (1) manufacturers in this industry struggle to compete in the relentless market; and (2) firms in this emerging market face additional uncertainties, such as government's changing policies, exchange rate fluctuation, and rising operational costs. All these issues are likely to make firms eager to improve their agility in order to enhance their competitive edge. In this study, rather than including all the antecedents of supply chain agility, we focus on two flexibility-related organizational factors—strategic flexibility and manufacturing flexibility—in view of their relevance to the fashion manufacturing industry. We study how intensively these two flexibility factors affect supply chain agility and firm performance, and then further examine how supply chain agility mediates the relationships between these flexibility factors and firm performance.

The resource-based view in the extant literature explains how firms can achieve unique, sustainable competitive advantages through the acquisition and control of available resources, thereby generating superior long-term performance (Barney, 1991; 2001). From this perspective, firm performance can be seen as a function of resource mix. Competitive advantages can be achieved when a firm's resources are heterogeneous, specific, difficult to replicate, and/or when a firm is able to create greater value for customers than its competitors (Ansoff, 1965; DeCastro & Chrisman, 1995). Specifically, the resources must be valuable, rare, inimitable, and non-substitutable (VRIN) (Barney, 1991; Peteraf, 1993). These characteristics (often referred to as the "VRIN framework") represent the potential performance outcomes of resources. This implies that the greater a firm's ability to differentiate itself and use its VRIN resources, the higher its chances of achieving superior performance. Consideration of these capabilities inspired the present research idea and laid the foundations for establishing the research hypotheses.

Employing the resource-based view, we developed a research framework for the conceptualization of the linkages among the four research constructs of strategic flexibility, manufacturing flexibility, supply chain agility, and firm performance. Through structural equation modeling (SEM), the causal relationships among these constructs were statistically tested with the data obtained from an industrial survey. Based upon the findings, recommendations regarding how manager can improve their firms' strategic supply chain deployments are provided, while theoretical contributions and industrial implications are specified.

The remainder of this paper is organized into four sections. Section 2 presents a review of the literature on the four research constructs and sets out a conceptual framework, with seven hypotheses addressing the interrelationships of the research constructs under study. Section 3 discusses the research methodology adopted in conducting the survey study. Section 4 analyzes

the data collected to test the seven proposed hypotheses and confirms the overall model. Section 5 concludes the study and discusses potential future research in the subject area.

2. Theoretical Background

In this section, the key antecedents and consequences of supply chain agility are identified. A research framework linking the key research constructs is conceptualized. This framework serves as a foundation for the subsequent empirical study.

2.1. Supply Chain Agility, Strategic Flexibility, Manufacturing Flexibility, and Firm Performance

A review of the extant literature, the basic concepts of the four major research constructs of this study are defined and discussed in this subsection. Table 1 provides a summary of the definitions of each construct and sub-construct, as well as the sources of the references.

2.1.1. Supply Chain Agility

Agility is a very broad, multidimensional concept that includes customer agility (Sambamurthy, Bharadwaj, & Grover, 2003), operational agility (Amit & Zott, 2001), partnering agility (Sambamurthy et al., 2003), enterprise agility (Overby, Bharadwaj, & Sambamurthy, 2006), organizational agility (Goldman et al., 1995), and supply chain agility (Agarwal et al., 2006b). The present study focuses solely on supply chain agility because it is the most critical capability for fashion manufacturers owing to the unique nature of the industry, in which interdependence among the supply chain members is intensive.

There are numerous definitions and interpretations of supply chain agility. The Iacocca Institute first used the term "agility" in the business context, arguing that an enterprise thrives, in an environment of rapid and unpredictable change, by acting in an agile manner (Nagel & Dove, 1991). Goldman et al. (1995) considered agility as an advantage in delivering value to customers, facing changes readily, valuing human knowledge and skills, and forming virtual partnerships. Swafford, Ghosh, and Murthy (2008) contended that a firm's level of supply chain agility represents the strength of the interface between the firm and its markets. For the present study, we follow the concepts of Braunscheidel and Suresh (2009), who defined supply chain agility as a firm's internal and external capability—in conjunction with its key suppliers and customers—to respond in a timely manner to market changes as well as to potential and actual disruptions.

Supply chain agility can be achieved through the synergies of different forms of flexibility from all parties in the supply chain (Agarwal, Shankar, & Mandal, 2006a), thus empowering each member firm to respond more effectively to a highly volatile marketplace. Owing to the fact that supply chain agility represents an outcome or externally focused concept, it is thus asserted by Swafford, Ghosh, and Murthy (2006) as a capability, rather than a competency. In sum, it addresses the rapidity of a firm in response to the key supply chain outcome measures, such as

the reduction of manufacturing lead-times, the increase of new product introductions, and the improved level of customer service; although the question of how effectively these measures can be achieved still remains.

2.1.2. Key Antecedents of Supply Chain Agility

Supply chain agility depends upon many different elements that pertain to firm performance; these include but are not limited to postponement, delivery speed, centralized and collaborative planning, vendor management inventory deployment, quick-response strategy, data accuracy, lead time reduction, cost minimization, IT and IT integration, and organizational flexibility. Reed and Blunsdon (1988) described organizational flexibility as an organization's capacity to adjust its internal structures and processes in response to changes in the business environment. In other words, organizational flexibility determines when and how work gets done within a firm and is thus the most important antecedent of supply chain agility in the fashion manufacturing industry. In this context, organizational flexibility can be regarded as involving the strategic use of a firm's own resources and tactical management of its manufacturing operations, which are referred to as strategic flexibility and manufacturing flexibility, respectively.

Strategic Flexibility

Strategic flexibility is the ability of a firm to adjust its strategic decisions in response to internal or external changes (Aaker & Mascarenhas, 1984; Matthyssens, Pauwels, & Vandenbempta, 2005; Price, Beach, Muhlemann, & Sharp, 1998). It also involves building the capability to react to changing market conditions; which typically means investing in diverse resources and possessing a wide array of strategic options (Bowman & Hurry, 1993). Firms possessing strategic flexibility have flexible resource pools and diverse portfolios of strategic options that allow them to practice effective "surprise management" (Ansoff, 1980). Inevitably, strategic flexibility equips firms with the ability to respond promptly to market opportunities and emerging technologies.

Taking the resource-based view, Sanchez (1995) contended that strategic flexibility is constrained by a firm's resources and the manner in which it employs them. This is because the resources themselves play an important role, along with the services they contribute to business operations. Sanchez (1997) further divided strategic flexibility into resource flexibility and coordination flexibility and explained that the former essentially describes the array of resources available to a firm whereas the latter refers to the options for deploying these resources. Thus, resource flexibility is determined by the inherent properties of the resources, while coordination flexibility reflects the ability of a firm to use the available resources (Grewal & Tansuhaj, 2001).

Manufacturing Flexibility

Manufacturing flexibility is defined as "the ability of a manufacturing system to cope with changing circumstances or instability caused by the environment" (Gupta & Goyal, 1989, p.120). This also refers to a short-term operational level of flexibility pertaining to day-to-day work (Sethi & Sethi, 1990; Suarez, Cusumano, & Fine, 1995). According to Upton (1994),

manufacturing flexibility determines a firm's ability to organize its production processes in order to generate different kinds of products in reaction to unexpected changes in the business environment, with minimal penalties in terms of time, effort, cost, or performance. With manufacturing flexibility, a firm can reconfigure its manufacturing resources to produce different products efficiently (Boyle, 2006) so as to increase the availability of its offerings to a market, improve its ability to respond quickly to changes, and achieve strong performance for different products. The ultimate goal of manufacturing flexibility is to reduce production time, lower production costs, and widen product ranges given the available resources.

Slack (1987) originally conceptualized manufacturing flexibility as a two-dimensional construct comprising range flexibility and response flexibility. The concept of range flexibility is defined as "the total envelope of capability or range of states, which the production system or resource is capable of achieving"; whereas the concept of response flexibility is defined as "the ease (in terms of cost, time, or both) with which changes can be made within the capability envelope" (p.39). Extending these concepts, Li and Ogunmokun (2008) viewed the range flexibility of a firm as being the "ability to provide a varied product mix in response to changes in market demand by taking on an increased range of tasks, obtaining timely suppliers, and rescheduling the order of production"; and they also viewed the response flexibility of a firm as being the "ability to provide a quick response to changes in delivery requests by tracking inventory and sales, assuming carrying expenses, and speeding up container movements" (p.740). Thus perceived, range flexibility is a static aspect typically measured over a long period, with time and cost as elements of friction; whereas response flexibility is a dynamic aspect involving change from one state to another, which is typically measured over a short period and without notable changes in cost (De Toni & Tonchia, 1998).

2.1.3. Firm Performance

Firm performance indicates how effectively an organization runs its business. It is a key measure used to evaluate the success, or the mere possibility of survival, of an organization. Firm performance is one of the most relevant constructs in the field of business studies (Rumelt, Schendel, & Teece, 1994) and is frequently considered the final outcome of a business model (Richard, Devinney, Yip, & Johnson, 2009). In the present study, we take firm performance as being the chief consequence of supply chain agility.

In practical terms, firm performance can be measured in a number of ways. Financial performance is the most common measure (Huang, Ou, Chen, & Lin, 2006; Rai, Patnayakuni, & Seth, 2006; Nadkarni & Narayanan, 2007), but it is a narrow indicator of organizational effectiveness (Santos & Brito, 2012). Following the proposal of Rai et al. (2006), we examine a firm's operational excellence, revenue growth, and customer relationships, rather than measuring financial performance alone. Such an extended understanding of firm performance facilitates a more comprehensive and balanced view and eliminates dependence on measures that are either susceptible to manipulation or do not capture the various facets of actual business performance.

The details of the firm's operational excellence, revenue growth and customer relationship are discussed in the Section 3.1.

2.2. Research Hypotheses

In line with the resource-based view, we developed seven research hypotheses to examine the interrelationships of supply chain agility with its two major antecedents and one chief consequence, as well as its mediation role in governing the effects of the two flexibility factors (antecedents) on firm performance (consequence).

2.2.1. Relationships between Strategic Flexibility and Manufacturing Flexibility and Supply Chain Agility

A firm can achieve competitive advantages in a dynamic environment by developing strategic flexibility in the form of the alternative courses of action available to it—a fundamental approach to managing risks and uncertainties (Sanchez, 1993). Fast-changing product markets, (such as the fashion market) feature both high-level competition and numerous uncertainties and operate in an unstable environment (Moon, Mo, & Chan, 2014). Lau (1996) posited that strategic flexibility enhances the capacity of a firm to respond to such a market environment by adjusting its objectives with the support of superior knowledge and capabilities. Sanchez (1995) argued that strategic flexibility, including resource flexibility and coordination flexibility, is more than an operational-level antecedent to agility. In practice, when resource flexibility is sustainably high, firms can ensure that rapid new product lines achieve the advantage of market leadership by reducing the search time for required resources. Moreover, firms can integrate, build, and reconfigure internal and external resources through coordination flexibility and thus reduce the cost, time, and effort involved in changing the mix and use of resources (Sanchez, 1997). On the other hand, the basic concept of "agility" refers to the rapidity with which a firm can move to different business operations in a competitive environment. Through improvements in resource flexibility and coordination flexibility, a firm can achieve a degree of agility that enables it to perform strategic deployment in a more efficient and effective manner (Li, Chung, Goldsby, & Holsapple, 2008). From this perspective, we propose the first hypothesis as follow:

Hypothesis 1 (H_1): Strategic flexibility positively influences supply chain agility.

Manufacturing flexibility is also a key organizational flexibility factor at the operational level; it is the capacity of a firm to efficiently reconfigure its manufacturing resources in order to produce different products and thus cope with market uncertainties and maintain a high level of performance (Gerwin, 1993; Slack, 2005). This type of flexibility is primarily the competency to meet an increasing variety of customer expectations without excessive cost, time, organizational disruption, and performance loss (Zhang et al., 2003). A firm can exploit its manufacturing flexibility (i.e., range flexibility and response flexibility) to utilize an extensive range of production options because of the reduction of required costs and time (Slack, 1987). More importantly, a higher level of manufacturing flexibility enables a firm to adjust and shorten the interval between planning and implementation, thereby increasing its ability to improvise

(Johnson, Lee, Sanin, & Grohmann, 2003). Thus, a firm can enhance its supply chain agility by increasing the speed with which it is able to move its business configuration from the current state to a new state. We therefore believe that manufacturing flexibility is one of the most critical elements in generating supply chain agility. The following hypothesis derives from this point:

Hypothesis 2 (H_2): Manufacturing flexibility positively influences supply chain agility.

2.2.2. Relationships between Strategic Flexibility/Manufacturing Flexibility and Firm Performance

Strategic flexibility is often expected to increase the effectiveness of communication, plans, and strategies; coupled with the adapted product offerings and other aspects of the marketing mix, this can improve the performance of a firm (Miles & Snow, 1978). The two major elements of strategic flexibility—resource flexibility and coordination flexibility—are functions of the resources a firm owns and its capacity to make use of these resources. Inevitably, strategic flexibility affects the manner in which firms can create competitive advantages in response to major changes in the external environment. Moreover, as Katsuhiko and Hitt (2004) contend, strategic flexibility denotes the capability of a firm to commit resources to new courses of action rapidly. This means recognizing when the time comes to halt or reverse existing resource commitments and acting promptly in response to various market changes. In this regard, strategic flexibility is a crucial factor in the success of a manufacturing firm in a volatile marketplace. Therefore, we propose the following hypothesis:

Hypothesis 3 (H_3): Strategic flexibility positively influences firm performance.

On the other hand, manufacturing flexibility can be viewed as the capacity of a firm to undertake new actions during its production process to meet the requirements of new circumstances, and to continue the production process effectively despite changes in the business environment (Upton, 1994). If there is an alignment of exogenous variables (e.g., the competitive environment, strategy, organizational attributes, and technology), then a manufacturer that possesses such capacities can generate competitive advantages (Vokurka & O'Leary-Kelly, 2000). Manufacturing flexibility is often considered an important factor in enhancing the competitive position of a manufacturer and winning customer orders (Zhang et al., 2003; Javier, Leopoldo, & Antonia, 2014). It has also been empirically determined to have a direct and significant effect on various performance outcomes, such as manufacturing costs (Kekre & Srinivasan, 1990; Narasimhan & Das, 1999), sales growth (Swamidass & Newell, 1986), and financial profitability (Vickery, Droge, & Markland, 1997). On these grounds, manufacturing flexibility has been extensively cited as a means of improving firm performance (Vokurka & O'Leary-Kelly, 2000). Therefore, we propose the following hypothesis:

Hypothesis 4 (H_4): Manufacturing flexibility positively influences firm performance.

2.2.3. Relationship between Supply Chain Agility and Firm Performance

As discussed above, supply chain agility pertains to the capability of a firm—both internally and externally, and in conjunction with its key suppliers and customers—to adapt or respond rapidly to market changes as well as to potential and actual disruptions, thus contributing to the agility of the extended supply chain (Braunscheidel & Suresh, 2009). In the past few decades, we have witnessed the intensification of global competition, a volatile marketplace, unpredictable and drastic changes in customer demand, and chaotic environments in many industries, particularly in the fashion industry (Moon et al., 2014). In response to these challenges, firms should keep their options open wherever possible by consciously developing the ability to provide superior value, manage disruption risks, and ensure uninterrupted service to customers in an agile manner, so as ultimately to improve their overall performance (Christopher, 2000; Christopher & Towill, 2001; Zhang, Vonderembse, & Lim, 2002; Chopra & Sodhi, 2004; Swafford et al., 2006; Yusuf, Gunasekaran, Adeleye, & Sivayoganathan, 2004). Indeed, the possession of such competitive advantages is the foundation of a firm's success in the face of strong competition and high uncertainty. Hence, we have the following hypothesis:

Hypothesis 5 (H_5): Supply chain agility positively influences firm performance.

2.2.4. The Role of Supply Chain Agility in Mediating the Impacts of Strategic Flexibility and Manufacturing Flexibility on Firm Performance

Supply chain agility is commonly broken down into two components: sensing and responding (Overby et al., 2006). Sensing capability refers to the capacity of a firm to sense environmental change, while responding capability refers to its capacity to respond to this. Dove (2001) related the responding component to "response ability," which he defined as the physical ability to act; he also related the sensing component to "knowledge management"—the intellectual ability to identify situations requiring action. An agile firm is adept at sensing changes in its business environment and alert to how these changes could affect its operations. More importantly, an agile firm can implement the necessary improvements and alter its current configuration to adapt to a new business environment in a timely manner. Tapping into the synergies of strategic and manufacturing flexibilities amongst all the parties within a supply chain, supply chain agility can enable member firms to respond more effectively to a highly uncertain marketplace (Agarwal et al., 2006a).

Strategic flexibility, as mentioned above, is determined by the strategic possession of a range of resources and by the ability to deploy those resources. The total effect of such inherent competencies on firm performance can be obtained from applying these competencies to respond promptly in a proactive or reactive manner to market threats and opportunities (Grewal & Tansuhaj, 2001). The sensing and responding nature of supply chain agility can enable a firm to extend its strategic flexibility to undertake actions both strategically and operationally in order to achieve its objectives. From this perspective, we believe that taking account of supply chain agility may help better explain the effects of strategic flexibility on firm performance. Thus, we propose the following hypothesis:

Hypothesis A (H_A): Supply chain agility mediates the impact of strategic flexibility on firm performance.

As discussed earlier, manufacturing flexibility refers to the capacity of a firm to adopt different configurations within its existing production capability and to move easily from one manufacturing system configuration to another (Boyle, 2006). Similar to the case of strategic flexibility, the inclusion of supply chain agility can better explain the total effect of manufacturing flexibility on firm performance. This signifies that the total influence of manufacturing flexibility on firm performance cannot be fully elicited unless a firm can sense changes in the market and undertake strategic actions in response to those changes through supply chain agility. Therefore, we believe that supply chain agility has a significant role in mediating the total effect of manufacturing flexibility on firm performance. Thus, we propose:

Hypothesis B (H_B): Supply chain agility mediates the impact of manufacturing flexibility on firm performance.

2.3. Overall Conceptual Model

Adopting the resource-based perspective on supply chain agility, firms can differentiate themselves by positioning the distinctive core competencies of their VRIN capabilities to respond rapidly to market changes (Barney, 1991; Wernerfelt, 1984). As described by Braunscheidel and Suresh (2009), supply chain agility is an externally focused capability that is derived from flexibilities allowing the supply chain to react quickly to market changes. Christopher (2000) also argued that an agile supply chain is market-sensitive; that is, it is capable of sensing and responding to real demand, thus enhancing a firm's overall performance. Reed and Blunsdon (1988) described flexibility, somewhat differently, as being the capacity of an organization to adjust its internal structures and processes in response to changes in the business environment. In this study, we follow Swafford et al. (2006) in holding that strategic flexibility and manufacturing flexibility are the two major components of organizational flexibility that influence supply chain agility and, in turn, enhance overall organizational performance.

Figure 1 represents schematically the overall conceptual model used in this study and illustrates the interrelationships of the four key research constructs: strategic flexibility (with the sub-constructs of resource flexibility and coordination flexibility), manufacturing flexibility (with the sub-constructs of range flexibility and response flexibility), supply chain agility, and firm performance. Furthermore, strategic flexibility and manufacturing flexibility are positioned as a second-order model rather than a first-order model because the former can yield higher significance (Moon, Yi, & Ngai, 2012).

3. Research Methods

In order to test the seven proposed hypotheses empirically and to confirm the overall conceptual model, an electronic questionnaire survey was conducted among the manufacturers in the fashion industry in the emerging Asian market.

3.1. Research Instrument Development and Pilot Test

To achieve an acceptable response rate and ensure the integrity of the instrument, we developed a single questionnaire to measure the multiple theoretical constructs of the study. Following an extensive literature review, the measures of each construct were taken from well-developed scales with questions relating to strategic flexibility, manufacturing flexibility, supply chain agility, and firm performance. Table 1 illustrates the original measures of the four research constructs as well as the sources of the references.

Resource flexibility and coordination flexibility are considered here to be the major components of strategic flexibility. The scales for measuring these components were derived from Liu, Li, and Wei (2009), with six questions on resource flexibility and four questions on coordination flexibility. By contrast, range flexibility and response flexibility are considered to be the sub-constructs of manufacturing flexibility. The measures for these sub-constructs were derived from the work of Li and Ogunmokun (2008); three questions were on range flexibility and another three on response flexibility. Supply chain agility was measured using the scales developed by Swafford et al. (2006), with a total of eight questions.

All the questions concerning the three constructs above were designed to elicit a subjective response, that is, to get the respondents to express their own views on each measurement item. All measures were rated on a seven-point scale. Since the problem of the common-method variance is a concern for many researchers (Chang, Witteloostuijn, & Eden, 2010), we bore this issue in mind when designing the research instrument. As Podsakoff, MacKenzie, Lee, and Podsakoff (2003) state, common-method variance is "variance that is attributable to the measurement method rather than to the construct of interest" (p.879). To ensure that this problem was reduced as much as possible, we followed several remedial approaches suggested by these authors. For example, we adopted scale items well-established in the extant literature, used different response formats for the different research constructs, separated the questions into groups according to their content, and gave assurances of anonymity in the invitation letters.

The questions on firm performance formulated by Rai et al. (2006) were adopted to reflect the concept from different perspectives: operational excellence, customer relationships, revenue growth, and financial performance (see Table 5). Questions concerning each of the first three perspectives were measured subjectively. For the last perspective, financial performance, we followed the approach of Vickery et al. (1997) and included five measures: return on investment after tax, growth in return on investment, sales growth, return on sales, and growth in return on sales. In a further bid to avoid common-method bias, these five measurement items were assessed both subjectively and objectively. Specifically, the respondents were first asked to express their own views on their financial performance in comparison with their competitors, and

then asked to provide information regarding their actual growth in each of these five areas over the previous fiscal year. In all, there were ten questions on financial performance.

To further ensure the validity of this research instrument, a pilot study was conducted among 16 target respondent firms prior to the formal survey process. The results indicated no major structural design errors in the questionnaire. We also invited three academic colleagues and five industrial practitioners in the field to give critical comments on the design of the questionnaire. The feedback was uniformly positive.

3.2. Sample and Sampling Procedures

To ensure the rigor of our study and distinguish it from other studies in the field, we focused on a single fashion industry during one time period and included only manufacturers. This approach allowed better control of the measurement process (Dixon, 1992). We also sought to include only those manufacturers with major production operations in China or in other Asian countries, both because Asia is an emerging market in the global economy and because the industrial practitioners in this region are the principal players in the fashion manufacturing industry. Four major reputable fashion associations registered in Hong Kong were adopted as the main source of the sample since they include a large number of the key fashion manufacturers in the region.

Random sampling was employed. The selected sample firms were carefully reviewed to avoid overlapping (i.e., to check whether they belonged to more than one association). As manufacturers may register more than one name for their businesses, their principal names and email addresses were double-checked. A final list of 725 randomly selected garment manufacturers was compiled. Together with the questionnaire, an invitation letter explaining the objectives of the study and stressing the confidentiality arrangement was mailed to the potential respondents in the list. To help arouse their interest in participating in the survey, the invitation also emphasized that the research would focus only on the fashion industry and that the findings of the study will be shared with participants upon their request. After several rounds of email reminders, 141 responses were finally received; this represented a total response rate of 19.4%, which is considered acceptable for an online survey and is close to the recommended minimum of 20% for empirical studies (Malhotra & Grover, 1998).

To ensure that the responses were meaningful, the participants were required to state their position and tenure with their company. The intent was to exclude responses from junior-level staff and from employees who had not been with the company sufficiently long. All the respondents identified themselves as senior- or middle-management employees and most had worked for over five years at their companies, which is indicative of the important roles they play in the development, maintenance, and success of their firms. Table 2 summarizes the company profiles of the respondent firms, while Table 3 shows the personal profiles of the informants.

Non-response bias was also evaluated by testing for significant differences between the early and late respondents, the latter being considered surrogates for non-respondents (Armstrong & Overton, 1977). Using this method, the responses collected in the first 30 days, which comprised 62% of the total valid response rate (87 out of 141 respondents), were compared with the responses (of the remaining 54 respondents) collected in the final 15 days of the data-collection period. Using a *t*-test, a comparison of the early and late respondents was performed with three randomly selected measures: return on sales, company size, and business nature. The results indicated no significant mean differences at the 0.05 level between the two waves of responses, suggesting that non-response bias is not an issue for this study.

3.3. Control Variables

Besides the constructs depicted in our research model in Figure 1, other contextual factors might have an influence on firm performance. Two control variables at the firm level (firm size and firm age) were investigated in this study. Firm size is often correlated with firm performance (Psillaki, Tsolas, & Margaritis, 2010), as large firms may derive greater synergistic effects from supply chain agility. Moreover, firm size influences such business activities as new product introduction and resource deployment (Baysinger & Hoskisson, 1989; Vokurka & O'Leary-Kelly, 2000). Firm age can also affect a firm's performance in that the return on investment and growth rate may be positively or negatively distorted in different years, as a company's experience and knowledge of running the business, as well as the attitude toward the adoption of innovation, may directly relate to the firm's age (Hsieh, Yeh, & Chen, 2010).

4. Results

In this section, we analyze statistically the data collected from the questionnaire survey and present the testing results of the seven proposed hypotheses and the confirmation of the overall conceptual model.

4.1. Measurement of Financial Performance

Prior to testing the hypotheses, we first analyzed the measures of a firm's financial performance. Both subjective and objective data were collected. Each of the five financial measures had one subjective rating ("versus competitors") and one objective value ("actual growth"), resulting in a total of ten ratings. All the respondent firms (i.e., all 141) provided subjective ratings on each measure, while 81 firms (57%) further provided actual growth information. The means of these ratings are presented in Part 1 of Table 4.

Considering the sample size, it is acceptable to run a correlation analysis of the subjective versus the actual ratings. The *p*-values in Part 2 are given to show whether the findings from the correlation analysis are statistically significant. The results show the following correlations:

0.276 for return on investment after tax (p-value=0.006); 0.186 for growth in return on investment (p-value=0.048); 0.224 for sales growth (p-value=0.022); 0.202 for return on sales (p-value=0.035); and 0.230 for growth in return on sales (p-value=0.019). Taken as a whole, all the correlations between the subjective scale ratings and the actual growth values are shown to be significant at the 0.05 level or better. According to Vickery et al. (1997), if the subjective scale ratings correlate significantly with the actual values, these ratings may be considered reliable indicators of the corresponding construct. Owing to concerns about confidentiality when releasing sensitive information, the response rate for objective values is always smaller than that for subjective ratings. Thus, we used only the subjective scale ratings in all the subsequent analyses because of the larger sample size.

4.2. Construct Validity and Reliability

To examine the validity and reliability of the measurement models of the four constructs, we conducted a series of analyses, including analyses of content validity, composite reliability, and discriminant validity. Content validity represents the adequacy of a measure in evaluating the domain of interest (Nunnally, 1978) and reveals the extent to which each variable corresponds to the construct concerned (Bohrnstedt, 1970). Content validity was ensured in this study because the measurement items were derived and modified from measures well-established in the extant literature (see Table 1) and incorporated suggestions from academics and industrial practitioners in the field. Moreover, the respondents in the pilot-test indicated that the content of each construct was well captured by the items in the measurement instrument.

Subsequently, we tested the composite reliability and discriminant validity of the constructs under investigation. The composite reliability measure can be used to check how well a construct is measured by its assigned indicators. In general, composite reliability varies between 0 and 1, with values greater than 0.6 generally judged to be acceptable (Bagozzi & Yi, 1988). The resulting data in Table 5 show that all the composite reliability measures are considerably above 0.6.

According to Fornell and Larcker (1981), discriminant validity of a construct can be established if the average variance extracted (AVE) of this construct is larger than the shared variances (i.e., square of the correlations) between it and any other constructs in the model. The results in Table 6 show that each construct meet this requirement satisfactorily. Based on the results of the above analyses, all research constructs in this study are considered as valid and reliable.

4.3. Testing the Interrelationships of the Research Constructs

In this study, PLS-Graph 3.0 was used for the data analysis. PLS-Gaph 3.0 is an SEM program that provides the ability to model latent constructs, even under conditions of non-

normality and with small- to medium-size samples (Chin, Marcolin, & Newsted, 1996). SEM is a statistical method founded on a confirmatory approach to the analysis of a structural theory bearing on some phenomenon (Byrne, 2013). It provides an efficient means of assessing the consistency of measurements of scale items and of the pre-specified model with an associated network of theoretical concepts (Jöreskog, 1993). Given its distinct advantages over traditional statistical techniques, we decided to use SEM to test and confirm the validity of the measurement scales (Koufteros, Vonderembse, & Doll, 2002; Sin et al., 2005; Saghiri, 2011). Another reason for employing SEM is that our proposed conceptual model is based on the extant literature; such a priori foundation warrants the use of SEM.

Figure 2 presents the estimates obtained from the PLS-Graph. The overall R^2 value is 0.57, demonstrating that the model explains a substantial amount of the variance in firm performance. The strategic flexibility–supply chain agility link (coefficient=0.21, t=2.06) and the supply chain agility–firm performance link (coefficient=0.53, t=2.86) are both significant, offering support for H_1 and H_5. Furthermore, as is evident from the loadings, both resource flexibility (weight=0.72, t=4.39) and coordination flexibility (weight=0.40, t=2.18) are significantly related to the latent variable of strategic flexibility, with resource flexibility being the dominant indicator. Similarly, the manufacturing flexibility–supply chain agility link (coefficient=0.54, t=5.86) is significant, thus supporting H_2. It is also noted that both range flexibility (weight=0.59, t=3.53) and response flexibility (weight=0.49, t=2.90) are significantly related to the latent variable of manufacturing flexibility, with range flexibility having a slightly higher impact than response flexibility. We also find support for H_3 at the 0.05 level (coefficient=0.26, t=1.84), but not for H_4, as the relationship between manufacturing flexibility and firm performance is statistically insignificant (coefficient=0.03, t=0.19). Figure 2 highlights the significant links among the four constructs in order to show the final model. With regard to the control variables, company size is significantly related to firm performance (coefficient=0.33, t=3.72), while company age is not (coefficient=0.09, t=1.16). The exact role of company size in supply chain agility and other constructs remains an interesting issue for future research.

4.4. Testing the Mediation Effects

In our proposed conceptual model, there is a potential role for supply chain agility in mediating the effects of the two flexibility factors on firm performance. We tested for such mediation effects through two complementary procedures. The first assesses the explanatory power (i.e., R^2) of the competing models compared to the base model (Subramani, 2004). Four models are involved in this analysis. The first model is the fully mediated model, in which supply chain agility fully mediates the impacts of strategic flexibility and manufacturing flexibility on firm performance. The R^2 obtained here is used as the base-line for comparison with the other two competing models. The second model is a partially mediated model, which is computed by adding one path (from strategic flexibility to firm performance) to the base model, thereby obtaining a new R^2 for this first competing model. Similarly, the third model—also a

partially mediated model—is computed by adding another path (from manufacturing flexibility to firm performance) to the base model, thus obtaining another R^2 for the second competing model. The fourth model is the total partially mediated model, achieved by adding the paths from both strategic flexibility and manufacturing flexibility simultaneously to firm performance.

As there is an additional direct link incorporated into the two partially mediated models, the base model and each of these two competing models are said to be nested (Subramani, 2004). The results of the nested model comparison (in Table 7) show that the R^2 for the fully mediated model is 47.3%, while the R^2 for the first and second partially mediated models are 48.8% and 47.8%, respectively. The differences between the R^2 statistics of the two competing models and the base model are positive, showing that they have improved the explanation of firm performance.

The significance of the two extra paths was further assessed using a procedure similar to that employed to test nested models in stepwise linear regression. The f^2 statistic was computed from the R^2 differences; the significance of the f^2 was then assessed using a pseudo-F test (Chin et al., 1996). To understand the additional contribution of the two paths, we examined the incremental changes in R^2. Table 7 shows that the f^2 statistic for strategic flexibility to firm performance is 0.029, while manufacturing flexibility to firm performance is 0.010, with a pseudo-F (1,137) of 3.944 and 1.360, respectively. These results indicate that the additional variance explained by the inclusion of the direct path of the strategic flexibility–firm performance link adds significantly to the explanatory power of the overall model (Table 7, row 1), which shows that the effect of strategic flexibility on firm performance is partially mediated by supply chain agility. In contrast, the additional variance explained by the inclusion of the manufacturing flexibility–firm performance link does not add significantly to the explanatory power of the overall model (Table 7, row 2), which shows that the effect of manufacturing flexibility on firm performance is fully mediated by supply chain agility.

The second procedure employs mediation analysis techniques (Hoyle & Kenny, 1999) to examine the two mediation hypotheses (H_A and H_B) in view of the magnitude and significance of individual mediated paths based on values of standardized direct paths computed by PLS-Graph. Hoyle and Kenny (1999) suggest that the magnitude and variance of the direct paths between an independent variable, a mediator, and a dependent variable can be used to calculate the extent to which a construct mediates the relationship between the independent and dependent variables. As Table 8 shows, supply chain agility mediates the relationship between strategic flexibility and firm performance (with z=1.68, significant at the 0.05 level) as well as the relationship between manufacturing flexibility and firm performance (with z=5.30, significant at the 0.01 level). This evidence confirms both H_A and H_B. The importance of leveraging supply chain agility as a mediator to strengthen firm performance is highlighted, implying that incorporating proper mediators may help better explain the impact of organizational flexibility on firm performance.

5. Conclusions

Fashion is by its very nature constantly undergoing change (Frings, 2008). Given that fashion trends change every season, or even every month, the production of fashion lines should be as fast and cost-effective as possible in order to gain maximum profits before the limited selling period ends. The pressure for both speed and cost-reduction is thus intense. To benefit from reduced production costs, many firms have opted to base their production operations in countries that offer the lowest costs (Moon, Ngai, Chang, & Ho, 2009). Over the last few decades, most fashion firms have moved their production operations to low-cost countries, mainly in Asia and particularly in China. This trend has made the region the world's major fashion supply center.

Running businesses in this emerging market is beset with challenges. There are more risks and uncertainties—in terms of economic, political, legal, social, cultural, and environmental issues—than in traditional markets (Moon et al., 2014). For example, China's new labor and environmental policies and the recent political tensions with the United States have plagued many firms in the industry. Moreover, the garment supply chain is long and multidimensional and includes a production sector (for garments, textiles, fibers, and accessories) as well as a trading sector (for retailers, wholesalers, and agents). Even more challengingly, different echelon members along the entire supply chain are often located in different countries. Overall, this situation has resulted in an extremely complicated supply chain structure. To manage it successfully, firms should devise and implement supply chain strategies wisely, especially with regard to supply chain agility and organizational flexibility.

5.1. Summary and Discussion

The results of this study indicate that strategic flexibility and manufacturing flexibility have a positive and significant effect on supply chain agility. A further inspection of the weights associated with the indicators of these two latent variables suggests that both of them are critical elements. However, resource flexibility is more important than coordination flexibility for strategic flexibility, implying that investment in diverse resources contributes more to product development, sales, and marketing. On the other hand, both range flexibility and response flexibility are important for manufacturing flexibility, with the former being slightly more important for obtaining a flexible manufacturing system.

The results further support the notion that supply chain agility plays an instrumental role in enhancing firm performance and that both strategic flexibility and manufacturing flexibility are key factors in helping firms adapt to the rapidly changing environment of the global fashion business. This is especially true when the two flexibility factors operate via supply chain agility. According to the data analysis, all of the proposed linkages—with the sole exception of H_4 (i.e., the link of manufacturing flexibility–firm performance)—were statistically significant. This implies that both strategic flexibility and manufacturing flexibility have positive, significant effects on supply chain agility; that, in turn, supply chain agility further impacts upon firm

performance; and that the direct effect of strategic flexibility on firm performance is significant while that of manufacturing flexibility is not.

As expected, supply chain agility plays an important role in mediating the effects of the two flexibility factors on firm performance. The results of the data analysis show that supply chain agility has a partial-mediation effect on the relationship between strategic flexibility and firm performance, which implies that strategic flexibility has some direct impact on firm performance. On the other hand, supply chain agility has a full-mediation effect on the relationship between manufacturing flexibility and firm performance. Therefore, the effect of manufacturing flexibility on firm performance is fully yielded via supply chain agility. This finding contradicts previous studies (e.g., Vokurka & O'Leary-Kelly, 2000), which have asserted that embracing manufacturing flexibility could enable a firm to respond successfully to changes in the marketplace and thus enhance business competitiveness directly. The results of the present study show that manufacturing flexibility does not have a direct influence on firm performance; instead, it has a positive effect on firm performance only when mediated by supply chain agility.

This counterintuitive result reflects recent changes in the global fashion industry. In the past, the demand was greater than the supply and buyers from advanced economies sourced only staple products from suppliers in Asian countries. The success of a garment manufacturer in the region often depended on its production capacity. Therefore, manufacturing flexibility contributed significantly to firm performance. However, this situation no longer obtains today, as the industry encounters strong market demand for low costs, fast production, and high quality. More importantly, fashion buyers not only demand a wide range of fancy products but also place their orders at the very last moment and frequently make changes to design details or size/color combinations. Garment manufacturers must develop supply chain agility in order to reap the dividends of manufacturing flexibility by being able to sense and respond more promptly and strategically to the challenges posed by such an unstable business environment.

5.2. Industrial Implications

Supported by both strategic flexibility and manufacturing flexibility, supply chain agility enhances a firm's ability to respond promptly to market needs. Manufacturing flexibility as a concept is relatively easier to understand and less abstract than strategic flexibility or supply chain agility, and the benefits it generates are obvious. Consequently, manufacturers often invest in enhancing their manufacturing flexibility by upgrading their machinery, labor, and handling of material (Zhang et al., 2003; Javier et al., 2014) in the hope of enabling their firms to respond with timely product modifications and new product commercialization. Strategic flexibility is very often neglected, although it is also a significant antecedent to supply chain agility and firm performance.

From a pragmatic standpoint, much can be gained if firms develop the strategic flexibility to deploy their scarce resources in a flexible manner for swift maneuvering. In this way, firms can reduce the costs, time, and effort involved in changing the mix and use of resources, thereby leading to efficient supply chain agility (Sanchez, 1997). Firms should be able to improve both

manufacturing flexibility and strategic flexibility, as well as to link these competencies to supply chain agility in order to enhance performance. This strategy is not just a matter of the resources per se; understanding ways to deploy such resources is more critical to success, particularly for those firms whose production is undertaken in more than one plant and whose customers are in more than one marketplace. This is because undertaking business in such a complicated and unstable environment needs greater degree of strategic planning to coordinate and balance all supply chain activities.

5.3. Theoretical Contributions

The results of the present study provide three important theoretical contributions to a better understanding of supply chain management, with a focus on supply chain agility. First, we have formulated a conceptual framework from a resource-based view that incorporates organizational flexibility (at both strategic and operational levels) as an antecedent to supply chain agility and firm performance. This framework can help firms identify the key capabilities needed to compete in a volatile business environment. The findings of our study enrich the literature by providing an in-depth understanding of the nature of strategic flexibility and manufacturing flexibility as well as their interrelationships with supply chain agility and firm performance. Most importantly, to the best of our knowledge, the present study is the first of its kind to use supply chain agility as a mediator to test the impacts of various flexibility factors on firm performance in the fashion manufacturing industry, which is one of the biggest and most complicated manufacturing industries in the world.

Second, this study has validated (through the use of SEM) the causal relationships among strategic flexibility, manufacturing flexibility, supply chain agility, and firm performance. Flexibility is a widely vetted and well-defined concept related to agility. However, few empirical studies have been conducted to confirm the significance of these relationships. In investigating this aspect, the present study has advanced the understanding of the statistical operationalization of the interrelationships among these key constructs. In addition to the studies that have posited supply chain agility as a valuable instrument, competing with other aspects of the supply chain, the theoretical development of this study highlights the key issues that can assist firms to achieve supply chain agility. In particular, the empirical findings offer a different perspective on the direct influence of manufacturing flexibility on firm performance. Practitioners in the fashion industry can refer to the findings of this study when strategically managing their resources and coping with the challenges of the global market arena.

Third, the current study builds on the findings of Swafford et al. (2006), who examined supply chain agility at the operational implementation level, to extend the concept to both the operational and strategic levels. Moreover, while their work focused only on the relationship between supply chain flexibility and supply chain agility, the current study included firm performance as the dependent variable in the research framework. In establishing the links between organizational flexibility and supply chain agility, the present study hopes to encourage managers to engage in strategic implementation of the appropriate proactive steps open to them

rather than merely investing in silo flexibility. Managers should be able to identify ways to create supply chain agility at the capability level from a resource-based perspective in order to gain sustainable, secure competitiveness.

5.4. Limitations and Future Research

Despite its profound theoretical contributions and important industrial implications, the present study has certain limitations. First, in analyzing and assessing the effects of strategic flexibility, manufacturing flexibility, and supply-chain agility, the focus of this study is on certain specific attributes; namely, the resource and coordination dimensions of strategic flexibility, as suggested by Liu et al. (2009); the range and response dimensions of manufacturing flexibility, as derived by Li and Ogunmokun (2008); and some forms of supply chain agility, as specified by Swafford et al. (2008). With this in mind, it must be acknowledged that other attributes reported in the field might contribute to different research findings. Nadkarni and Narayanan (2007), for example, investigated strategic flexibility using four measures—resource deployment, shifts in resource deployment, competitive simplicity, and shifts in competitive action—these measures may enlarge the concept of the construct. To augment the research findings laid out here, researchers in their future research should consider using different measures of structural attributes to account for specific constructs and/or consider expanding the dimensions of each construct.

In addition, the sample (141 firms) was relatively small, and this study was conducted exclusively in the fashion manufacturing sector in Asia. Questions might be raised about the generalizability of the findings; caution should be exercised when extrapolating them to firms in other industries or regions. Another limitation of our study is its cross-sectional design. Since the environment of the fashion market is always changing, the present study may not reflect future business situations. To strengthen the generalizability, it is recommended that for future studies researchers consider a longitudinal approach with a larger sample—that is, with a broader representation of firms in other manufacturing sectors (such as toys, electronic products, or home appliances) as well as in other regions (such as Latin America or Africa). The addition of samples from different cultures and recruiting respondents/participants with different business mindsets would render the results more generalizable and more fruitful, and would no doubt suggest further avenues of exploration in this field.

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List of Tables

Table 1

Definitions and original measures of the research constructs.

Construct	Definition (source of reference)	Original measures (source of reference)
Strategic flexibility	A firm's ability to adjust its strategic decisions in response to either internal or external changes in the market environment (Aaker & Mascarenhas, 1984; Matthyssens et al., 2005; Price et al., 1998)	
*Resource flexibility	The array of resources available for a firm to use (Sanchez, 1995, 1997)	1. The main resources contribute to product development, products, sales, and so on 2. The sharing degree of the main resources used in developing, producing, selling and after-sell services of different products is high 3. The firm often finds new uses for existing main resources through communication between units 4. Uses of the main resource can be easily switched to an alternative one in different units of the firm (Liu et al., 2009)
*Coordination flexibility	The options available to deploy existing resources through organizational systems and processes (Sanchez, 1995, 1997)	1. The time of changeover to a different product is short on the main production line 2. The cost of changeover to a different product is small on the main production line 3. In order to cope with various conditions, we make efforts to improve mobility by fostering capabilities incrementally 4. In order to cope with various conditions, we make efforts to improve adaptability by fostering capabilities incrementally. (Liu et al., 2009)
Manufacturing flexibility	A firm's ability to reconfigure its manufacturing resources in order to produce efficiently different products of acceptable quality to cope with the unexpected changes in the business environment with little penalty in time, effort, cost, or performance (Boyle, 2006; Upton, 1994)	
*Range flexibility	A firm's ability to provide a varied product mix in response to changes in market demand by taking on an increased range of tasks, obtaining timely suppliers, and rescheduling the order of production (Slack, 1987; Li & Ogunmokun, 2008)	1. The working unit has great flexibility in rescheduling the order of production in response to changes in demand 2. The working unit has great flexibility in obtaining timely suppliers in response to changes in demand 3. The working unit has great flexibility in handling an increased range of work skills in response to changes in demand (Li & Ogunmokun, 2008)
*Response flexibility	A firm's ability to provide a quick response to changes in delivery requests by tracking inventory and sales, assuming carrying expenses, and speeding up container movements (Slack, 1987; Li & Ogunmokun, 2008)	1. The working unit responds quickly in assuming carrying expenses 2. The working unit responds quickly in speeding up container movements 3. The working unit responds quickly in tracking inventory and sales (Li & Ogunmokun, 2008)
Supply-chain agility	The capability of the firm, both internally and externally, in conjunction with its key suppliers and customers, to adapt or respond quickly to marketplace changes as well as to potential and actual disruptions, contributing to the agility of the extended supply chain (Braunscheidel & Suresh, 2009)	1. Speed in reducing manufacturing lead-time 2. Speed in reducing development cycle time 3. Speed in increasing frequencies of new product introductions 4. Speed in increasing levels of customization 5. Speed in adjusting worldwide delivery capability 6. Speed in improving level of customer service 7. Speed in improving delivery reliability 8. Speed in improving responsiveness to changing market needs (Swafford et al., 2008)
Firm performance	A firm's overall performance along the dimensions of operational excellence, customer relationships, revenue growth, and financial performance (e.g. return on investment, profit margin, and sales growth) (Rai et al., 2006; Vickery et al., 1997)	<u>Competitive performance</u> 1. Product delivery cycle time 2. Timeliness of after sales service 3. Productivity improvements (e.g. assets, operating costs, labor costs) 4. Strong and continuous bond with customers 5. Precise knowledge of customer buying patterns 6. Increasing sales of existing products 7. Finding new revenue streams (e.g. new products, new markets) (Rai et al., 2006) <u>Financial performance</u>

	1. Return on investment after tax 2. Growth in return on investment 3. Sales growth 4. Return on sales 5. Growth in return on sales (Vickery et al., 1997)

Note: *=sub-construct

Table 2
Company profiles.

Company data (n=141)								
Business nature	n	%	Headquarters	n	%	Major production location	n	%
1) Garment manufacturer	133	94.3	1) Hong Kong	93	66	1) China	103	73
2) Buying agent	4	2.8	2) China	12	8.5	2) Bangladesh	5	3.5
3) Fabric supplier	1	0.7	3) Taiwan	8	5.7	3) Sri Lanka	4	2.8
4) Trim supplier	1	0.7	4) Sri Lanka	3	2.1	4) Cambodia	4	2.8
5) Footwear maker	1	0.7	5) Bangladesh	2	1.4	5) Vietnam	3	2.1
6) Other	1	0.7	6) Other	23	16.3	6) Other	22	15.6

Firm size (no. of employees)	n	%		Firm age (years)	n	%	
1) <300	17	12.1		1) <5	2	1.4	
2) <500	36	25.5		2) 5-10	10	7.1	
3) <1,000	53	37.6	Mean: 6,220	3) 11-20	41	29.1	Mean: 31
4) >1,000	88	62.4	Median: 1,800	4) >20	100	70.9	Median: 30

Table 3
Informant profiles.

Informant data (n=141)								
Gender	n	%	Educational level	n	%	Age	n	%
1) Male	110	78	1) Secondary	20	8.5	1) 25-30	2	1.4
2) Female	31	22	2) Post-secondary	30	21.3	3) 31-40	38	27
			3) Bachelor	62	44	4) 41-50	65	46.1
			4) Master	35	25.5	5) >50	36	25.5
			5) Doctorate	1	0.7			

Job title	n	%	Service year	n	%	
1) President/managing director/CEO	59	41.8	1) <5	13	9.2	
2) COO/operation director	24	17	2) 5-10	55	39	Mean: 14.9 years
3) Production director/ manager	12	8.5	3) >10	86	61	Median: 13 years
4) Purchasing director	4	2.8				
5) Supply chain director/manager	3	2.1				
6) Other	39	27.7				

Note: The 'Other' category covers mid-level managers and higher.

Table 4
Means and correlations of firm financial performance measures.

	Measures of financial performance				
	Return on investment after tax	Growth in return on investment	Sales growth	Return on sales	Growth in return on sales
Part 1 Means					
Versus competitors (n=141)	4.60	4.61	4.82	4.71	4.70
Actual growth (%) (n=81)	6.592	6.853	6.916	6.883	5.721
Part 2. Correlations (*p*-value)					
Versus competitors and actual growth (%) (n=81)	0.276 (0.006)	0.186 (0.048)	0.224 (0.022)	0.202 (0.035)	0.230 (0.019)

Table 5
Descriptive statistics and reliability of measurement items.

Research construct	Measurement item	Mean	SD	Standardized path loading	t-value	Cronbach's alpha	Composite reliability
Strategic flexibility – resource flexibility	1) Main resources contribute to product development	5.57	1.132	0.666	10.607	0.738	0.731
	2) Main resources contribute to products	5.70	1.040	0.701	10.025		
	3) Main resources contribute to sales	5.40	1.171	0.696	10.748		
	4) Degree of sharing of the main resources between different products	5.34	1.223	0.777	10.787		
	5) New uses of existing main resources	5.15	1.304	0.596	7.953		
	6) Switch of resources to alternative uses	4.53	1.463	0.569	5.988		
Strategic flexibility – coordination flexibility	1) Changeover time for different products	4.45	1.665	0.390	6.319	0.642	0.771
	2) Changeover cost for different products	3.72	1.570	0.114	5.493		
	3) Efforts to improve mobility	5.48	1.012	0.267	13.446		
	4) Efforts to improve adaptability	5.58	0.995	0.602	9.326		
Manufacturing flexibility – range flexibility	1) Flexibility in rescheduling the order of production	5.24	1.239	0.891	28.850	0.830	0.850
	2) Flexibility in obtaining timely suppliers	4.91	1.364	0.870	29.078		
	3) Flexibility in handling increased range of work skills	4.99	1.316	0.853	22.190		
Manufacturing flexibility – response flexibility	1) Quick response in assuming carrying expenses	4.82	1.254	0.816	20.542	0.787	0.864
	2) Quick response in speeding up container movements	4.88	1.344	0.891	24.598		
	3) Quick response in tracking inventory and sales	5.10	1.247	0.790	17.191		
Supply-chain agility	1) Speed in reducing manufacturing lead-time	4.56	1.364	0.760	9.321	0.872	0.894
	2) Speed in reducing development cycle time	4.86	1.295	0.718	10.374		
	3) Speed in increasing frequency of new product introductions	4.90	1.263	0.712	10.391		
	4) Speed in increasing levels of product customization	5.13	1.233	0.711	9.413		
	5) Speed in adjusting delivery capability	5.02	1.305	0.701	9.763		
	6) Speed in improving customer service	5.64	0.869	0.751	9.596		
	7) Speed in improving delivery reliability	5.46	0.926	0.748	11.182		

	8) Speed in improving responsiveness	5.38	1.084	0.797	9.335		
Firm performance – operational excellence	1) Product delivery cycle time	5.57	1.050	0.524	2.779	0.684	0.784
	2) Timeliness of after-sales service	5.57	0.996	0.586	4.000		
	3) Productivity improvements	5.33	1.064	0.669	7.573		
Firm performance – customer relationship	1) Bond with customers	6.10	0.816	0.588	4.291	0.783	
	2) Knowledge of customer buying patterns	5.90	0.845	0.680	7.897		
Firm performance – revenue growth	1) Increase sales of existing products	5.51	1.065	0.499	4.677	0.602	
	2) Finding new revenue streams	5.26	1.192	0.510	5.286		
Firm performance – financial achievement (subjective rating)	1) Return on investment after tax	4.60	1.020	0.785	9.100	0.887	
	2) Growth in return on investment	4.61	0.964	0.653	8.177		
	3) Sales growth	4.82	1.089	0.617	7.268		
	4) Return on sales	4.71	0.991	0.720	8.414		
	5) Growth in return on sales	4.70	0.950	0.660	7.402		

Table 6

Means, correlations, and AVE of research constructs.

Construct	Mean (SD)	Resource flexibility	Coordination flexibility	Range flexibility	Response flexibility	Supply chain agility	Firm performance	Firm size	Firm age
Resource flexibility	5.282 (1.283)	0.670							
Coordination flexibility	4.807 (1.547)	0.499	0.704						
Range flexibility	5.048 (1.312)	0.315	0.461	0.871					
Response flexibility	4.932 (1.285)	0.322	0.421	0.664	0.833				
Supply chain agility	5.119 (1.223)	0.326	0.394	0.575	0.540	0.737			
Firm performance	5.221 (1.123)	0.350	0.334	0.351	0.490	0.618	0.630		
Firm size	–	0.101	-0.031	-0.088	0.015	-0.104	0.226	1.000	
Firm age	–	0.018	0.125	0.069	0.020	0.059	0.100	0.133	1.000

Note: (1) The shaded values are the square roots of the average variance extracted for each construct. Off-diagonal values are correlations among constructs. For discriminant validity, diagonal values should be larger than off-diagonal values.
(2) Firm size is in thousands of employees; firm age is in years.

Table 7

Nested model comparison.

Additional direct path	R^2 in base model (no direct path)	R^2 in competing model (with direct path)	R^2 difference	f^2 statistic	Pseudo F(1,137)	Conclusion
SF → FP	0.473	0.488	0.015	0.029	3.944	Significant
MF → FP	0.473	0.478	0.005	0.010	1.360	Insignificant

Note: SF=strategic flexibility; MF=manufacturing flexibility; FP=firm performance

Table 8
Significance of mediated paths of supply-chain agility to firm performance.

Indirect effect	Hypothesis	Mediated paths	Path	Z statistic
Strategic flexibility	H_A – Supply-chain agility mediates the impact of strategic flexibility on firm performance.	SF → SCA → FP	0.111	1.68**
Manufacturing flexibility	H_B – Supply-chain agility mediates the impact of manufacturing flexibility on firm performance.	MF → SCA → FP	0.286	5.30***

Note: **$P < 0.05$; ***$P < 0.01$

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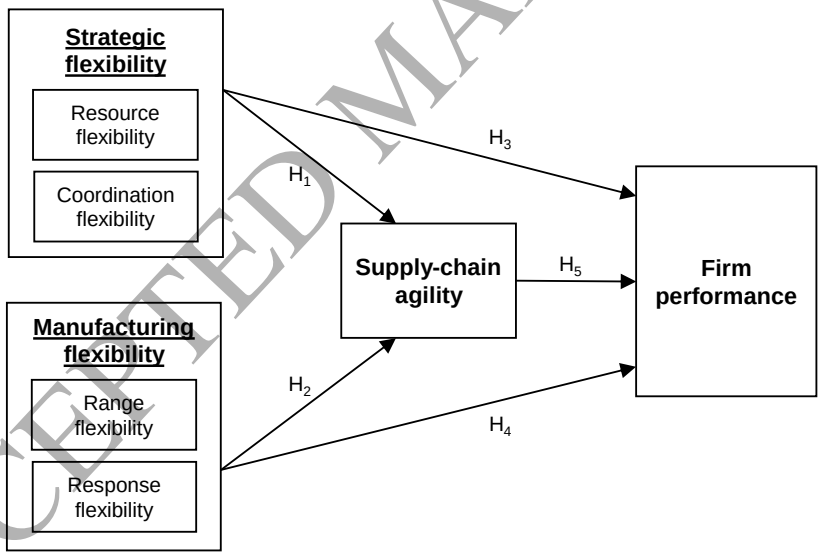

Fig. 1. Research model of the effects of flexibilities and supply-chain agility on firm performance.

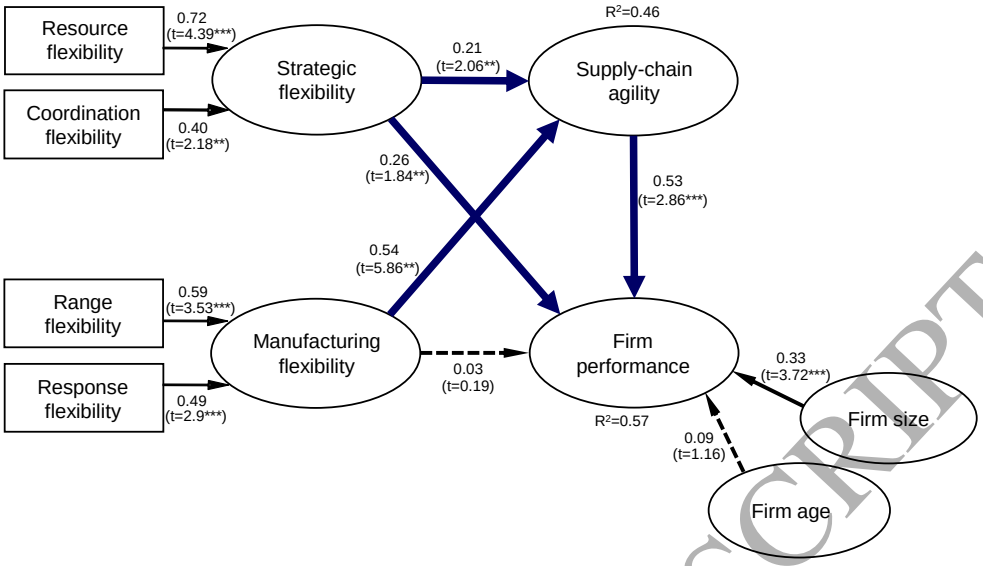

Fig. 2. Analysis result of the research model.