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Dynamic supply chain capabilities: How market sensing, supply chain agility and adaptability affect supply chain ambidexterity

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How market sensing, supply chain agility and adaptability affect supply chain ambidexterity

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Abstract

Purpose – This paper positions market sensing, supply chain agility and supply chain adaptability as a coherent cluster of dynamic supply chain capabilities. The purpose of this paper is to understand how dynamic supply chain capabilities interrelate and their effect on supply chain ambidexterity.
Design/methodology/approach – Based on a survey of Pakistani manufacturing firms, a theoretically-derived model was tested in a structural equation model.
Findings – The results of the study show that a market-sensing capability is an antecedent of supply chain agility and supply chain adaptability. Furthermore, supply chain agility, directly, and supply chain adaptability, indirectly, affect supply chain ambidexterity. Supply chain agility, therefore, mediates the relationship between supply chain adaptability and supply chain ambidexterity.
Originality/value – The contribution of this study lies in: first, identifying dynamic capability clusters relevant for achieving supply chain ambidexterity; second, evaluating performance implications of dynamic capabilities in the supply chain, specifically supply chain agility and adaptability; and third, proposing a unique measurement of supply chain ambidexterity in the light supply chain theory, and empirically evaluating the relationship between dynamic capabilities and supply chain ambidexterity.

Keywords Survey, Supply chain agility
Paper type Research paper

1. Introduction

Today's companies compete in an increasingly volatile and unpredictable marketplace (Christopher and Holweg, 2011; Dubey *et al.*, 2018). To remain competitive, companies need to explore for new market opportunities and exploit existing efficiencies within their operations (March, 1991; Wu *et al.*, 2017). Exploration includes the search for new possibilities, the discovery of innovative ideas and the flexibility to respond to new opportunities as they arise (March, 1991). Exploitation refers to selecting, refining and implementing standardized procedures to achieve efficiencies in a firm's operations (March, 1991).

For a long time, scholars have argued that operations managers are faced with a trade-off between flexibility and efficiency—where prioritising one is often to the detriment of the other (De Meyer *et al.*, 1989; Kannan, 1998; Hayes and Wheelwright, 1984; Skinner, 1985; Skinner, 1969; Hill, 1993). The argument goes that companies should pursue either a low cost competitive strategy supported by efficient operational processes, or a strategy of differentiation supported by more flexible processes (Hill, 1993; Markides, 2006; Porter, 1996, 1980). According to this group of scholars, attempting to reconcile efficiency

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and flexibility results in the operation becoming stuck in-between, leading to high switching costs (Porter, 1980, 1996; Markides, 2006).

Yet, another group of scholars argues that organisations can be simultaneously flexible and efficient by developing an ambidexterity capability (Duncan, 1976; Adler *et al.*, 1999; Gibson and Birkinshaw, 2004; Tushman and O'Reilly III, 1996). Ambidextrous organisations are ones that are aligned and efficient in the management of today's business demands, while also adaptive enough to changes in the environment so they will be around tomorrow (Gibson and Birkinshaw, 2004 p. 209). For example, Adler *et al.* (1999) found that by partitioning its operation, a Toyota subsidiary could exploit the cost advantages associated with repetitive tasks whilst simultaneously exploring for new flexible manufacturing systems during non-routine work. Other OM scholars have found that companies with operational ambidexterity capabilities are able to explore new, and exploit existing, processes simultaneously—leading to enhanced operational performance (Kortmann *et al.*, 2014; Patel *et al.*, 2012; Tamayo-Torres *et al.*, 2017).

The notion of operational ambidexterity has since been extended beyond the boundaries of the firm—to the supply chain (Blome, Schoenherr and Kaesser, 2013; Im and Rai, 2008; Kristal *et al.*, 2010; Lee and Rha, 2016; Rojo *et al.*, 2016). Kristal *et al.* (2010) defined supply chain ambidexterity as a firm's strategic choice to simultaneously pursue both supply chain exploitation (efficiency) and exploration (flexibility) practices (Kristal *et al.*, 2010 p. 415). The notion of supply chain ambidexterity runs counter to those scholars that suggest companies should select the right supply chain for their product; with primarily functional products using efficient supply chains and primarily innovative products relying on flexible supply chains (i.e. Fisher, 1997). Instead, supply chain ambidexterity means managers are not faced with an either/or decision, but can simultaneously have a flexible and efficient supply chain for a particular product (Lee and Rha, 2016; Rojo *et al.*, 2016).

To achieve such an ambitious goal, Lee (2004) argued that successful companies require supply chains that can rapidly respond to short-term changes in demand (agility) and adjust to long-term market changes by restructuring the supply chain (adaptability). Supply chain agility (SAG) is defined as the firm's ability to respond to market changes such as variation in demand patterns, in terms of quality, quantity and variety, as well as to supply patterns, in terms of shortages and disruptions (Blome, Schoenherr and Rexhausen, 2013). Supply chain adaptability is defined as the ability of the firm to make supply chain design changes—that are far more radical and long term than changes pursued under the notion of supply chain agility—in the wake of sensed opportunities (Eckstein *et al.*, 2015; Ketchen and Hult, 2007).

Because supply chain agility and adaptability are developed and renewed in response to changes in customer demand, these two constructs have been positioned as dynamic capabilities (see Eckstein *et al.*, 2015; Whitten *et al.*, 2012). Dynamic capabilities are higher-order capabilities that refer to a firm's ability to sense opportunities and threats in the marketplace, to seize opportunities as they arise and to transform assets and organisational structures as the organisation grows and market requirements change (Teece, 2007). Supply chain agility is positioned as a seizing dynamic capability because it allows the firm to identify opportunities and threats in the marketplace and to provide an agile supply chain response (Eckstein *et al.*, 2015). Supply chain adaptability is positioned as a transforming dynamic capability, because the resource base and structure of the supply chain is transformed over the longer term in response to changes in the marketplace (Eckstein *et al.*, 2015). As agility and adaptability are integrated and coordinated with supply chain partners, a complex adaptive system forms which is able to sense changes in the marketplace, seize new opportunities and transform the supply chain to satisfy customer demand (Whitten *et al.*, 2012).

Importantly, we argue a firm's supply chain would have difficulty seizing opportunities in the marketplace and reconfiguring its operations in response, without the capability to

sense these opportunities in the first place. Market sensing reflects the firm's routines related to actively learning about customers, competitors, supply chain members and the business environment that allows for understanding of market conditions as well as for prediction purposes (Morgan, 2012). Recent studies have investigated the direct and indirect effects of supply chain agility and adaptability on different measures of firm performance (Dubey *et al.*, 2018; Eckstein *et al.*, 2015). But despite these laudable efforts, the role of market-sensing capabilities has been largely ignored (Teece *et al.*, 2016). To fill this gap in our understanding, this paper attempts to answer the following research question:

RQ1. How do market sensing, supply chain agility and supply chain adaptability affect supply chain ambidexterity?

We answer our research question by examining survey data collected from 277 manufacturing firms in Pakistan. Empirical research findings on companies in Pakistan are limited as a result of the difficulty of data collection; however, due to the uncertainty of the economic system, dynamic supply chain capabilities play an important role in firm survival. We, therefore, believe that Pakistan, like other dynamic markets, is an excellent context within which to investigate dynamic supply chain capabilities in comparison to more mature markets where firms adjust to significant changes less often. Data are analysed by means of structural equation modelling.

This study contributes to theory and practice in the area of dynamic capabilities in supply chains. According to Teece (2007), dynamic capabilities exist in the form of capability clusters consisting of sensing, seizing and transforming/reconfiguration capabilities. Like Teece (2007), we position market sensing, supply chain agility and adaptability as a coherent cluster of dynamic supply chain capabilities that should be considered in conjunction rather than is isolation. We empirically show that supply chain agility has a significant short-term effect on supply chain ambidexterity, that supply chain adaptability has a significant long-term effect on supply chain ambidexterity and that market sensing acts a key antecedent for both variables. Combined, this dynamic supply chain capability cluster allows organisations to modify their products, services and supply chain structures according to market requirements over both the short and long term. In making this argument, we respond to the call by supply chain theorists to identify dynamic capabilities relevant to the supply chain environment (Beske *et al.*, 2014). Finally, we provide a new measurement of supply chain ambidexterity developed based on extant scales to better explain short- and long-term performance vs traditional performance measures.

The remainder of the paper is organised as follows. Section 2 discusses the studies theoretical foundations, reviews the relevant literature and develops a hypothetical model of the relationship between market sensing, supply chain agility, adaptability and ambidexterity. Section 3 provides a justification of the research design. Section 4 presents the study's findings and Section 5 discusses the results. The studies implications for theory and management, along with its limitations, are discussed in Section 6.

2. Literature review and hypothetical model

2.1 Dynamic supply chain capabilities

We ground this study in the dynamic capabilities view of the firm. Dynamic capabilities are the organisation's ability "to sense and then seize new opportunities, and to reconfigure and protect knowledge assets, competencies, and complementary assets with the aim of achieving a sustained competitive advantage" (Augier and Teece, 2009, p. 412). Dynamic capabilities depict the firm's ability to modify its distinctive and co-specialised resources in order to respond to changing environmental conditions (Augier and Teece, 2009). They manifest in firms through the transformation of business processes, resource allocations and reallocations, and operations (Teece, 2007). Dynamic capabilities can lead to differences

in the performance of firms, even if firms are similar in terms of resources and capability endowments (Easterby-Smith *et al.*, 2009). Yet at their core, these capabilities are similar in the sense that they enable knowledge creation and dissemination, and continuous modification of organisational processes in response to environmental changes (Easterby-Smith *et al.*, 2009).

The application of the dynamic capabilities view to strategic decisions in supply chain management is becoming increasingly common (Witcher *et al.*, 2008; Allred *et al.*, 2011; Fawcett *et al.*, 2011; Blome, Schoenherr and Rexhausen, 2013; Defee and Fugate, 2010). Dynamic capabilities in the supply chain emerge when firms engage their employees in understanding customer requirements and translate these requirements so that they are effectively communicated throughout the supply chain (Handfield *et al.*, 2015). Indeed, scholars have begun challenging the conceptualization that dynamic capabilities are bounded by the firm, and have extended our understanding beyond firm boundaries to acknowledge the presence of "dynamic supply chain capabilities" (Dubey *et al.*, 2018; Eckstein *et al.*, 2015; Swafford *et al.*, 2006).

For example, Swafford *et al.* (2006) argued that supply chain agility is a capability that allows the supply chain to seize opportunities once they are sensed. Supply chain agility is positioned by other authors as a fundamental capability needed to endure and flourish in volatile environments (Gligor and Holcomb, 2014; Braunscheidel and Suresh, 2009), as it allows for a flexible supply chain response (Gligor and Holcomb, 2012). Building on this argument, Blome, Schoenherr and Rexhausen (2013) put forward the idea that supply chain agility is a dynamic capability able to positively influence the operational performance of the firm. Supply chain agility can also be regarded as an extension of agile manufacturing which focuses mainly the firm (Yusuf *et al.*, 1999; Brown and Bessant, 2003). Furthermore, supply chain agility is typically considered to extend the narrower concept of supply chain flexibility (Stevenson and Spring, 2007; Gligor and Holcomb, 2012).

Supply chain adaptability refers to a firm's ability to reconfigure and transform *s*upply chain design according to expected market changes (Lee, 2004). Ketchen and Hult (2007) explained that supply chain adaptability is the willingness to reshape the supply chain when necessary, without ties to legacy issues or the way the chain has been operated previously. Stevenson and Spring (2007) suggested that supply chain adaptability is the property of a supply chain which allows the members to cope with dynamics associated with the supply chain. Eckstein *et al.* (2015) drew together this line of reasoning and suggested that supply chain agility and adaptability can be considered dynamic capabilities that result from the firm's ability to reconfigure firm-level and supply chain-level resources.

Interestingly, many of these studies examine the effects of supply chain agility and adaptability, either individually or combined, on firm performance (Blome, Schoenherr and Rexhausen, 2013; Dubey *et al.*, 2018; Eckstein *et al.*, 2015; Lee, 2004; Lee and Rha, 2016), however, the role of market sensing is largely ignored. This is a curious omission as it stands to reason that supply chain managers would need the ability to sense opportunities and threats in the marketplace in the first instance, in order to provide a flexible response (supply chain agility) and to restructure the supply chain over the longer term (supply chain adaptability). Indeed, Day (1992, 1994) argued that firms involved in developing a better understanding of the market situation (market sensing) have a better chance of understanding and acting on uncertainties and market trends (Day, 1992, 1994). Bharadwaj and Dong (2014) reaffirmed that systematically undertaking market sensing activities to remain synchronized with market changes can facilitate the provision of superior value propositions.

It, thus, stands to reason that, like the dynamic capabilities of the firm (Teece, 2007), dynamic supply chain capabilities including market sensing, supply chain agility and supply chain adaptability exist in cluster. It follows that dynamic supply chain capabilities

are interrelated and need to exist in combination to prove beneficial to the firm. We now turn our attention to understanding how market sensing, supply chain agility and adaptability interrelate and the resulting effects on supply chain ambidexterity.

2.2 Supply chain ambidexterity

To become ambidextrous, firms need to harmonise the contradictory demands imposed by the environment (Raisch and Birkinshaw, 2008). These demands include balancing efficiency in exploiting current resource positions vs exploring and responding to future market conditions through search and experimentation activities (He and Wong, 2004). This simultaneous pursuit of seemingly conflicting goals has been termed organisational ambidexterity (Weber and Tarba, 2014).

Operations management scholars have acknowledge that a firm's internal operation can be both flexible and efficient if the right structures are in place (Adler *et al.*, 1999; Kortmann *et al.*, 2014; Patel *et al.*, 2012; Tamayo-Torres *et al.*, 2017). For example, Patel *et al.* (2012) found that firms with greater operational ambidexterity capabilities are able to respond to demand and competitive uncertainty by pursuing efficient and flexible manufacturing strategies. Tamayo-Torres *et al.* (2017) found that ambidexterity acts as an enabler across quality, speed, flexibility and cost dimensions, therefore driving manufacturing performance.

The concept of ambidexterity has since been applied within a supply chain context (Blome, Schoenherr and Kaesser, 2013; Im and Rai, 2008; Kristal *et al.*, 2010; Lee and Rha, 2016; Rojo *et al.*, 2016). For example, Kristal *et al.* (2010) explained that supply chains encompass a variety of sub-systems which can simultaneously pursue either efficiency or responsiveness objectives. Im and Rai (2008) found that knowledge sharing leads to relationship performance gains and that such sharing is enabled by the ambidextrous management of buyer-supplier relationships. Rojo *et al.* (2016) identified that building a supply chain ambidexterity capability can help firms to achieve an optimal level of supply chain flexibility. Likewise, Lee and Rha (2016) found that supply chain ambidexterity is important as firms mitigate the negative impact of supply chain disruptions, thereby enhancing business performance. To build an ambidextrous supply chain, Blome, Schoenherr and Kaesser (2013) suggested that buyers can gain synergistic advantages by pursing both contractual supplier relationships to achieve cost efficiencies, and relational collaborations to realise flexibility benefits.

Unfortunately, however, the majority of these studies examine the relationship between supply chain ambidexterity and firm performance without acknowledging the antecedents of supply chain ambidexterity.

2.3 The relationship between market sensing, supply chain agility and adaptability

We suggest that supply chain ambidexterity requires a firm's supply chain to be simultaneously agile, so it can quickly respond to short-term market changes, and adaptable so the resource base and structure of the supply chain can be reconfigured to achieve longer term efficiency gains. We stress that there would be no need for an agile or adaptive response if, in the first instance, supply chain managers are unable to sense opportunities and threats in the marketplace.

Based on this line of reasoning, we hypothesise that market sensing acts as an antecedent of supply chain agility and adaptability. Support for this relationship can be found in the dynamic capabilities view, which suggests that the ability to sense market opportunities accurately is a pre-requisite of the development and deployment of other dynamic capabilities (Teece, 2007). Firms with well-developed market-sensing capabilities are more likely to be agile because they have a better understanding of supply chain partner activities allowing for proactive response to market uncertainty (Tse *et al.*, 2016). Indeed, market sensing allows firms to become well prepared and to develop structures, technologies and policies to respond to market changes in an efficient manner (Ngai *et al.*, 2011).

In fact, Eckstein *et al.* (2015) argued that the ability to sense marketplace changes is an important dimension of supply chain agility. Supply chain agility necessitates that firms respond promptly and adequately to unexpected changes in the market situation (Tippins and Sohi, 2003). This is not possible unless the firm has a clear understanding of the future implications of market opportunities (Teece *et al.*, 2016). Faster and more accurate responses to business opportunities (i.e. supply chain agility) that thwart competition and retain customers are the outcome of the ability to better sense and disseminate market information (Day, 1992). Drawing together this line of reasoning, we hypothesise that:

H1. Market sensing has a positive effect on supply chain agility.

We go on to suggest that a firm's ability to understand and adjust quickly to marketplace changes depends on its adaptive capabilities (Day, 2014). Market sensing positively affects supply chain adaptability because understanding the magnitude of change or variability in the business environment is the first step towards building flexibility and efficiency into supply chain design (Christopher and Holweg, 2011). This argument is supported by Schoenherr and Swink (2015) who suggest that supply chain adaptability reduces the constraints on the firm's response to changing product or service requirements, by spotting new resources (e.g. raw materials) and problem solving (e.g. product commercialisation and launching).

An important contribution made by Lee (2004) highlights how supply chain adaptability transforms supply chain design in response to the "structural shift" in the market. However, in order to achieve this transformation, Lee (2004) argues that this structural shift has to be perceived ahead of time so that long-term supply chain design decisions can be adjusted (Lee, 2004). This is achieved by sensing changes in the market through activities such as capturing market data, separating noise and identifying key patterns. Based on this information, the firm decides on facility relocation, supply source changes and relevant outsource manufacturing (Lee, 2004). It can, thus, be argued that a supply chain manager's ability to scan the marketplace, interpret and respond to the signals of change acts as a key trigger of supply chain adaptability (Reeves and Deimler, 2011). We, therefore, hypothesise the following:

H2. Market sensing has a positive effect on supply chain adaptability.

2.4 The relationship between supply chain agility, adaptability and ambidexterity

We have argued that supply chain agility is the firm's ability to respond quickly to market changes and disruptions, both internally as well as with the support of its suppliers and customers (Braunscheidel and Suresh, 2009). By possessing a supply chain agility capability, firms are able to modify their routines according to changing market conditions, and seize market opportunities in a timely manner (Swafford *et al.*, 2006) without modifying the inherent structure of a supply chain's design (Eckstein *et al.*, 2015). Becoming agile requires the ability to cater to sometimes conflicting requirements, such as innovation vs efficiency and meeting global vs local demand, etc. (Lewis *et al.*, 2014). Supply chain agility improves the firm's responsiveness by integrating sensitivity to market changes, with the capability of using resources in response to these changes in a flexible and timely manner (Li *et al.*, 2008).

In a somewhat counter-intuitive way, supply chain agility also makes a firm more cost efficient. Although both are somewhat conflicting objectives, such contradictions, as suggested by Adler *et al.* (1999), are embraced in the knowledge age. For example, Yang (2014) noted that in order to match supply with demand, firms make investments in the ability to customise products, make adjustments in production volumes and produce a wide range of products. The collaboration between supply chain partners that results from

the pursuit of these goals allows transaction costs and total resource inputs to decrease, leading to the reduction of supply chain costs. Supply chain agility also drives down costs through inventory reduction and effective integration with suppliers, while increasing responsiveness through rapid adaptation to demand (Mason *et al.*, 2002). Therefore, it can be argued that supply chain agility provides the agile and efficiency gains of an ambidextrous supply chain. Thus, we propose the following hypothesis:

H3. Supply chain agility has a positive effect on supply chain ambidexterity.

Importantly, however, supply chain agility cannot be thought to positively affect the ambidexterity of a supply chain in isolation. In contrast to supply chain agility, which centres on short-term responses, supply chain adaptability requires longer-term changes to the structure and resource base of a firm's supply chain (Lee, 2004, p. 4). Supply chain adaptability helps firms cope with longer-term challenges such as changes in product range and mix, markets served, service levels and profit margins (McCullen *et al.*, 2006).

In this study, we hypothesise that supply chain adaptability has a longer term, positive impact on supply chain ambidexterity. Moreover, we suggest that supply chain adaptability affects both dimensions of supply chain ambidexterity positively. First, supply chain adaptability influences efficiency because the flexibility built into the supply chain (by outsourcing, using flexible labour arrangements, etc.) requires that fixed costs be changed into variable costs, which over a period of time can reduce total supply chain costs (Christopher and Holweg, 2011). Furthermore, designing product ranges with higher levels of component commonality also reduces inventory carrying costs (Lee, 2004).

Second, supply chain adaptability positively influences responsiveness, as developing alternative supply bases through facility relocation helps to maintain quality levels and to guarantee steady service in times of changing markets and economies (Eckstein *et al.*, 2015). Diversification in sourcing also helps to improve service levels and delivery performance (Christopher and Holweg, 2011). Similarly, innovativeness supports reduction in development lead times, design cycles and flexible design capabilities (Eckstein *et al.*, 2015).

Like with supply chain agility, supply chain adaptability positively influences the efficiency and flexibility of the supply chain; it is just that the former is oriented towards short-term response, while the latter is focused on longer-term restructuring. Indeed, this line of reasoning supports our argument that having an ambidextrous supply chain means managers are not faced with an either/or decision, but can have a flexible and efficient supply chain for the same product (Lee and Rha, 2016; Rojo *et al.*, 2016). We, therefore, hypothesise the following:

H4. Supply chain adaptability has a positive effect on supply chain ambidexterity.

2.5 Mediating role of supply chain agility

Dynamic capabilities theory suggests that capabilities do not remain infinitely competitive (Protogerou *et al.*, 2012). Over time, the processes underlying dynamic capabilities become imitable and require transformation (Teece, 2014). It follows that, in order to sustain competitive advantage in the long run, certain short-term changes have to be made. Based on this reasoning, we suggest that supply chain adaptability is the capability that influences the long-term sustainability of a firm's competitive advantage, while the influence of supply chain agility is shorter term.

This argument is supported by Eckstein *et al.* (2015) who suggest that supply chain adaptability acts as an enabler of supply chain agility. Specifically, they state that the ability to reconfigure the supply chain according to market requirement (supply chain adaptability) acts as the basis for the firm to develop a supply chain agility capability (Eckstein *et al.*, 2015). Supply chain agility requires the ability to quickly deal with demand-side changes, such as

changing customer preferences, and supply-side changes, such as delivery failures (Blome, Schoenherr and Rexhausen, 2013). A firm is able to cope with delivery failures if it has been involved in the continuous development of its supplier and logistics infrastructure (Lee, 2004). Similarly, a firm is able to deal with changing customer preferences if it has been monitoring these changes overtime (Lee, 2004). Accordingly, the long-term structural changes (supply chain adaptability) needed to achieve the dual motivations of efficiency and flexibility necessitate a series of short-term supply chain interventions (supply chain agility). Based on this line of reasoning, supply chain agility plays a mediating role in the relationship between supply chain adaptability and ambidexterity. Therefore, we posit the following hypothesis:

H5. Supply chain agility mediates the relationship between supply chain adaptability and supply chain ambidexterity.

Drawing together these arguments, we advance the following hypothetical model (see Figure 1).

3. Research methods

3.1 Research design

We follow a positivistic ontology believing that the major constructs of our works (e.g. supply chain agility and supply chain adaptability) are real and not subject to social construction. The underlying epistemology predicts that these constructs can be measured with quantitative methods which we do with the help of a survey. Therefore, we adopted a deductive research approach, as we are testing hypotheses that are underpinned by existing theories (dynamic capabilities) (Ketchen and Shook, 1996). In addition, related studies on dynamic capabilities and supply chain ambidexterity from a supply chain perspective have used the same methodology enabling generalisability of results (Blome, Schoenherr and Rexhausen, 2013; Eckstein *et al.*, 2015; Kristal *et al.*, 2010). The unit of analysis for the study is the firm. The context of the study is the developing economy of Pakistan; a country experiencing an intense period of political and economic changes (World Bank, 2017). A recent study showed that Pakistan is expected to grow at a rate of 5.97 per cent over the next ten years (Zahid, 2017). The country also faces challenges from Chinese firms that are expected to join the competition in Pakistani markets under the upcoming China-Pakistan Economic Corridor.

3.2 Data collection

As an emerging economy, Pakistan presented several challenges with regards to data collection. Hoskisson *et al.* (2000) highlighted some of the issues faced by strategy researchers in emerging countries such as: difficulty in collecting random and representative samples, lack of reliability of the postal system, lack of trust between the respondent and researcher, difficulty in gaining access to top management and a lack of understanding of common management issues among practicing managers. Indeed, many

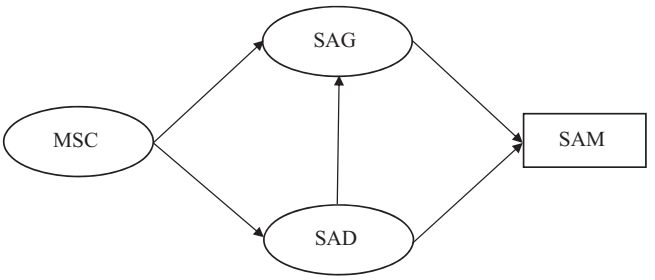

Figure 1.
Research model

studies conducted in emerging economies like Pakistan and India have reported similar issues (Ryan and Tipu, 2013; Jeswani *et al.*, 2008; Ali *et al.*, 2012; Malik and Kotabe, 2009). For example, Malik and Kotabe (2009) collected data from seven cities in India and Pakistan using convenience sampling, and cited that there were no updated or complete lists of firms available in either of the countries. Many other studies, in both these countries, have not used probability sampling methods (e.g. Ryan and Tipu, 2013; Jeswani *et al.*, 2008; Ali *et al.*, 2012) due to similar reasons.

Similar problems were also faced in this study. For example, there was no comprehensive database for identifying manufacturing organisations in the country. Instead, we constructed the list of organisations to be included in the sampling frame using various sources such as: manufacturing organisations listed on the Pakistan Stock Exchange; lists of managers available from Quality and Productivity Society of Pakistan; yellow pages and websites of associations for the leading industries. We made sure that no duplicate entries of firms were included, so that a comprehensive database of manufacturing firms in Pakistan was constructed. E-mail addresses from all these sources were combined, and multiple waves of e-mails were sent between February and July 2016. All surveys were accompanied by a cover letter that briefly introduced the research and highlighted the importance of the respondent's cooperation. Discounting the e-mails that remained undelivered, 3,375 e-mails were sent in total. In total, 277 usable responses (8.2 per cent response rate) were received, which, for e-mail data collection in an emerging country is a decent figure, even though it comes with non-response bias issues.

We tested non-response bias using the methodology suggested by Armstrong and Overton (1977), comparing early and late respondents, with late respondents acting as a proxy for non-respondents (Schoenherr and Swink, 2015). Comparison between early and late respondents was made based on three demographic variables: first, years of existence of the respondent's firm; second, sales of the respondent's firm; and third, experience of the respondent using independent sample *t*-tests. The results showed that there was no significant difference between the two groups. The industry and respondent profiles are provided in Tables I and II. The distribution of the firms in the sample closely resembles the distribution of local industry (Pakistan Bureau of Statistics, 2005-2006). For example, 25.5 per cent of the respondents belonged to the textile sector, vs 26.2 per cent contribution in terms of output in the national economy. Similarly, 17 per cent of respondents were from FMCGs (vs 16.5 per cent); 4.3 per cent of respondents were from auto and auto-part manufacturing (vs 5.4 per cent); 10.8 per cent of respondents belonged to chemical manufacturing (vs 12 per cent); and 2.9 per cent were from the electronics industry (vs 1.8 per cent).

3.3 Measures

Following the advice of Schminke (2004), extant measures were used to develop survey instruments. A thorough literature review was conducted to identify scales from the previous studies, demonstrating suitable reliability and validity. Given the fact that the variables of interest in this study cannot be typically obtained from a firm's financial statements, perceptual measures were instead used to collect data from respondents. Perceptual measures were found to be adequate because the literature indicates a high correlation between subjective and objective measures of variables (Protogerou *et al.*, 2012). The following section provides the details about these scales and their sources.

Market sensing capability (MSC): relates to the ability of the firm to sense opportunities and threats in the market (Teece, 2007). The scale is adopted from Morgan *et al.* (2009) and consists of five items measured on the scale of 1 (strongly disagree) to 7 (strongly agree). The scale elicited data on the efforts of the firm, and aimed at learning about customer needs, competitor strategies, distribution channels, market trends and the broader market environment.

Industry	Frequency	Per cent
Textile	71	25.6
FMCG	47	17.0
Surgical instruments	25	9.0
Packaging	16	5.8
Sports goods	13	4.7
Auto and parts manufacturing	12	4.3
Chemical and chemical products	30	10.8
Leather garments	9	3.2
Electronics	8	2.9
Other	35	12.6
Not Provided	11	4.0
Organisation history		
Less than 5 years	44	15.9
5–10 years	49	17.7
11–20 years	58	20.9
More than 20 years	126	45.5
Sales (in Pak Rupees)		
Less than 10 m	6	2.2
10 m–50 m	34	12.3
51 m–100 m	29	10.5
101 m–200 m	21	7.6
Greater than 200 m	87	31.4
Not provided	100	36.1

Table I.
Industries represented in the sample

Designation	Frequency	Per cent
Owner/partner	35	12.6
CEO/general manager	14	5.1
Functional head	108	39.0
Executive	38	13.7
Middle manager	52	18.8
Engineer	3	1.1
Not provided	27	9.7
Experience		
Less than 1 year	9	3.2
2–5 years	63	22.7
6–10 years	79	28.5
11–20 years	78	28.2
Greater than 20 years	16	5.8
Not provided	32	11.6

Table II.
Respondent profile

Supply chain agility (SAG): identifies the firm practices that capitalise on market opportunities. This scale is based on the supply chain agility scale developed by Blome, Schoenherr and Rexhausen (2013) and is measured on the scale of 1 (strongly disagree) to 7 (strongly agree). It measures the firm's ability to adapt its offering quickly according to changing customer needs, the ability to cope with the changing demands and requirements to modify product portfolios, and the ability to cope with supply side problems.

Supply chain adaptability (SAD): operationalised in this study as the ability to modify supply chain design. The construct is based on the supply chain adaptability construct from

Lee's (2004) Triple-A supply chain. It consists of a five-item scale developed in the Whitten *et al.* (2012) study, and is measured on the scale of 1 (strongly disagree) to 7 (strongly agree). As per the assertions of Lee (2004), the scale measures the ability of the firm to: spot new suppliers in developing countries; develop suppliers and logistics infrastructure; understand ultimate customers; develop flexible product designs; and understand the firm's product standing in the technology and product life cycles.

Supply chain ambidexterity (SAM): ambidexterity in organisation research is measured in various ways. The constructs have been formed as second-order reflective (Kristal *et al.*, 2010) and second-order formative (Tamayo-Torres *et al.*, 2017), by multiplying (Gibson and Birkinshaw, 2004), adding (Lubatkin *et al.*, 2006) or subtracting (He and Wong, 2004) the two sub-dimensions. However, multiplying two dimensions has been by far the most used method of forming the construct (see Junni *et al.*, 2013 for a detailed review). We measure SAM as an interaction of supply chain efficiency (SCE) and supply chain responsiveness (SCR). Both scales are measured on the scale of 1 (far worse than competitor) to 7 (far better than competitor). The details about the items of the two scales are provided in the following:

- Supply chain efficiency: SCE measures the cost-based performance of the supply chain. The scale consists of five items adopted from Sezen (2008), who adopted it from Beamon (1999). The items ask the respondents to rate their firm's performance in comparison to their closest competitors, in terms of total costs of resources, distribution, transportation and handling, as well as the costs of manufacturing, inventory holding and return on investment.
- Supply chain responsiveness: the SCR scale consists of five items adopted from Rajaguru and Matanda (2013). The items ask the respondents to rate their firm's performance in comparison to their closest competitors in terms of the ability to respond quickly and effectively to customer requirements, respond quickly and effectively to competitor tactics, and quickly develop new products.

3.4 Common method Bias

Common method bias occurs due to resemblances in measurement methods resulting in biased reliability and validity estimates, and imprecise estimation of relationships between variables of interest (Podsakoff *et al.*, 2003). Pre-emptive procedural remedies were taken in this study to avoid the problem of common method bias, as prior research has shown such measures to be more effective (Green *et al.*, 2016). Guidelines suggested by Conway and Lance 2010, Podsakoff and Organ (1986), Podsakoff *et al.* (2003) were followed in this respect. In terms of procedural remedies, dependent and independent variables appear in different sections of the survey and with different Likert-type scales; for example, strongly disagree–strongly agree vs far better–far worse. Furthermore, respondents were ensured that their responses will remain completely anonymous. Respondents were also given the choice of submitting the survey without filling in their name and company name. The survey instrument was refined through two rounds of pilot surveys and opinions from experts, in order to remove any ambiguity in the questionnaire items that could bias the respondents in any way. Following the above guidelines, exploratory factor analysis was performed without a rotation. Three factors emerged from the solution, with the first factor accounting for less than 50 per cent of the variation. In the next step, all the variables in the research model were loaded on a single factor in a confirmatory factor analysis (CFA). This showed considerably poor results compared to the research model ($\chi^2 = 3.75$, CFI = 0.817, RMSEA = 0.1) and did not achieve the basic threshold levels. Thus, it was concluded that common method bias is not a major concern in this study.

3.5 Assessment of psychometric properties

CFA was used to establish the validity and unidimensionality of the constructs. Separate CFA was performed for dependent and independent variables. Model fit indices for both independent variable CFA ($\chi^2 = 1.39$, $p > 0.05$, GFI = 0.969, CFI = 0.992 and RMSEA = 0.034) and dependent variable CFA ($\chi^2 = 1.77$, $p > 0.05$, GFI = 0.983, CFI = 0.992 and RMSEA = 0.053) were found to be adequate (Hu and Bentler, 1999). Factor loadings for all the constructs were either close to or above 0.7. Combined with significant p-values, this provides the evidence for convergent validity. Reliability of the constructs was established using Cronbach's α coefficients. Reliability coefficients for all the constructs were greater than 0.7, indicating reliability of the constructs. Table III provides the information about factor loadings and reliability measures for the constructs in the study.

In order to establish discriminant validity, we compared the bi-variate correlations with the square root of AVE extracted (Fornell and Larcker, 1981). According to this criterion, if the correlation between a pair of constructs is less than AVE, discriminant validity is established. It is evident from Table IV that correlations between all pairs of constructs are lesser than associated AVEs, indicating discriminant validity. Table IV also provides means and standard deviations for the constructs in the study.

4. Research findings

In this study, we developed a hypothesised model to identify the underpinning constructs of supply chain ambidexterity. To do so, we positioned market sensing, supply chain agility and supply chain adaptability as three dynamic supply chain capabilities. We then

Indicator (Cronbach's α, Average variance extracted)	Standardised coefficients
Market sensing capability ($\alpha = 0.86$, AVE = 0.56)	
Learning about customer needs and requirements	0.747
Discovering competitor strategies and tactics	0.676
Gaining insights about the distribution channel	0.723
Identifying and understanding market trends	0.727
Learning about the broad market environment	0.844
Supply chain agility ($\alpha = 0.84$, AVE = 0.57)	
Adapting services and/or products to new customer requirements quickly	0.712
Reacting to new market developments quickly	0.788
Reacting to significant increases and decreases in demand quickly	0.785
Adjusting product portfolio as per market requirement	0.736
Supply chain adaptability ($\alpha = 0.77$, AVE = 0.57)	
Spot new supply bases and markets all over the world	0.765
Evaluating ultimate consumers needs	0.758
Determining the standing of companies' products in terms of technology cycles and product life cycles	0.749
Supply chain efficiency ($\alpha = 0.77$, AVE = 0.53)	
Total cost of resources used	0.728
Total cost of distribution, including transportation and handling costs	0.678
Total cost of manufacturing, including labour, maintenance and re-work costs	0.780
Supply chain responsiveness ($\alpha = 0.87$, AVE = 0.69)	
Respond quickly to changing consumer needs	0.774
Ability to respond quickly to changing competitor strategies	0.894
Ability to respond effectively to changing competitor strategies	0.822

Table III.
Measurement model validation-reliability and convergent validity

considered the interrelationship between these three constructs and their impact on supply chain ambidexterity. Furthermore, we considered the mediating role of supply chain agility in the relationship between adaptability and ambidexterity.

Before we tested our hypotheses using structural equation modelling, indicators were tested for the assumptions of constant variance, the existence of outliers, and normality by using plots of residuals by predicted values, rankit plot of residuals and statistics of skewness and kurtosis. Multivariate outliers were assessed based on Mahalanobis distances of predicted variables. As the maximum absolute values of skewness and kurtosis were well within the limitations of past research (0.75 and 0.50, respectively) (Curran *et al.*, 1996). In addition, also the above-mentioned plots did not show any concerning deviations. Finally, we also checked whether multi-collinearity of variables was a problem, but as variance inflation factors were less than 1.97 (the recommended threshold is 10.0) we concluded that multi-collinearity was not a problem (Hair *et al.*, 2014).

Figure 2 provides the results of the structural model. Path coefficients with solid lines indicate significant relationships ($p < 0.01$), while the ones with dotted lines indicate insignificant relationships. Model fit was found to be adequate ($\chi^2 = 1.35$, $p > 0.05$, GFI = 0.96, CFI = 0.99, and RMSEA = 0.036). Based on the results of the structural model, *H1-H3* were significant, whereas support could not be found for *H4*. In order to test the mediation relationship posited in *H5*, a bootstrapping technique (Hayes, 2013) was used. In order to test the hypotheses, indirect effect coefficients were generated using 5,000 bootstrap samples, along with a 95 per cent biased corrected confidence interval. Results showed that SAG significantly mediated the relationship between SAD and SAM ($\beta = 4.41$, $p < 0.01$). Results of the mediation test showed that indirect coefficient was significant ($p < 0.01$). Therefore, *H5* was supported.

5. Discussion

Meta-analytic studies have called for more empirical studies investigating the implications of dynamic capabilities (Wilden *et al.*, 2016). Even though there seems to be a consensus that

	Mean	SD	MSC	SAG	SAD	SCE	SCR
MSC	5.39	1.06	*0.745*				
SAG	5.03	1.11	0.670**	*0.756*			
SAD	4.85	1.21	0.661**	0.712**	*0.757*		
SCE	4.96	1.03	0.478**	0.614**	0.537**	*0.730*	
SCR	5.14	1.20	0.594**	0.764**	0.636**	0.636**	*0.831*

Notes: The square root of the AVE is depicted on the diagonal in italic. **Significant at the 0.01 level (two-tailed)

Table IV. Correlations, means and standard deviations

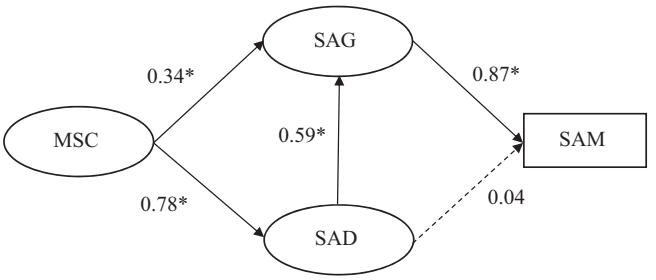

Figure 2. Research findings

dynamic capabilities should have a positive relationship with performance outcomes, Pezeshkan *et al.* (2016) suggested that empirical evidence regarding this relationship is mixed, at best. Given the popularity of dynamic capabilities as a research area, there is significant criticism surrounding this debate (Schilke, 2014). In support of earlier arguments by Teece (2007), we have gathered empirical data to show that, like firm-level dynamic capabilities, dynamic supply chain capabilities exist in clusters of sensing, seizing and transforming capabilities. Specifically, supply chain agility allows firm's to seize opportunities in the marketplace by providing a short-term supply chain response. Supply chain adaptability allows firms to provide a longer-term response to marketplace changes by transforming the resource base and structure of the supply chain.

Importantly, we found that supply chain agility and adaptability are only necessary if supply chain managers are able to sense market opportunities and threats in the first place. After sensing opportunities and threats, managers can respond in two ways. In the short term, firms develop capabilities that allow them to modify their products and services quickly, and according to customer requirements both in terms of quantity and variety (supply chain agility). In the longer term, firms invest in the process of learning about their ultimate customers, understanding the life cycle of their products and the continuous development of new suppliers (supply chain adaptability). Thus, market sensing not only helps supply chain managers to understand market changes, it also empowers them to improve decision making regarding execution and reconfiguration of their capabilities.

These findings contribute to the existing literature by empirically showing that market sensing is an antecedent of supply chain agility and adaptability capabilities. This findings resonate with previous studies that have highlighted the importance of market sensing for supply chain agility (Tse *et al.*, 2016) and supply chain adaptability (Aitken *et al.*, 2002; Eckstein *et al.*, 2015). With regard to dynamic capabilities theory (Teece, 2007), these results suggest that a sensing capability is the pre-requisite for seizing and reconfiguration capabilities.

We further identified a significant direct impact of supply chain agility, and an indirect impact of adaptability on supply chain ambidexterity. These results highlight the central role played by these dynamic capabilities in changing the market situation. Supply chain agility provides increased responsiveness and yields higher profitability, if exploited properly, and is thus a resource to fall back upon in turbulent times (Blome, Schoenherr and Rexhausen, 2013). The ability to respond to changing market requirements is significant with regards to achieving market success. Conversely, the ability to sense market opportunities correctly, but the lack of capability to capitalise on them, would not improve performance and the opportunities would thus be lost (Roberts and Grover, 2012). Similarly, an insignificant direct relationship, and a significant indirect relationship, between supply chain adaptability and ambidexterity highlights the importance of successfully transforming supply chain design into short-term responses that can bring immediate results. In accordance with Eckstein *et al.* (2015), our findings suggest that supply chain agility allows the firms to transform supply chain adaptability capabilities into superior performance levels.

6. Contribution and future research directions

6.1 Theoretical and managerial contribution

While ambidexterity has become an important element in the wider supply chain discourse (e.g. Blome, Schoenherr and Kaesser, 2013; Kristal *et al.*, 2010; Matthews *et al.*, 2015), no consensus on how to measure supply chain ambidexterity exists. For example, Kristal *et al.* (2010) measured the ambidextrous supply chain strategy as a dichotomy between exploration- and exploitation-based practices. Blome, Schoenherr and Kaesser (2013), on the other hand, base their ambidextrous supply chain governance construct on a contractual-relational governance dichotomy. Im and Rai (2008) base their construct of contextual ambidexterity on the adaptabilty-alignment dichotomy.

In this paper, we introduce a new way of measuring supply chain ambidexterity, including traditional measures of responsiveness and efficiency, and combine them in a multiplicative way in-line with prior research in the area (see Gibson and Birkinshaw, 2004; Hill and Birkinshaw, 2014). We believe that by integrating responsiveness and efficiency as measures, we capture the major trade-off that has been discussed in the supply chain context, allowing a unique and suitable supply chain specific contribution to theory. Also, instead of measuring ambidexterity based on classical performance measures, we provide a theoretical angle that captures the essence of dynamic supply chain capabilities, providing insights on how firms can achieve sustained competitive advantage in a supply chain context.

Finally, we challenge the common assumption that only one supply chain type (efficient/responsive) is suitable for a particular product (e.g. Fisher, 1997; Lee, 2002). Instead, we suggest to managers that a product can have both a flexible and efficient supply chain if underpinned by the dynamic supply chain capabilities of market sensing, supply chain agility and adaptability. The results of this study suggest to managers that dynamic supply chain capabilities exist in clusters that need to be invested in simultaneously to capitalise on efficiency and flexibility gains.

6.2 Limitations and future research directions

The findings of this study should be interpreted in light of its limitations. These limitations may also point out some avenues for future research. First, this study used self-reported perceptual data in order to measure both independent and dependent variables. While this is the dominant practice in most management research, and substantial efforts were made to achieve the highest possible level of data quality during the process of data collection and construct validation, self-reporting bias cannot be totally ruled out. Second, the study used a cross-sectional research design, thus the usual caveats of this design apply to this study. Findings of this study cannot be taken as conclusive evidence of the underlying causal relationships. Conclusive evidence can only be generated through longitudinal research.

Future research in the area may employ a longitudinal research design, or employ secondary (panel) data. However, as emphasised by Protogerou *et al.* (2012), these limitations do not invalidate the results. A single study is never enough to provide the final argument related to underlying relationships in the model being tested. Given that this study takes into consideration a fairly large data set, it provides the basis for the logic of the dynamic supply chain capabilities–supply chain ambidexterity relationship. Models based on a cross-sectional design need to be developed in order to evaluate the pertinence of the research model before longitudinal designs can be used. Better understanding of this logic, however, will require these relationships to be studied using diverse types of evidence (qualitative/quantitative). Finally, we considered the interplay between various dynamic supply chain capabilities in terms of how these capabilities affect the overall performance of the supply chain. We found that a market sensing capability positively and directly affects supply chain agility and adaptability. Combined, these dynamic supply chain capability clusters allow organisations to modify their products, services and supply chain structures according to market requirements both over the short and long term. Therefore, future research should consider market sensing, supply chain agility and adaptability in conjunction rather than in isolation.

References

Adler, P.S., Goldoftas, B. and Levine, D.I. (1999), "Flexibility versus efficiency? A case study of model changeovers in the Toyota production system", *Organization Science*, Vol. 10 No. 1, pp. 43-68.

Aitken, J., Christopher, M. and Towill, D. (2002), "Understanding, implementing and exploiting agility and leanness", *International Journal of Logistics Research and Applications*, Vol. 5 No. 1, pp. 59-74.

Ali, S., Peters, L.D. and Lettice, F. (2012), "An organizational learning perspective on conceptualizing dynamic and substantive capabilities", *Journal of Strategic Marketing*, Vol. 20 No. 7, pp. 589-607.

Allred, C.R., Fawcett, S.E., Wallin, C. and Magnan, G.M. (2011), "A dynamic collaboration capability as a source of competitive advantage", *Decision Sciences*, Vol. 42 No. 1, pp. 129-161.

Armstrong, J.S. and Overton, T.S. (1977), "Estimating nonresponse bias in mail surveys", *Journal of Marketing Research*, Vol. 14 No. 3, pp. 396-402.

Augier, M. and Teece, D.J. (2009), "Dynamic capabilities and the role of managers in business strategy and economic performance", *Organization Science*, Vol. 20 No. 2, pp. 410-421.

Beamon, B.M. (1999), "Measuring supply chain performance", *International Journal of Operations & Production Management*, Vol. 19 No. 3, pp. 275-292.

Beske, P., Land, A. and Seuring, S. (2014), "Sustainable supply chain management practices and dynamic capabilities in the food industry: a critical analysis of the literature", *International Journal of Production Economics*, Vol. 152, pp. 131-143.

Bharadwaj, N. and Dong, Y. (2014), "Toward further understanding the market-sensing capability–value creation relationship", *Journal of Product Innovation Management*, Vol. 31 No. 4, pp. 799-813.

Blome, C., Schoenherr, T. and Kaesser, M. (2013), "Ambidextrous governance in supply chains: The impact on innovation and cost performance", *Journal of Supply Chain Management*, Vol. 49 No. 4, pp. 59-80.

Blome, C., Schoenherr, T. and Rexhausen, D. (2013), "Antecedents and enablers of supply chain agility and its effect on performance: a dynamic capabilities perspective", *International Journal of Production Research*, Vol. 51 No. 4, pp. 1295-1318.

Braunscheidel, M.J. and Suresh, N.C. (2009), "The organizational antecedents of a firm's supply chain agility for risk mitigation and response", *Journal of Operations Management*, Vol. 27 No. 2, pp. 119-140.

Brown, S. and Bessant, J. (2003), "The manufacturing strategy-capabilities links in mass customisation and agile manufacturing—an exploratory study", *International Journal of Operations & Production Management*, Vol. 23 No. 7, pp. 707-730.

Christopher, M. and Holweg, M. (2011), "'Supply Chain 2.0': managing supply chains in the era of turbulence", *International Journal of Physical Distribution & Logistics Management*, Vol. 41 No. 1, pp. 63-82.

Conway, J.M. and Lance, C.E. (2010), "What reviewers should expect from authors regarding common method bias in organizational research", *Journal of Business and Psychology*, Vol. 25 No. 3, pp. 325-334.

Curran, P.J., West, S.G. and Finch, J.F. (1996), "The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis", *Psychological Methods*, Vol. 1 No. 1, pp. 16-29.

Day, G.S. (1992), "Continuous learning about markets", *Planning Review*, Vol. 20 No. 5, pp. 47-49.

Day, G.S. (1994), "The capabilities of market-driven organizations", *The Journal of Marketing*, Vol. 58 No. 4, pp. 37-52.

Day, G.S. (2014), "An outside-in approach to resource-based theories", *Journal of the Academy of Marketing Science*, Vol. 42 No. 1, pp. 27-28.

De Meyer, A., Nakane, J., Miller, J.G. and Ferdows, K. (1989), "Flexibility: the next competitive battle the manufacturing futures survey", *Strategic Management Journal*, Vol. 10 No. 2, pp. 135-144.

Defee, C.C. and Fugate, B.S. (2010), "Changing perspective of capabilities in the dynamic supply chain era", *The International Journal of Logistics Management*, Vol. 21 No. 2, pp. 180-206.

Dubey, R., Altay, N., Gunasekaran, A., Blome, C., Papadopoulos, T. and Childe, S.J. (2018), "Supply chain agility, adaptability and alignment: empirical evidence from the Indian auto components industry", *International Journal of Operations & Production Management*, Vol. 38 No. 1, pp. 129-148.

Duncan, R.B. (Ed.) (1976), *The Ambidextrous Organization: Designing Dual Structures for Innovation*, North Holland, New York, NY.

Easterby-Smith, M., Lyles, M.A. and Peteraf, M.A. (2009), "Dynamic capabilities: current debates and future directions", *British Journal of Management*, Vol. 20 No. S1, pp. S1-S8.

Eckstein, D., Goellner, M., Blome, C. and Henke, M. (2015), "The performance impact of supply chain agility and supply chain adaptability: the moderating effect of product complexity", *International Journal of Production Research*, Vol. 53 No. 10, pp. 3028-3046.

Fawcett, S.E., Wallin, C., Allred, C., Fawcett, A.M. and Magnan, G.M. (2011), "Information technology as an enabler of supply chain collaboration: a dynamic capabilities perspective", *Journal of Supply Chain Management*, Vol. 47 No. 1, pp. 38-59.

Fisher, M.L. (1997), "What is the right supply chain for your product", *Harvard Business Review*, Vol. 75, pp. 105-117.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Gibson, C.B. and Birkinshaw, J. (2004), "The antecedents, consequences, and mediating role of organizational ambidexterity", *Academy of Management Journal*, Vol. 47 No. 2, pp. 209-226.

Gligor, D. and Holcomb, M. (2014), "The road to supply chain agility: an RBV perspective on the role of logistics capabilities", *The International Journal of Logistics Management*, Vol. 25 No. 1, pp. 160-179.

Gligor, D.M. and Holcomb, M.C. (2012), "Antecedents and consequences of supply chain agility: establishing the link to firm performance", *Journal of Business Logistics*, Vol. 33 No. 4, pp. 295-308.

Green, J.P., Tonidandel, S. and Cortina, J.M. (2016), "Getting through the gate: statistical and methodological issues raised in the reviewing process", *Organizational Research Methods*, Vol. 19 No. 3, pp. 402-432.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2014), *Multivariate Data Analysis*, Pearson Education Limited, Essex.

Handfield, R.B., Cousins, P.D., Lawson, B. and Petersen, K.J. (2015), "How can supply management really improve performance? A knowledge-based model of alignment capabilities", *Journal of Supply Chain Management*, Vol. 51 No. 3, pp. 3-17.

Hayes, A.F. (2013), *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*, Guilford Press, New York, NY.

Hayes, R.H. and Wheelwright, S.C. (1984), *Restoring Our Competitive Edge: Competing Through Manufacturing*, John Wiley & Sons, New York, NY.

He, Z.-L. and Wong, P.-K. (2004), "Exploration vs exploitation: an empirical test of the ambidexterity hypothesis", *Organization Science*, Vol. 15 No. 4, pp. 481-494.

Hill, T. (1993), *Manufacturing Strategy: The Strategic Management of the Manufacturing Function*, Macmillan, Basingstoke.

Hill, S.A. and Birkinshaw, J. (2014), "Ambidexterity and survival in corporate venture units", *Journal of Management*, Vol. 40 No. 7, pp. 1899-1931.

Hoskisson, R.E., Eden, L., Lau, C.M. and Wright, M. (2000), "Strategy in emerging economies", *Academy of Management Journal*, Vol. 43 No. 3, pp. 249-267.

Hu, L. t. and Bentler, P.M. (1999), "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 6 No. 1, pp. 1-55.

Im, G. and Rai, A. (2008), "Knowledge sharing ambidexterity in long-term interorganizational relationships", *Management Science*, Vol. 54 No. 7, pp. 1281-1296.

Jeswani, H.K., Wehrmeyer, W. and Mulugetta, Y. (2008), "How warm is the corporate response to climate change? Evidence from Pakistan and the UK", *Business Strategy and the Environment*, Vol. 17 No. 1, pp. 46-60.

Junni, P., Sarala, R.M., Taras, V. and Tarba, S.Y. (2013), "Organizational ambidexterity and performance: a meta-analysis", *The Academy of Management Perspectives*, Vol. 27 No. 4, pp. 299-312.

Kannan, V.R. (1998), "Analysing the trade-off between efficiency and flexibility in cellular manufacturing systems", *Production Planning & Control*, Vol. 9 No. 6, pp. 572-579.

Ketchen, D.J. and Hult, G.T.M. (2007), "Bridging organization theory and supply chain management: the case of best value supply chains", *Journal of Operations Management*, Vol. 25 No. 2, pp. 573-580.

Ketchen, D.J. and Shook, C.L. (1996), "The application of cluster analysis in strategic management research: an analysis and critique", *Strategic Management Journal*, Vol. 17 No. 6, pp. 441-458.

Kortmann, S., Gelhard, C., Zimmermann, C. and Piller, F.T. (2014), "Linking strategic flexibility and operational efficiency: the mediating role of ambidextrous operational capabilities", *Journal of Operations Management*, Vol. 32 No. 7, pp. 475-490.

Kristal, M.M., Huang, X. and Roth, A.V. (2010), "The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance", *Journal of Operations Management*, Vol. 28 No. 5, pp. 415-429.

Lee, H.L. (2002), "Aligning supply chain strategies with product uncertainties", *California Management Review*, Vol. 44 No. 3, pp. 105-119.

Lee, H.L. (2004), "The triple-A supply chain", *Harvard Business Review*, Vol. 82 No. 10, pp. 102-113.

Lee, S.M. and Rha, J.S. (2016), "Ambidextrous supply chain as a dynamic capability: building a resilient supply chain", *Management Decision*, Vol. 54 No. 1, pp. 2-23.

Lewis, M.W., Andriopoulos, C. and Smith, W.K. (2014), "Paradoxical leadership to enable strategic agility", *California Management Review*, Vol. 56 No. 3, pp. 58-77.

Li, X., Chung, C., Goldsby, T.J. and Holsapple, C.W. (2008), "A unified model of supply chain agility: the work-design perspective", *The International Journal of Logistics Management*, Vol. 19 No. 3, pp. 408-435.

Lubatkin, M.H., Simsek, Z., Ling, Y. and Veiga, J.F. (2006), "Ambidexterity and performance in small-to medium-sized firms: the pivotal role of top management team behavioral integration", *Journal of Management*, Vol. 32 No. 5, pp. 646-672.

McCullen, P., Saw, R., Christopher, M. and Towill, D. (2006), "The F1 supply chain: adapting the car to the circuit—the supply chain to the market", *Supply Chain Forum: An International Journal*, Vol. 7 No. 1, pp. 14-23.

Malik, O.R. and Kotabe, M. (2009), "Dynamic capabilities, government policies, and performance in firms from emerging economies: evidence from India and Pakistan", *Journal of Management Studies*, Vol. 46 No. 3, pp. 421-450.

March, J. (1991), "Exploration and exploitation in organizational learning", *Organization science*, Vol. 2 No. 1, pp. 71-87.

Markides, C. (2006), "Disruptive innovation: in need of better theory*", *Journal of Product Innovation Management*, Vol. 23 No. 1, pp. 19-25.

Mason, S.J., Cole, M.H., Ulrey, B.T. and Yan, L. (2002), "Improving electronics manufacturing supply chain agility through outsourcing", *International Journal of Physical Distribution & Logistics Management*, Vol. 32 No. 7, pp. 610-620.

Matthews, R.L., Tan, K.H. and Marzec, P.E. (2015), "Organisational ambidexterity within process improvement: an exploratory study of four project-oriented firms", *Journal of Manufacturing Technology Management*, Vol. 26 No. 4, pp. 458-476.

Morgan, N.A. (2012), "Marketing and business performance", *Journal of the Academy of Marketing Science*, Vol. 40 No. 1, pp. 102-119.

Morgan, N., Vorhies, D. and Mason, C. (2009), "Market orientation, marketing capabilities, and firm performance", *Strategic Management Journal*, Vol. 30 No. 8, pp. 909-920.

Ngai, E.W., Chau, D.C. and Chan, T. (2011), "Information technology, operational, and management competencies for supply chain agility: findings from case studies", *The Journal of Strategic Information Systems*, Vol. 20 No. 3, pp. 232-249.

Pakistan Bureau of Statistics (2005-2006), "Census of manufacturing industries", Pakistan Bureau of Statistics, available at: http://pbs.gov.pk/content/census-manufacturing-industries-cmi-2005-06 (accessed 16 June 2018).

Patel, P.C., Terjesen, S. and Li, D. (2012), "Enhancing effects of manufacturing flexibility through operational absorptive capacity and operational ambidexterity", *Journal of Operations Management*, Vol. 30 No. 3, pp. 201-220.

Pezeshkan, A., Fainshmidt, S., Nair, A., Frazier, M.L. and Markowski, E. (2016), "An empirical assessment of the dynamic capabilities–performance relationship", *Journal of Business Research*, Vol. 69 No. 8, pp. 2950-2956.

Podsakoff, P.M. and Organ, D.W. (1986), "Self-reports in organizational research: problems and prospects", *Journal of Management*, Vol. 12 No. 4, pp. 531-544.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.

Porter, M.E. (1980), *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, Simon & Schuster, New York, NY.

Porter, M.E. (1996), "What is strategy", *Harvard Business Review*, Vol. 75 No. 1, pp. 61-78.

Protogerou, A., Caloghirou, Y. and Lioukas, S. (2012), "Dynamic capabilities and their indirect impact on firm performance", *Industrial and Corporate Change*, Vol. 21 No. 3, pp. 615-647.

Raisch, S. and Birkinshaw, J. (2008), "Organizational ambidexterity: antecedents, outcomes, and moderators", *Journal of Management*, Vol. 34 No. 3, pp. 375-409.

Rajaguru, R. and Matanda, M.J. (2013), "Effects of inter-organizational compatibility on supply chain capabilities: exploring the mediating role of inter-organizational information systems (IOIS) integration", *Industrial Marketing Management*, Vol. 42 No. 4, pp. 620-632.

Reeves, M. and Deimler, M. (2011), "Adaptability: the new competitive advantage", *Harvard Business Review*, Vol. 89 No. 4, pp. 1-9.

Roberts, N. and Grover, V. (2012), "Investigating firm's customer agility and firm performance: the importance of aligning sense and respond capabilities", *Journal of Business Research*, Vol. 65 No. 5, pp. 579-585.

Rojo, A., Llorens-Montes, J. and Perez-Arostegui, M.N. (2016), "The impact of ambidexterity on supply chain flexibility fit", *Supply Chain Management: An International Journal*, Vol. 21 No. 4, pp. 433-452.

Ryan, J.C. and Tipu, S.A. (2013), "Leadership effects on innovation propensity: a two-factor full range leadership model", *Journal of Business Research*, Vol. 66 No. 10, pp. 2116-2129.

Schilke, O. (2014), "On the contingent value of dynamic capabilities for competitive advantage: the nonlinear moderating effect of environmental dynamism", *Strategic Management Journal*, Vol. 35 No. 2, pp. 179-203.

Schminke, M. (2004), "From the editors raising the bamboo curtain", *Academy of Management Journal*, Vol. 47 No. 3, pp. 310-314.

Schoenherr, T. and Swink, M. (2015), "The roles of supply chain intelligence and adaptability in new product launch success", *Decision Sciences*, Vol. 46 No. 5, pp. 901-936.

Sezen, B. (2008), "Relative effects of design, integration and information sharing on supply chain performance", *Supply Chain Management: An International Journal*, Vol. 13 No. 3, pp. 233-240.

Skinner, W. (1969), "Manufacturing-missing link in corporate strategy", *Harvard Business Review*, Vol. 47 No. 3, pp. 136-145.

Skinner, W. (1985), *Manufacturing, The Formidable Competitive Weapon: The Formidable Competitive Weapon*, John Wiley & Sons Inc., New York, NY.

Stevenson, M. and Spring, M. (2007), "Flexibility from a supply chain perspective: definition and review", *International Journal of Operations & Production Management*, Vol. 27 No. 7, pp. 685-713.

Swafford, P.M., Ghosh, S. and Murthy, N. (2006), "The antecedents of supply chain agility of a firm: scale development and model testing", *Journal of Operations Management*, Vol. 24 No. 2, pp. 170-188.

Tamayo-Torres, J., Roehrich, J.K. and Lewis, M.A. (2017), "Ambidexterity, performance and environmental dynamism", *International Journal of Operations & Production Management*, Vol. 37 No. 3, pp. 282-299.

Teece, D., Peteraf, M. and Leih, S. (2016), "Dynamic capabilities and organizational agility", *California Management Review*, Vol. 58 No. 4, pp. 13-35.

Teece, D.J. (2007), "Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance", *Strategic Management Journal*, Vol. 28 No. 13, pp. 1319-1350.

Teece, D.J. (2014), "The foundations of enterprise performance: dynamic and ordinary capabilities in an (economic) theory of firms", *The Academy of Management Perspectives*, Vol. 28 No. 4, pp. 328-352.

Tippins, M.J. and Sohi, R.S. (2003), "IT competency and firm performance: is organizational learning a missing link?", *Strategic Management Journal*, Vol. 24 No. 8, pp. 745-761.

Tse, Y.K., Zhang, M., Akhtar, P. and MacBryde, J. (2016), "Embracing supply chain agility: an investigation in the electronics industry", *Supply Chain Management: An International Journal*, Vol. 21 No. 1, pp. 140-156.

Tushman, M.L. and O'Reilly, C.A. III (1996), "Ambidextrous organizations: managing evolutionary and revolutionary change", *California Management Review*, Vol. 38 No. 4, pp. 8-29.

Weber, Y. and Tarba, S.Y. (2014), "Strategic agility: a state of the art", *California Management Review*, Vol. 56 No. 3, pp. 5-12.

Whitten, D., Green, K.W. Jr and Zelbst, P.J. (2012), "Triple-A supply chain performance", *International Journal of Operations & Production Management*, Vol. 32 No. 1, pp. 28-48.

Wilden, R., Devinney, T.M. and Dowling, G.R. (2016), "The architecture of dynamic capability research identifying the building blocks of a configurational approach", *The Academy of Management Annals*, Vol. 10 No. 1, pp. 997-1076.

Witcher, B.J., Chau, V.S. and Harding, P. (2008), "Dynamic capabilities: top executive audits and Hoshin Kanri at Nissan South Africa", *International Journal of Operations & Production Management*, Vol. 28 No. 6, pp. 540-561.

World Bank (2017), "Pakistan to record highest growth rate in nine years", World Bank, Islamabad.

Wu, K.-J., Tseng, M.-L., Chiu, A.S. and Lim, M.K. (2017), "Achieving competitive advantage through supply chain agility under uncertainty: a novel multi-criteria decision-making structure", *International Journal of Production Economics*, Vol. 190, pp. 96-107.

Yang, J. (2014), "Supply chain agility: securing performance for Chinese manufacturers", *International Journal of Production Economics*, Vol. 150, pp. 104-113.

Yusuf, Y.Y., Sarhadi, M. and Gunasekaran, A. (1999), "Agile manufacturing: the drivers, concepts and attributes", *International Journal of Production Economics*, Vol. 62 Nos 1-2, pp. 33-43.

Zahid, W. (2017), "Pakistan's GDP growth rate is even higher than that of China: Harvard study", *Tribune*.

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