



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

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3 **Dynamic supply chain capabilities:**
4 **How market sensing, supply chain agility and adaptability affect supply chain**
5 **ambidexterity**
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9 **Abstract:**

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11 **Purpose:** This paper positions market sensing, supply chain agility and supply chain
12 adaptability as a coherent cluster of dynamic supply chain capabilities. The purpose of the
13 paper is to understand how dynamic supply chain capabilities interrelate and their effect on
14 supply chain ambidexterity.
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19 **Design/methodology/approach:** Based on a survey of Pakistani manufacturing firms, a
20 theoretically-derived model was tested in a structural equation model.
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23 **Findings:** The results of the study show that a market-sensing capability is an antecedent of
24 supply chain agility and supply chain adaptability. Furthermore, supply chain agility, directly,
25 and supply chain adaptability, indirectly, affect supply chain ambidexterity. Supply chain
26 agility therefore mediates the relationship between supply chain adaptability and supply chain
27 ambidexterity.
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32 **Originality/value:** The contribution of this study lies in: (1) identifying dynamic capability
33 clusters relevant for achieving supply chain ambidexterity;(2) evaluating performance
34 implications of dynamic capabilities in the supply chain, specifically supply chain agility and
35 adaptability; and (3) proposing a unique measurement of supply chain ambidexterity in the
36 light supply chain theory, and empirically evaluating the relationship between dynamic
37 capabilities and supply chain ambidexterity.
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43 **Keywords:** Market sensing, supply chain agility, supply chain adaptability, supply chain
44 ambidexterity, dynamic capabilities view, survey
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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 (ibid).

For a long time, scholars have argued that operations managers are faced with a trade-off between flexibility and efficiency – where prioritizing 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 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

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3 during non-routine work. Other OM scholars have found that companies with operational
4 ambidexterity capabilities are able to explore new, and exploit existing, processes
5 simultaneously – leading to enhanced operational performance (Kortmann et al., 2014, Patel
6 et al., 2012, Tamayo-Torres et al., 2017).
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11 The notion of operational ambidexterity has since been extended beyond the
12 boundaries of the firm – to the supply chain (Blome et al., 2013a; Im and Rai, 2008; Kristal et
13 al., 2010; Lee and Rha, 2016; Rojo et al., 2016). Kristal et al. (2010) define supply chain
14 ambidexterity as a firm's strategic choice to simultaneously pursue both supply chain
15 exploitation (efficiency) and exploration (flexibility) practices (Kristal et al., 2010 p. 415).
16 The notion of supply chain ambidexterity runs counter to those scholars that suggest
17 companies should select the right supply chain for their product; with primarily functional
18 products using efficient supply chains and primarily innovative products relying on flexible
19 supply chains (i.e. Fisher, 1997). Instead, supply chain ambidexterity means managers are not
20 faced with an either/or decision, but can simultaneously have a flexible AND efficient supply
21 chain for a particular product (Lee and Rha, 2016; Rojo et al., 2016).
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36 To achieve such an ambitious goal, Lee (2004) argues that successful companies
37 require supply chains that can rapidly respond to short-term changes in demand (agility) and
38 adjust to long-term market changes by restructuring the supply chain (adaptability). Supply
39 chain agility (SAG) is defined as the firm's ability to respond to market changes such as
40 variation in demand patterns, in terms of quality, quantity, and variety, as well as to supply
41 patterns, in terms of shortages and disruptions (Blome et al., 2013b). Supply chain
42 adaptability is defined as the ability of the firm to make supply chain design changes– that are
43 far more radical and long-term than changes pursued under the notion of supply chain agility
44 – in the wake of sensed opportunities (Eckstein et al., 2015, Ketchen and Hult, 2007).
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3 Because supply chain agility and adaptability are developed and renewed in response
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5 to changes in customer demand, these two constructs have been positioned as dynamic
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7 capabilities (see Eckstein et al., 2015; Whitten et al., 2012). Dynamic capabilities are higher-
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9 order capabilities that refer to a firm's ability to *sense* opportunities and threats in the
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11 marketplace, to *seize* opportunities as they arise and to *transform* assets and organisational
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13 structures as the organisation grows and market requirements change (Teece, 2007). Supply
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15 chain agility is positioned as a *seizing* dynamic capability because it allows the firm to
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17 identify opportunities and threats in the marketplace and to provide an agile supply chain
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19 response (Eckstein et al., 2015). Supply chain adaptability is positioned as a *transforming*
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21 dynamic capability, because the resource base and structure of the supply chain is
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23 transformed over the longer term in response to changes in the marketplace (Eckstein et al.,
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25 2015). As agility and adaptability are integrated and coordinated with supply chain partners, a
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27 complex adaptive system forms which is able to sense changes in the marketplace, seize new
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29 opportunities and transform the supply chain to satisfy customer demand (Whitten et al.,
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31 2012).
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36 Importantly, we argue a firm's supply chain would have difficulty seizing
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38 opportunities in the marketplace and reconfiguring its operations in response, without the
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40 capability to sense these opportunities in the first place. Market sensing reflects the firm's
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42 routines related to actively learning about customers, competitors, supply chain members and
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44 the business environment that allows for understanding of market conditions as well as for
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46 prediction purposes (Morgan, 2012). Recent studies have investigated the direct and indirect
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48 effects of supply chain agility and adaptability on different measures of firm performance
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50 (Dubey et al., 2018, Eckstein et al., 2015). But despite these laudable efforts, the role of
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52 market-sensing capabilities has been largely ignored (Teece et al., 2016). To fill this gap in
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54 our understanding, this paper attempts to answer the following research question: *how do*
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3 *market sensing, supply chain agility and supply chain adaptability affect supply chain*
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5 *ambidexterity?*
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8 We answer our research question by examining survey data collected from 277
9 manufacturing firms in Pakistan. Empirical research findings on companies in Pakistan are
10 limited as a result of the difficulty of data collection; however, due to the uncertainty of the
11 economic system, dynamic supply chain capabilities play an important role in firm survival.
12 We therefore believe that Pakistan, like other dynamic markets, is an excellent context within
13 which to investigate dynamic supply chain capabilities in comparison to more mature markets
14 where firms adjust to significant changes less often. Data is analysed by means of structural
15 equation modelling.
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26 This study contributes to theory and practice in the area of dynamic capabilities in
27 supply chains. According to Teece (2007), dynamic capabilities exist in the form of
28 capability clusters consisting of sensing, seizing, and transforming/reconfiguration
29 capabilities. Like Teece (2007), we position market sensing, supply chain agility and
30 adaptability as a coherent cluster of dynamic supply chain capabilities that should be
31 considered in conjunction rather than in isolation. We empirically show that supply chain
32 agility has a significant short-term effect on supply chain ambidexterity, that supply chain
33 adaptability has a significant long-term effect on supply chain ambidexterity and that market
34 sensing acts as a key antecedent for both variables. Combined, this dynamic supply chain
35 capability cluster allows organisations to modify their products, services and supply chain
36 structures according to market requirements over both the short and long-term. In making this
37 argument, we respond to the call by supply chain theorists to identify dynamic capabilities
38 relevant to the supply chain environment (Beske et al., 2014). Finally, we provide a new
39 measurement of supply chain ambidexterity developed based on extant scales to better
40 explain short and long-term performance versus traditional performance measures.
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3 The remainder of the paper is organised as follows. Section 2 discusses the studies
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5 theoretical foundations, reviews the relevant literature and develops a hypothetical model of
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7 the relationship between market sensing, supply chain agility, adaptability and ambidexterity.
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9 Section 3 provides a justification of the research design. Section 4 presents the study's
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11 findings and section 5 discusses the results. The studies implications for theory and
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13 management, along with its limitations, are discussed in Section 6.
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19 **2. LITERATURE REVIEW AND HYPOTHETICAL MODEL**

20 21 *2.1. Dynamic Supply Chain Capabilities*

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24 We ground this study in the dynamic capabilities view of the firm. Dynamic capabilities are
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26 the organisation's ability 'to sense and then seize new opportunities, and to reconfigure and
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28 protect knowledge assets, competencies, and complementary assets with the aim of achieving
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30 a sustained competitive advantage'(Augier and Teece, 2009 , p. 412). Dynamic capabilities
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32 depict the firm's ability to modify its distinctive and co-specialised resources in order to
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34 respond to changing environmental conditions (Augier and Teece, 2009). They manifest in
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36 firms through the transformation of business processes, resource allocations and
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38 reallocations, and operations (Teece, 2007). Dynamic capabilities can lead to differences in
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40 the performance of firms, even if firms are similar in terms of resources and capability
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42 endowments (Easterby-Smith et al., 2009). Yet at their core, these capabilities are similar in
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44 the sense that they enable knowledge creation and dissemination, and continuous
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46 modification of organisational processes in response to environmental changes (Easterby-
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48 Smith et al., 2009).
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53 The application of the dynamic capabilities view to strategic decisions in supply chain
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55 management is becoming increasingly common (Witcher et al., 2008, Allred et al., 2011,
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3 Fawcett et al., 2011, Blome et al., 2013b, Defee and Fugate, 2010). Dynamic capabilities in
4 the supply chain emerge when firms engage their employees in understanding customer
5 requirements and translate these requirements so that they are effectively communicated
6 throughout the supply chain (Handfield et al., 2015). Indeed, scholars have begun challenging
7 the conceptualization that dynamic capabilities are bounded by the firm, and have extended
8 our understanding beyond firm boundaries to acknowledge the presence of 'dynamic supply
9 chain capabilities' (Dubey et al., 2018, Eckstein et al., 2015, Swafford et al., 2006).
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18 For example, Swafford et al. (2006) argue that supply chain agility is a capability that
19 allows the supply chain to *seize* opportunities once they are sensed. Supply chain agility is
20 positioned by other authors as a fundamental capability needed to endure and flourish in
21 volatile environments (Gligor and Holcomb, 2014, Braunscheidel and Suresh, 2009), as it
22 allows for a flexible supply chain response (Gligor and Holcomb, 2012). Building on this
23 argument, Blome et al. (2013b) put forward the idea that supply chain agility is a dynamic
24 capability able to positively influence the operational performance of the firm. Supply chain
25 agility can also be regarded as an extension of agile manufacturing which focuses mainly the
26 firm (Yusuf et al., 1999, Brown and Bessant, 2003). Furthermore, supply chain agility is
27 typically considered to extend the narrower concept of supply chain flexibility (Stevenson
28 and Spring, 2007, Gligor and Holcomb, 2012).
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43 Supply chain adaptability refers to a firm's ability to *reconfigure and transform*
44 supply chain design according to expected market changes (Lee, 2004). Ketchen and Hult
45 (2007) explain that supply chain adaptability is the willingness to reshape the supply chain
46 when necessary, without ties to legacy issues or the way the chain has been operated
47 previously. Stevenson and Spring (2007) suggest that supply chain adaptability is the
48 property of a supply chain which allows the members to cope with dynamics associated with
49 the supply chain. Eckstein et al. (2015) draw together this line of reasoning and suggest that
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3 supply chain agility and adaptability can be considered dynamic capabilities that result from
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5 the firm's ability to reconfigure firm-level and supply chain-level resources.
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8 Interestingly, many of these studies examine the effects of supply chain agility and
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10 adaptability, either individually or combined, on firm performance (Blome et al., 2013b,
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12 Dubey et al., 2018, Eckstein et al., 2015, Lee, 2004, Lee and Rha, 2016), however the role of
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14 market sensing is largely ignored. This is a curious omission as it stands to reason that supply
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16 chain managers would need the ability to sense opportunities and threats in the marketplace
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18 in the first instance, in order to provide a flexible response (supply chain agility) and to
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20 restructure the supply chain over the longer-term (supply chain adaptability). Indeed, Day
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22 (1992; 1994) argues that firms involved in developing a better understanding of the market
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24 situation (market sensing) have a better chance of understanding and acting on uncertainties
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26 and market trends (Day, 1992, Day, 1994). Bharadwaj and Dong (2014) reaffirm that
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28 systematically undertaking market sensing activities to remain synchronized with market
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30 changes can facilitate the provision of superior value propositions.
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34 It thus stands to reason that, like the dynamic capabilities of the firm (Teece, 2007),
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36 dynamic supply chain capabilities including market sensing, supply chain agility and supply
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38 chain adaptability exist in cluster. It follows that dynamic supply chain capabilities are
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40 interrelated and need to exist in combination to prove beneficial to the firm. We now turn our
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42 attention to understanding how market sensing, supply chain agility and adaptability
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44 interrelate and the resulting effects on supply chain ambidexterity.
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47 ***2.2. Supply Chain Ambidexterity***

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50 To become ambidextrous, firms need to harmonise the contradictory demands imposed by the
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52 environment (Raisch and Birkinshaw, 2008). These demands include balancing efficiency in
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54 exploiting current resource positions versus exploring and responding to future market
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3 conditions through search and experimentation activities (He and Wong, 2004). This
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5 simultaneous pursuit of seemingly conflicting goals has been termed organisational
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7 ambidexterity (Weber and Tarba, 2014).
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10 Operations management scholars have acknowledge that a firm's internal operation
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12 can be both flexible and efficient if the right structures are in place (Adler et al., 1999,
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14 Kortmann et al., 2014, Patel et al., 2012, Tamayo-Torres et al., 2017). For example, Patel et
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16 al. (2012) found that firms with greater operational ambidexterity capabilities are able to
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18 respond to demand and competitive uncertainty by pursuing efficient and flexible
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20 manufacturing strategies. Tamayo-Torres et al. (2017) found that ambidexterity acts as an
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22 enabler across quality, speed, flexibility and cost dimensions, therefore driving
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24 manufacturing performance.
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27 The concept of ambidexterity has since been applied within a supply chain context
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29 (Blome et al., 2013a; Im and Rai, 2008; Kristal et al., 2010; Lee and Rha, 2016; Rojo et al.,
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31 2016). For example, Kristal et al. (2010) explains that supply chains encompass a variety of
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33 sub-systems which can simultaneously pursue either efficiency or responsiveness objectives.
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35 Im and Rai (2008) found that knowledge sharing leads to relationship performance gains and
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37 that such sharing is enabled by the ambidextrous management of buyer-supplier relationships.
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39 Rojo et al. (2016) identify that building a supply chain ambidexterity capability can help
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41 firms to achieve an optimal level of supply chain flexibility. Likewise, Lee and Rha (2016)
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43 find that supply chain ambidexterity is important as firms mitigate the negative impact of
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45 supply chain disruptions, thereby enhancing business performance. To build an ambidextrous
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47 supply chain, Blome et al. (2013a) suggest that buyers can gain synergistic advantages by
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49 pursuing both contractual supplier relationships to achieve cost efficiencies, and relational
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51 collaborations to realize flexibility benefits.
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3 Unfortunately however, the majority of these studies examine the relationship
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5 between supply chain ambidexterity and firm performance without acknowledging the
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7 antecedents of supply chain ambidexterity.
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10 **2.3. The relationship between market sensing, supply chain agility and adaptability**

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12 We suggest that supply chain ambidexterity requires a firm's supply chain to be
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14 simultaneously agile, so it can quickly respond to short term market changes, and adaptable
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16 so the resource base and structure of the supply chain can be reconfigured to achieve longer
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18 term efficiency gains. We stress there would be no need for an agile or adaptive response if,
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20 in the first instance, supply chain managers are unable to sense opportunities and threats in
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22 the marketplace.
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26 Based on this line of reasoning, we hypothesise that market sensing acts as an
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28 antecedent of supply chain agility and adaptability. Support for this relationship can be found
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30 in the dynamic capabilities view, which suggests that the ability to sense market opportunities
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32 accurately is a pre-requisite of the development and deployment of other dynamic capabilities
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34 (Teece, 2007). Firms with well-developed market-sensing capabilities are more likely to be
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36 agile because they have a better understanding of supply chain partner activities allowing for
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38 proactive response to market uncertainty (Tse et al., 2016). Indeed, market sensing allows
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40 firms to become well prepared and to develop structures, technologies and policies to respond
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42 to market changes in an efficient manner (Ngai et al., 2011).
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46 In fact, Eckstein et al. (2015) argues that the ability to sense marketplace changes is
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48 an important dimension of supply chain agility. Supply chain agility necessitates that firms
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50 respond promptly and adequately to unexpected changes in the market situation (Tippins and
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52 Sohi, 2003). This is not possible unless the firm has a clear understanding of the future
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54 implications of market opportunities (Teece et al., 2016). Faster and more accurate responses
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3 to business opportunities (i.e. supply chain agility) that thwarts competition and retains
4 customers, is the outcome of the ability to better sense and disseminate market information
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7 (Day, 1992). Drawing together this line of reasoning, we hypothesize that:
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10 *H1: Market sensing has a positive effect on supply chain agility.*
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12 We go on to suggest that a firm's ability to understand and adjust quickly to marketplace
13 changes depends on its adaptive capabilities (Day, 2014). Market sensing positively affects
14 supply chain adaptability because understanding the magnitude of change or variability in the
15 business environment is the first step towards building flexibility and efficiency into supply
16 chain design (Christopher and Holweg, 2011). This argument is supported by Schoenherr and
17 Swink (2015) who suggest that supply chain adaptability reduces the constraints on the firm's
18 response to changing product or service requirements, by spotting new resources (e.g. raw
19 materials) and problem solving (e.g. product commercialisation and launching).
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30 An important contribution made by Lee (2004) highlights how supply chain
31 adaptability transforms supply chain design in response to the 'structural shift' in the market.
32 However, in order to achieve this transformation, Lee argues that this structural shift has to
33 be perceived *ahead of time* so that long-term supply chain design decisions can be adjusted
34 (Lee, 2004). This is achieved by sensing changes in the market through activities such as
35 capturing market data, separating noise, and identifying key patterns. Based on this
36 information, the firm decides on facility relocation, supply source changes, and relevant
37 outsource manufacturing (Lee, 2004). It can thus be argued that a supply chain manager's
38 ability to scan the marketplace, interpret and respond to the signals of change acts as a key
39 trigger of supply chain adaptability (Reeves and Deimler, 2011). We therefore hypothesize the
40 following:
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54 *H2: Market sensing has a positive effect on supply chain adaptability.*
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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 versus efficiency and meeting global versus 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) notes 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:

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

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3 Importantly however, supply chain agility cannot be thought to positively affect the
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5 ambidexterity of a supply chain in isolation. In contrast to supply chain agility, which centres
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7 on short-term responses, supply chain adaptability requires longer-term changes to the
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9 structure and resource base of a firm's supply chain (Lee, 2004 , p. 4). Supply chain
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11 adaptability helps firms cope with longer-term challenges such as changes in product range
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13 and mix, markets served, service levels, and profit margins (McCullen et al., 2006).
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17 In this study, we hypothesise that supply chain adaptability has a longer-term, positive
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19 impact on supply chain ambidexterity. Moreover, we suggest that supply chain adaptability
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21 affects both dimensions of supply chain ambidexterity positively. Firstly, supply chain
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23 adaptability influences efficiency because the flexibility built into the supply chain (by
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25 outsourcing, using flexible labour arrangements, etc.) requires that fixed costs be changed
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27 into variable costs, which over a period of time can reduce total supply chain costs
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29 (Christopher and Holweg, 2011). Furthermore, designing product ranges with higher levels
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31 of component commonality also reduces inventory carrying costs (Lee, 2004).
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35 Secondly, supply chain adaptability positively influences responsiveness, as
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37 developing alternative supply bases through facility relocation helps to maintain quality
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39 levels and to guarantee steady service in times of changing markets and economies (Eckstein
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41 et al., 2015). Diversification in sourcing also helps to improve service levels and delivery
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43 performance (Christopher and Holweg, 2011). Similarly, innovativeness supports reduction
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45 in development lead times, design cycles and flexible design capabilities (Eckstein et al.,
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47 2015).
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51 Like with supply chain agility, supply chain adaptability positively influences the
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53 efficiency and flexibility of the supply chain; it is just that the former is oriented towards
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55 short-term response, while the latter is focused on longer-term restructuring. Indeed, this line
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57 of reasoning supports our argument that having an ambidextrous supply chain means
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3 managers are not faced with an either/or decision, but can have a flexible and efficient supply
4 chain for the same product (Lee and Rha, 2016, Rojo et al., 2016). We therefore hypothesize
5 the following:
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10 *H4: Supply chain adaptability has a positive effect on supply chain ambidexterity.*
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18 **2.5. Mediating Role of Supply Chain Agility**

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20 Dynamic capabilities theory suggests that capabilities do not remain infinitely competitive
21 (Proterou et al., 2012). Over time, the processes underlying dynamic capabilities become
22 imitable and require transformation (Teece, 2014). It follows that, in order to sustain
23 competitive advantage in the long run, certain short-term changes have to be made. Based on
24 this reasoning, we suggest that supply chain adaptability is the capability that influences the
25 long-term sustainability of a firm's competitive advantage, while the influence of supply
26 chain agility is shorter-term.
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36 This argument is supported by Eckstein et al. (2015) who suggest that supply chain
37 adaptability acts as an enabler of supply chain agility. Specifically, they state that the ability
38 to reconfigure the supply chain according to market requirement (supply chain adaptability)
39 acts as the basis for the firm to develop a supply chain agility capability (Eckstein et al.
40 2015). Supply chain agility requires the ability to quickly deal with demand-side changes,
41 such as changing customer preferences, and supply-side changes, such as delivery failures
42 (Blome et al., 2013b). A firm is able to cope with delivery failures if it has been involved in
43 the continuous development of its supplier and logistics infrastructure (Lee, 2004). Similarly,
44 a firm is able to deal with changing customer preferences if it has been monitoring these
45 changes overtime (Lee, 2004). Accordingly, the long-term structural changes (supply chain
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3 adaptability) needed to achieve the dual motivations of efficiency and flexibility necessitate a
4 series of short-term supply chain interventions (supply chain agility). Based on this line of
5 reasoning, supply chain agility plays a mediating role in the relationship between supply
6 chain adaptability and ambidexterity. Therefore, we posit:
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12 *H5: Supply chain agility mediates the relationship between supply chain adaptability and*
13 *supply chain ambidexterity.*
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16 Drawing together these arguments, we advance the following hypothetical model (See Figure
17 1).
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21 ---Insert Figure 1 here---
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26 27 **3. RESEARCH METHODS**

28 29 **3.1. Research Design**

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32 We follow a positivistic ontology believing that the major constructs of our works (e.g.
33 supply chain agility and supply chain adaptability) are real and not subject to social
34 construction. The underlying epistemology predicts that these constructs can be measured
35 with quantitative methods which we do with the help of a survey. Therefore, we adopted a
36 deductive research approach, as we are testing hypotheses that are underpinned by existing
37 theories (dynamic capabilities) (Ketchen and Shook, 1996). In addition, related studies on
38 dynamic capabilities and supply chain ambidexterity from a supply chain perspective have
39 used the same methodology enabling generalisability of results (Blome et al., 2013b, Eckstein
40 et al., 2015, Kristal et al., 2010). The unit of analysis for the study is the firm. The context of
41 the study is the developing economy of Pakistan; a country experiencing an intense period of
42 political and economic change (World Bank, 2017). A recent study showed that Pakistan is
43 expected to grow at a rate of 5.97 per cent over the next ten years (Zahid, 2017). The country
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3 also faces challenges from Chinese firms that are expected to join the competition in
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5 Pakistani markets under the upcoming China-Pakistan Economic Corridor (CPEC).
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7 8 **3.2. Data Collection**

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10 As an emerging economy, Pakistan presented several challenges with regards to data
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12 collection. Hoskisson et al. (2000) highlights some of the issues faced by strategy researchers
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14 in emerging countries such as: difficulty in collecting random and representative samples;
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16 lack of reliability of the postal system; lack of trust between the respondent and researcher;;
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18 difficulty in gaining access to top management, and a lack of understanding of common
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20 management issues among practicing managers. Indeed, many studies conducted in emerging
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22 economies like Pakistan and India have reported similar issues (Ryan and Tipu, 2013,
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24 Jeswani et al., 2008, Ali et al., 2012; Malik and Kotabe, 2009). For example, Malik and
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26 Kotabe (2009) collected data from seven cities in India and Pakistan using convenience
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28 sampling, and cited that there were no updated or complete lists of firms available in either of
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30 the countries. Many other studies, in both these countries, have not used probability sampling
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32 methods (e.g. Ryan and Tipu, 2013, Jeswani et al., 2008, Ali et al., 2012) due to similar
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34 reasons.
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39 Similar problems were also faced in this study. For example, there was no
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41 comprehensive database for identifying manufacturing organisations in the country. Instead,
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43 we constructed the list of organisations to be included in the sampling frame using various
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45 sources such as: manufacturing organisations listed on the Pakistan Stock Exchange; lists of
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47 managers available from Quality and Productivity Society of Pakistan; yellow pages and
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49 websites of associations for the leading industries. We made sure that no duplicate entries of
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51 firms were included, so that a comprehensive database of manufacturing firms in Pakistan
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53 was constructed. Email addresses from all these sources were combined, and multiple waves
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55 of emails were sent between February and July 2016. All surveys were accompanied by a
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cover letter that briefly introduced the research and highlighted the importance of the respondent's cooperation. Discounting the emails that remained undelivered, 3,375 emails were sent in total. In total, 277 usable responses (8.2 per cent response rate) were received, which, for email 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: 1) years of existence of the respondent's firm; 2) sales of the respondent's firm; and 3) 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 1 and 2. The distribution of the firms in the sample closely resembles the distribution of local industry (Pakistan Bureau of Statistics, 2005-06). For example, 25.5 per cent of the respondents belonged to the textile sector, versus 26.2 per cent contribution in terms of output in the national economy. Similarly, 17 per cent of respondents were from FMCGs (versus 16.5 per cent); 4.3 per cent of respondents were from auto and auto-part manufacturing (versus 5.4 per cent); 10.8 per cent of respondents belonged to chemical manufacturing (versus 12 per cent); and 2.9 per cent were from the electronics industry (versus 1.8 per cent).

--- Insert Table 1 & 2 about here ---

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

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3 interest in this study cannot be typically obtained from a firm's financial statements,
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5 perceptual measures were instead used to collect data from respondents. Perceptual measures
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7 were found to be adequate because the literature indicates a high correlation between
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9 subjective and objective measures of variables (Protogerou et al., 2012).The following
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11 section provides the details about these scales and their sources.
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14 ***Market Sensing Capability (MSC):*** relates to the ability of the firm to sense opportunities
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16 and threats in the market (Teece, 2007). The scale is adopted from Morgan et al. (2009) and
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18 consists of five items measured on the scale of 1 (strongly disagree) to 7 (strongly agree). The
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20 scale elicited data on the efforts of the firm, and aimed at learning about customer needs,
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22 competitor strategies, distribution channels, market trends, and the broader market
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24 environment.
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27 ***Supply Chain Agility (SAG):*** identifies the firm practices that capitalise on market
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29 opportunities. This scale is based on the supply chain agility scale developed by Blome et al.
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31 (2013b) and is measured on the scale of 1 (strongly disagree) to 7 (strongly agree). It
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33 measures the firm's ability to adapt its offering quickly according to changing customer
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35 needs, the ability to cope with the changing demands and requirements to modify product
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37 portfolios, and the ability to cope with supply side problems.
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41 ***Supply Chain Adaptability (SAD):*** operationalised in this study as the ability to modify
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43 supply chain design. The construct is based on the supply chain adaptability construct from
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45 Lee's (2004) Triple-A supply chain. It consists of a 5-item scale developed in the Whitten et
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47 al. (2012) study, and is measured on the scale of 1 (strongly disagree) to 7 (strongly agree).
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49 As per the assertions of Lee (2004), the scale measures the ability of the firm to: spot new
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51 suppliers in developing countries; develop suppliers and logistics infrastructure; understand
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53 ultimate customers; develop flexible product designs; and understand the firm's product
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55 standing in the technology and product life cycles.
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3 **Supply Chain Ambidexterity (SAM):** Ambidexterity in organisation research is measured in
4 various ways. The constructs have been formed as second-order reflective (Kristal et al.,
5 2010) and second-order formative (Tamayo-Torres et al., 2017), by multiplying (Gibson and
6 Birkinshaw, 2004), adding (Lubatkin et al., 2006), or subtracting (He and Wong, 2004) the
7 two sub-dimensions. However, multiplying two dimensions has been by far the most used
8 method of forming the construct (see Junni et al., 2013 for a detailed review). We measure
9 SAM as an interaction of supply chain efficiency (SCE) and supply chain responsiveness
10 (SCR). Both scales are measured on the scale of 1 (far worse than competitor) to 7 (far better
11 than competitor). The details about the items of the two scales are provided in the following.

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

34 **3.4. Common Method Bias**

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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

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3 this study to avoid the problem of common method bias, as prior research has shown such
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5 measures to be more effective (Green et al., 2016). Guidelines suggested by Conway and
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7 Lance (2010), Podsakoff and Organ (1986), and Podsakoff et al.(2003) were followed in this
8
9 respect. In terms of procedural remedies, dependent and independent variables appear in
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11 different sections of the survey and with different Likert-type scales; for example, strongly
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13 disagree–strongly agree versus far better–far worse. Furthermore, respondents were ensured
14
15 that their responses will remain completely anonymous. Respondents were also given the
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17 choice of submitting the survey without filling in their name and company name. The survey
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19 instrument was refined through two rounds of pilot surveys and opinions from experts, in
20
21 order to remove any ambiguity in the questionnaire items that could bias the respondents in
22
23 any way. Following the above guidelines, exploratory factor analysis was performed without
24
25 a rotation. Three factors emerged from the solution, with the first factor accounting for less
26
27 than 50 per cent of the variation. In the next step, all the variables in the research model were
28
29 loaded on a single factor in a confirmatory factor analysis. This showed considerably poor
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31 results compared to the research model ($\chi^2=3.75$, CFI=0.817, RMSEA=0.1) and did not
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33 achieve the basic threshold levels. Thus, it was concluded that common method bias is not a
34
35 major concern in this study.
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40 **3.5. Assessment of Psychometric Properties**

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42 Confirmatory factor analysis (CFA) was used to establish the validity and unidimensionality
43
44 of the constructs. Separate CFA was performed for dependent and independent variables.
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46 Model fit indices for both independent variable CFA ($\chi^2=1.39$, $p>0.05$, GFI=0.969,
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48 CFI=0.992 and RMSEA= 0.034) and dependent variable CFA ($\chi^2=1.77$, $p>0.05$, GFI=0.983,
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50 CFI=0.992 and RMSEA=0.053) were found to be adequate (Hu and Bentler, 1999). Factor
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52 loadings for all the constructs were either close to or above 0.7. Combined with significant p-
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values, this provides the evidence for convergent validity. Reliability of the constructs was established using Cronbach's alpha coefficients. Reliability coefficients for all the constructs were greater than 0.7, indicating reliability of the constructs. Table 3 provides the information about factor loadings and reliability measures for the constructs in the study.

--- Insert Table 3 about here ---

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 4 below that correlations between all pairs of constructs are lesser than associated AVEs, indicating discriminant validity. Table 4 also provides means and standard deviations for the constructs in the study.

--- Insert Table 4 about here ---

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 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

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3 limitations of past research (0.75 and 0.50, respectively) (Curran et al., 1996). In addition,
4 also the above-mentioned plots did not show any concerning deviations. Finally, we also
5 checked whether multicollinearity of variables was a problem, but as variance inflation
6 factors were less than 1.97 (the recommended threshold is 10.0) we concluded that multi-
7 collinearity was not a problem (Hair et al., 2014).
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14 Figure 2 provides the results of the structural model. Path coefficients with solid lines
15 indicate significant relationships ($p < 0.01$), while the ones with dotted lines indicate
16 insignificant relationships. Model fit was found to be adequate ($\chi^2 = 1.35$, $p > 0.05$, GFI = 0.96,
17 CFI = 0.99, and RMSEA = 0.036). Based on the results of the structural model, H1, H2, and
18 H3 were significant, whereas support could not be found for H4. In order to test the
19 mediation relationship posited in hypothesis 5, a bootstrapping technique (Hayes, 2013) was
20 used. In order to test the hypotheses, indirect effect coefficients were generated using 5,000
21 bootstrap samples, along with a 95 per cent biased corrected confidence interval. Results
22 showed that SAG significantly mediated the relationship between SAD and SAM ($\beta = 4.41$,
23 $p < 0.01$). Results of the mediation test showed that indirect coefficient was significant
24 ($p < 0.01$). Therefore, H5 was supported.
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41 5. DISCUSSION

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44 Meta-analytic studies have called for more empirical studies investigating the
45 implications of dynamic capabilities (Wilden et al., 2016). Even though there seems to be a
46 consensus that dynamic capabilities should have a positive relationship with performance
47 outcomes, Pezeshkan et al. (2016) suggest that empirical evidence regarding this relationship
48 is mixed, at best. Given the popularity of dynamic capabilities as a research area, there is
49 significant criticism surrounding this debate (Schilke, 2014). In support of earlier arguments
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3 by Teece (2007), we have gathered empirical data to show that, like firm-level dynamic
4 capabilities, dynamic supply chain capabilities exist in clusters of sensing, seizing and
5 transforming capabilities. Specifically, supply chain agility allows firm's to seize
6 opportunities in the marketplace by providing a short-term supply chain response. Supply
7 chain adaptability allows firms to provide a longer-term response to marketplace changes by
8 transforming the resource base and structure of the supply chain.
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16 Importantly, we found that supply chain agility and adaptability are only necessary if
17 supply chain managers are able to sense market opportunities and threats in the first place.
18 After sensing opportunities and threats, managers can respond in two ways. In the short term,
19 firms develop capabilities that allow them to modify their products and services quickly, and
20 according to customer requirements both in terms of quantity and variety (supply chain
21 agility). In the longer term, firms invest in the process of learning about their ultimate
22 customers, understanding the life cycle of their products, and the continuous development of
23 new suppliers (supply chain adaptability). Thus, market sensing not only helps supply chain
24 managers to understand market changes, it also empowers them to improve decision-making
25 regarding execution and reconfiguration of their capabilities.
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38 These findings contribute to the existing literature by empirically showing that market
39 sensing is an antecedent of supply chain agility and adaptability capabilities. This findings
40 resonate with previous studies that have highlighted the importance of market sensing for
41 supply chain agility (Tse et al., 2016) and supply chain adaptability (Aitken et al., 2002,
42 Eckstein et al., 2015). With regard to dynamic capabilities theory (Teece, 2007), these results
43 suggest that a sensing capability is the pre-requisite for seizing and reconfiguration
44 capabilities.
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54 We further identified a significant direct impact of supply chain agility, and an
55 indirect impact of adaptability on supply chain ambidexterity. These results highlight the
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3 central role played by these dynamic capabilities in changing the market situation. Supply
4 chain agility provides increased responsiveness and yields higher profitability, if exploited
5 properly, and is thus a resource to fall back upon in turbulent times (Blome et al., 2013b).
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7 The ability to respond to changing market requirements is significant with regards to
8 achieving market success. Conversely, the ability to sense market opportunities correctly, but
9 the lack of capability to capitalise on them, would not improve performance and the
10 opportunities would thus be lost (Roberts and Grover, 2012). Similarly, an insignificant direct
11 relationship, and a significant indirect relationship, between supply chain adaptability and
12 ambidexterity highlights the importance of successfully transforming supply chain design
13 into short-term responses that can bring immediate results. In accordance with Eckstein et al.
14 (2015), our findings suggest that supply chain agility allows the firms to transform supply
15 chain adaptability capabilities into superior performance levels.
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29 **6. CONTRIBUTION AND FUTURE RESEARCH DIRECTIONS**

30 ***6.1 Theoretical and Managerial contribution***

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32 While ambidexterity has become an important element in the wider supply chain discourse
33 (e.g. Blome et al., 2013a, Kristal et al., 2010, Matthews et al., 2015), no consensus on how to
34 measure supply chain ambidexterity exists. For example, Kristal et al. (2010) measures the
35 ambidextrous supply chain strategy as a dichotomy between exploration- and exploitation-
36 based practices. Blome et al. (2013a), on the other hand, base their ambidextrous supply
37 chain governance construct on a contractual-relational governance dichotomy. Im and Rai
38 (2008) base their construct of contextual ambidexterity on the adaptability-alignment
39 dichotomy.
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52 In this paper, we introduce a new way of measuring supply chain ambidexterity,
53 including traditional measures of responsiveness and efficiency, and combine them in a
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3 multiplicative way in-line with prior research in the area (see Gibson and Birkinshaw, 2004,
4 Hill and Birkinshaw, 2014). We believe that by integrating responsiveness and efficiency as
5 measures, we capture the major trade-off that has been discussed in the supply chain context,
6 allowing a unique and suitable supply chain specific contribution to theory. Also, instead of
7 measuring ambidexterity based on classical performance measures, we provide a theoretical
8 angle that captures the essence of dynamic supply chain capabilities, providing insights on
9 how firms can achieve sustained competitive advantage in a supply chain context.
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18 Finally, we challenge the common assumption that only one supply chain type
19 (efficient/ responsive) is suitable for a particular product (e.g. Fisher, 1997, Lee, 2002).
20 Instead, we suggest to managers that a product can have both a flexible and efficient supply
21 chain if underpinned by the dynamic supply chain capabilities of market sensing, supply
22 chain agility and adaptability. The results of this study suggest to managers that dynamic
23 supply chain capabilities exist in clusters that need to be invested in simultaneously to
24 capitalize on efficiency and flexibility gains.
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34 ***6.2. Limitations and Future Research Directions***

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36 The findings of this study should be interpreted in light of its limitations. These limitations
37 may also point out some avenues for future research. First, this study used self-reported
38 perceptual data in order to measure both independent and dependent variables. While this is
39 the dominant practice in most management research, and substantial efforts were made to
40 achieve the highest possible level of data quality during the process of data collection and
41 construct validation, self-reporting bias cannot be totally ruled out. Second, the study used a
42 cross-sectional research design, thus the usual caveats of this design apply to this study.
43 Findings of this study cannot be taken as conclusive evidence of the underlying causal
44 relationships. Conclusive evidence can only be generated through longitudinal research.
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3 Future research in the area may employ a longitudinal research design, or employ
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5 secondary (panel) data. However, as emphasised by Protojerou et al.(2012), these limitations
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7 do not invalidate the results. A single study is never enough to provide the final argument
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9 related to underlying relationships in the model being tested. Given that this study takes into
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11 consideration a fairly large dataset, it provides the basis for the logic of the dynamic supply
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13 chain capabilities- supply chain ambidexterity relationship. Models based on a cross-sectional
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15 design need to be developed in order to evaluate the pertinence of the research model before
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17 longitudinal designs can be used. Better understanding of this logic, however, will require
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19 these relationships to be studied using diverse types of evidence (qualitative/quantitative).
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21 Finally, we considered the interplay between various dynamic supply chain capabilities in
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23 terms of how these capabilities affect the overall performance of the supply chain. We found
24
25 that a market sensing capability positively and directly affects supply chain agility and
26
27 adaptability. Combined, these dynamic supply chain capability clusters allow organisations to
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29 modify their products, services and supply chain structures according to market requirements
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31 both over the short and long-term. Therefore, future research should consider market sensing,
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33 supply chain agility and adaptability in conjunction rather than in isolation.
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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*, 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.

- 1
2
3 Bharadwaj, N. and Dong, Y. (2014), "Toward further understanding the market-sensing
4 capability–value creation relationship", *Journal of Product Innovation Management*,
5 Vol. 31 No. 4, pp. 799-813.
- 6 Blome, C., Schoenherr, T. and Kaesser, M. (2013a), "Ambidextrous governance in supply
7 chains: The impact on innovation and cost performance", *Journal of Supply Chain*
8 *Management*, Vol. 49 No. 4, pp. 59-80.
- 9
10 Blome, C., Schoenherr, T. and Rexhausen, D. (2013b), "Antecedents and enablers of supply
11 chain agility and its effect on performance: a dynamic capabilities perspective",
12 *International Journal of Production Research*, Vol. 51 No. 4, pp. 1295-1318.
- 13
14 Braunscheidel, M. J. and Suresh, N. C. (2009), "The organizational antecedents of a firm's
15 supply chain agility for risk mitigation and response", *Journal of Operations*
16 *Management*, Vol. 27 No. 2, pp. 119-140.
- 17
18 Brown, S. and Bessant, J. (2003), "The manufacturing strategy-capabilities links in mass
19 customisation and agile manufacturing—an exploratory study", *International Journal*
20 *of Operations & Production Management*, Vol. 23 No. 7, pp. 707-730.
- 21
22 Christopher, M. and Holweg, M. (2011), "'Supply Chain 2.0': managing supply chains in the
23 era of turbulence", *International Journal of Physical Distribution & Logistics*
24 *Management*, Vol. 41 No. 1, pp. 63-82.
- 25
26 Conway, J. M. and Lance, C. E. (2010), "What reviewers should expect from authors
27 regarding common method bias in organizational research", *Journal of Business and*
28 *Psychology*, Vol. 25 No. 3, pp. 325-334.
- 29
30 Curran, P. J., West, S. G. and Finch, J. F. (1996), "The robustness of test statistics to
31 nonnormality and specification error in confirmatory factor analysis", *Psychological*
32 *methods*, Vol. 1 No. 1, p. 16.
- 33
34 Day, G. S. (1992), "Continuous learning about markets", *Planning Review*, Vol. 20 No. 5, pp.
35 47-49.
- 36
37 Day, G. S. (1994), "The capabilities of market-driven organizations", *The Journal of*
38 *Marketing*, pp. 37-52.
- 39
40 Day, G. S. (2014), "An outside-in approach to resource-based theories", *Journal of the*
41 *Academy of Marketing Science*, Vol. 42 No. 1, pp. 27-28.
- 42
43 De Meyer, A., Nakane, J., Miller, J. G. and Ferdows, K. (1989), "Flexibility: the next
44 competitive battle the manufacturing futures survey", *Strategic Management Journal*,
45 Vol. 10 No. 2, pp. 135-144.
- 46
47 Defee, C. C. and Fugate, B. S. (2010), "Changing perspective of capabilities in the dynamic
48 supply chain era", *International Journal of Logistics Management*, The, Vol. 21 No.
49 2, pp. 180-206.
- 50
51 Dubey, R., Altay, N., Gunasekaran, A., Blome, C., Papadopoulos, T. and Childe, S. J. (2018),
52 "Supply chain agility, adaptability and alignment: empirical evidence from the Indian
53 auto components industry", *International Journal of Operations & Production*
54 *Management*, Vol. 38 No. 1, pp. 129-148.
- 55
56 Duncan, R. B. (Ed.) (1976), *The ambidextrous organization: Designing dual structures for*
57 *innovation*, North Holland, New York.

- 1
2
3 Easterby-Smith, M., Lyles, M. A. and Peteraf, M. A. (2009), "Dynamic capabilities: Current
4 debates and future directions", *British Journal of Management*, Vol. 20 No. s1, pp.
5 S1-S8.
- 6
7 Eckstein, D., Goellner, M., Blome, C. and Henke, M. (2015), "The performance impact of
8 supply chain agility and supply chain adaptability: the moderating effect of product
9 complexity", *International Journal of Production Research*, Vol. 53 No. 10, pp. 3028-
10 3046.
- 11
12 Fawcett, S. E., Wallin, C., Allred, C., Fawcett, A. M. and Magnan, G. M. (2011),
13 "Information technology as an enabler of supply chain collaboration: A dynamic
14 capabilities perspective", *Journal of Supply Chain Management*, Vol. 47 No. 1, pp.
15 38-59.
- 16
17 Fornell, C. and Larcker, D. F. (1981), "Evaluating structural equation models with
18 unobservable variables and measurement error", *Journal of Marketing Research*, Vol.
19 18 No. 1, pp. 39-50.
- 20
21 Gibson, C. B. and Birkinshaw, J. (2004), "The antecedents, consequences, and mediating role
22 of organizational ambidexterity", *Academy of Management Journal*, Vol. 47 No. 2,
23 pp. 209-226.
- 24
25 Gligor, D. and Holcomb, M. (2014), "The road to supply chain agility: an RBV perspective
26 on the role of logistics capabilities", *The International Journal of Logistics
27 Management*, Vol. 25 No. 1, pp. 160-179.
- 28
29 Gligor, D. M. and Holcomb, M. C. (2012), "Antecedents and consequences of supply chain
30 agility: establishing the link to firm performance", *Journal of Business Logistics*, Vol.
31 33 No. 4, pp. 295-308.
- 32
33 Green, J. P., Tonidandel, S. and Cortina, J. M. (2016), "Getting through the gate: statistical
34 and methodological issues raised in the reviewing process", *Organizational Research
35 Methods*, Vol. 19 No. 3, pp. 402-432.
- 36
37 Hair, J. F., Black, W. C., Babin, B. J. and Anderson, R. E. (2014), *Multivariate Data
38 Analysis*, Pearson Education Limited, UK.
- 39
40 Handfield, R. B., Cousins, P. D., Lawson, B. and Petersen, K. J. (2015), "How can supply
41 management really improve performance? a knowledge-based model of alignment
42 capabilities", *Journal of Supply Chain Management*, Vol. 51 No. 3, pp. 3-17.
- 43
44 Hayes, A. F. (2013), *Introduction to Mediation, Moderation, and Conditional Process
45 Analysis: A Regression-Based Approach*, Guilford Press.
- 46
47 Hayes, R. H. and Wheelwright, S. C. (1984), *Restoring our competitive edge: competing
48 through manufacturing*, John Wiley & Sons New York, NY.
- 49
50 Hill, S. A. and Birkinshaw, J. (2014), "Ambidexterity and survival in corporate venture
51 units", *Journal of Management*, Vol. 40 No. 7, pp. 1899-1931.
- 52
53 Hill, T. (1993), *Manufacturing strategy: the strategic management of the manufacturing
54 function*, Macmillan.
- 55
56 Hoskisson, R. E., Eden, L., Lau, C. M. and Wright, M. (2000), "Strategy in emerging
57 economies", *Academy of Management Journal*, Vol. 43 No. 3, pp. 249-267.
- 58
59
60

- 1
2
3 Hu, L. t. and Bentler, P. M. (1999), "Cutoff criteria for fit indexes in covariance structure
4 analysis: conventional criteria versus new alternatives", *Structural Equation*
5 *Modeling: A Multidisciplinary Journal*, Vol. 6 No. 1, pp. 1-55.
- 6
7 Im, G. and Rai, A. (2008), "Knowledge sharing ambidexterity in long-term
8 interorganizational relationships", *Management Science*, Vol. 54 No. 7, pp. 1281-
9 1296.
- 10
11 Jeswani, H. K., Wehrmeyer, W. and Mulugetta, Y. (2008), "How warm is the corporate
12 response to climate change? evidence from Pakistan and the UK", *Business Strategy*
13 *and the Environment*, Vol. 17 No. 1, pp. 46-60.
- 14
15 Junni, P., Sarala, R. M., Taras, V. and Tarba, S. Y. (2013), "Organizational ambidexterity and
16 performance: A meta-analysis", *The Academy of Management Perspectives*, Vol. 27
17 No. 4, pp. 299-312.
- 18
19 Kannan, V. R. (1998), "Analysing the trade-off between efficiency and flexibility in cellular
20 manufacturing systems", *Production Planning & Control*, Vol. 9 No. 6, pp. 572-579.
- 21
22 Ketchen, D. J. and Hult, G. T. M. (2007), "Bridging organization theory and supply chain
23 management: The case of best value supply chains", *Journal of Operations*
24 *Management*, Vol. 25 No. 2, pp. 573-580.
- 25
26 Ketchen, D. J. and Shook, C. L. (1996), "The Application of Cluster Analysis in Strategic
27 Management Research: An Analysis and Critique", *Strategic Management Journal*,
28 Vol. 17 No. 6, pp. 441-458.
- 29
30 Kortmann, S., Gelhard, C., Zimmermann, C. and Piller, F. T. (2014), "Linking strategic
31 flexibility and operational efficiency: the mediating role of ambidextrous operational
32 capabilities", *Journal of Operations Management*, Vol. 32 No. 7, pp. 475-490.
- 33
34 Kristal, M. M., Huang, X. and Roth, A. V. (2010), "The effect of an ambidextrous supply
35 chain strategy on combinative competitive capabilities and business performance",
36 *Journal of Operations Management*, Vol. 28 No. 5, pp. 415-429.
- 37
38 Lee, H. L. (2004), "The triple-A supply chain", *Harvard Business Review*, Vol. 82 No. 10,
39 pp. 102-113.
- 40
41 Lee, S. M. and Rha, J. S. (2016), "Ambidextrous supply chain as a dynamic capability:
42 building a resilient supply chain", *Management Decision*, Vol. 54 No. 1, pp. 2-23.
- 43
44 Lewis, M. W., Andriopoulos, C. and Smith, W. K. (2014), "Paradoxical leadership to enable
45 strategic agility", *California Management Review*, Vol. 56 No. 3, pp. 58-77.
- 46
47 Li, X., Chung, C., Goldsby, T. J. and Holsapple, C. W. (2008), "A unified model of supply
48 chain agility: the work-design perspective", *The International Journal of Logistics*
49 *Management*, Vol. 19 No. 3, pp. 408-435.
- 50
51 Lubatkin, M. H., Simsek, Z., Ling, Y. and Veiga, J. F. (2006), "Ambidexterity and
52 performance in small-to medium-sized firms: The pivotal role of top management
53 team behavioral integration", *Journal of Management*, Vol. 32 No. 5, pp. 646-672.
- 54
55 Malik, O. R. and Kotabe, M. (2009), "Dynamic capabilities, government policies, and
56 performance in firms from emerging economies: evidence from India and Pakistan",
57 *Journal of Management Studies*, Vol. 46 No. 3, pp. 421-450.
- 58
59 March, J. (1991), "Exploration and exploitation in organizational learning", *Organization*
60 *science*, Vol. 2 No. 1, pp. 71-87.

- 1
2
3 Markides, C. (2006), "Disruptive Innovation: In Need of Better Theory*", *Journal of Product*
4 *Innovation Management*, Vol. 23 No. 1, pp. 19-25.
- 5
6 Mason, S. J., Cole, M. H., Ulrey, B. T. and Yan, L. (2002), "Improving electronics
7 manufacturing supply chain agility through outsourcing", *International Journal of*
8 *Physical Distribution & Logistics Management*, Vol. 32 No. 7, pp. 610-620.
- 9
10 Matthews, R. L., Tan, K. H. and Marzec, P. E. (2015), "Organisational ambidexterity within
11 process improvement: an exploratory study of four project-oriented firms", *Journal of*
12 *Manufacturing Technology Management*, Vol. 26 No. 4, pp. 458-476.
- 13
14 McCullen, P., Saw, R., Christopher, M. and Towill, D. (2006), "The F1 supply chain:
15 adapting the car to the circuit—the supply chain to the market", in *Supply chain forum:*
16 *an international journal*, Vol. 7, pp. 14-23.
- 17
18 Morgan, N., Vorhies, D. and Mason, C. (2009), "Market orientation, marketing capabilities,
19 and firm performance", *Strategic Management Journal*, Vol. 30 No. 8, pp. 909-920.
- 20
21 Morgan, N. A. (2012), "Marketing and business performance", *Journal of the Academy of*
22 *Marketing Science*, Vol. 40 No. 1, pp. 102-119.
- 23
24 Ngai, E. W., Chau, D. C. and Chan, T. (2011), "Information technology, operational, and
25 management competencies for supply chain agility: findings from case studies", *The*
26 *Journal of Strategic Information Systems*, Vol. 20 No. 3, pp. 232-249.
- 27
28 Pakistan Bureau of Statistics (2005-06), "Census of Manufacturing Industries ", Pakistan,
29 Pakistan Bureau of Statistics.
- 30
31 Patel, P. C., Terjesen, S. and Li, D. (2012), "Enhancing effects of manufacturing flexibility
32 through operational absorptive capacity and operational ambidexterity", *Journal of*
33 *Operations Management*, Vol. 30 No. 3, pp. 201-220.
- 34
35 Pezeshkan, A., Fainshmidt, S., Nair, A., Frazier, M. L. and Markowski, E. (2016), "An
36 empirical assessment of the dynamic capabilities–performance relationship", *Journal*
37 *of Business Research*, Vol. 69 No. 8, pp. 2950-2956.
- 38
39 Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y. and Podsakoff, N. P. (2003), "Common
40 method biases in behavioral research: a critical review of the literature and
41 recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, p. 879.
- 42
43 Podsakoff, P. M. and Organ, D. W. (1986), "Self-reports in organizational research: problems
44 and prospects", *Journal of Management*, Vol. 12 No. 4, pp. 531-544.
- 45
46 Porter, M. E. (1980), *Competitive strategy: Techniques for analyzing industries and*
47 *competitors*, Simon and Schuster.
- 48
49 Porter, M. E. (1996), "What is strategy", *Harvard business review*, Vol. 75 No. 1.
- 50
51 Protogerou, A., Caloghirou, Y. and Lioukas, S. (2012), "Dynamic capabilities and their
52 indirect impact on firm performance", *Industrial and Corporate Change*, Vol. 21 No.
53 3, pp. 615-647.
- 54
55 Raisch, S. and Birkinshaw, J. (2008), "Organizational ambidexterity: antecedents, outcomes,
56 and moderators", *Journal of Management*, Vol. 34 No. 3, pp. 375-409.
- 57
58 Rajaguru, R. and Matanda, M. J. (2013), "Effects of inter-organizational compatibility on
59 supply chain capabilities: exploring the mediating role of inter-organizational
60 information systems (IOIS) integration", *Industrial Marketing Management*, Vol. 42
No. 4, pp. 620-632.

- 1
2
3 Reeves, M. and Deimler, M. (2011), "Adaptability: The new competitive advantage", No.
4 July-August, pp. 1-9.
- 5
6 Roberts, N. and Grover, V. (2012), "Investigating firm's customer agility and firm
7 performance: the importance of aligning sense and respond capabilities", *Journal of*
8 *Business Research*, Vol. 65 No. 5, pp. 579-585.
- 9
10 Rojo, A., Llorens-Montes, J. and Perez-Arostegui, M. N. (2016), "The impact of
11 ambidexterity on supply chain flexibility fit", *Supply Chain Management: An*
12 *International Journal*, Vol. 21 No. 4, pp. 433-452.
- 13
14 Ryan, J. C. and Tipu, S. A. (2013), "Leadership effects on innovation propensity: a two-factor
15 full range leadership model", *Journal of Business Research*, Vol. 66 No. 10, pp. 2116-
16 2129.
- 17
18 Schilke, O. (2014), "On the contingent value of dynamic capabilities for competitive
19 advantage: the nonlinear moderating effect of environmental dynamism", *Strategic*
20 *Management Journal*, Vol. 35 No. 2, pp. 179-203.
- 21
22 Schminke, M. (2004), "From the editors raising the bamboo curtain", *Academy of*
23 *Management Journal*, Vol. 47 No. 3, pp. 310-314.
- 24
25 Schoenherr, T. and Swink, M. (2015), "The roles of supply chain intelligence and
26 adaptability in new product launch success", *Decision Sciences*, Vol. 46 No. 5, pp.
27 901-936.
- 28
29 Sezen, B. (2008), "Relative effects of design, integration and information sharing on supply
30 chain performance", *Supply Chain Management: An International Journal*, Vol. 13
31 No. 3, pp. 233-240.
- 32
33 Skinner, W. (1969), "Manufacturing-missing link in corporate strategy", *Harvard Business*
34 *Review. Boston*, Vol. May-June, pp. 136-145.
- 35
36 Skinner, W. (1985), *Manufacturing, the Formidable Competitive Weapon: The Formidable*
37 *Competitive Weapon*, John Wiley & Sons Inc.
- 38
39 Stevenson, M. and Spring, M. (2007), "Flexibility from a supply chain perspective: definition
40 and review", *International Journal of Operations & Production Management*, Vol. 27
41 No. 7, pp. 685-713.
- 42
43 Swafford, P. M., Ghosh, S. and Murthy, N. (2006), "The antecedents of supply chain agility
44 of a firm: scale development and model testing", *Journal of Operations Management*,
45 Vol. 24 No. 2, pp. 170-188.
- 46
47 Tamayo-Torres, J., Roehrich, J. K. and Lewis, M. A. (2017), "Ambidexterity, performance
48 and environmental dynamism", *International Journal of Operations & Production*
49 *Management*, Vol. 37 No. 3, pp. 282-299.
- 50
51 Teece, D., Peteraf, M. and Leih, S. (2016), "Dynamic capabilities and organizational agility",
52 *California Management Review*, Vol. 58 No. 4, pp. 13-35.
- 53
54 Teece, D. J. (2007), "Explicating dynamic capabilities: the nature and microfoundations of
55 (sustainable) enterprise performance", *Strategic Management Journal*, Vol. 28 No.
56 13, pp. 1319-1350.
- 57
58 Teece, D. J. (2014), "The foundations of enterprise performance: dynamic and ordinary
59 capabilities in an (economic) theory of firms", *The Academy of Management*
60 *Perspectives*, Vol. 28 No. 4, pp. 328-352.

- 1
2
3 Tippins, M. J. and Sohi, R. S. (2003), "IT competency and firm performance: is
4 organizational learning a missing link?", *Strategic Management Journal*, Vol. 24 No.
5 8, pp. 745-761.
- 6
7 Tse, Y. K., Zhang, M., Akhtar, P. and MacBryde, J. (2016), "Embracing supply chain agility:
8 an investigation in the electronics industry", *Supply Chain Management: An
9 International Journal*, Vol. 21 No. 1, pp. 140-156.
- 10
11 Tushman, M. L. and O'Reilly III, C. A. (1996), "Ambidextrous organizations: Managing
12 evolutionary and revolutionary change", *California Management Review*, Vol. 38 No.
13 4, pp. 8-29.
- 14
15 Weber, Y. and Tarba, S. Y. (2014), "Strategic agility: A state of the art", *California
16 Management Review*, Vol. 56 No. 3, pp. 5-12.
- 17
18 Whitten, D., Green Jr, K. W. and Zelbst, P. J. (2012), "Triple-A supply chain performance",
19 *International Journal of Operations & Production Management*, Vol. 32 No. 1, pp.
20 28-48.
- 21
22 Wilden, R., Devinney, T. M. and Dowling, G. R. (2016), "The architecture of dynamic
23 capability research identifying the building blocks of a configurational approach", *The
24 Academy of Management Annals*, Vol. 10 No. 1, pp. 997-1076.
- 25
26 Witcher, B. J., Chau, V. S. and Harding, P. (2008), "Dynamic capabilities: top executive
27 audits and hoshin kanri at Nissan South Africa", *International Journal of Operations
28 & Production Management*, Vol. 28 No. 6, pp. 540-561.
- 29
30 World Bank (2017), "Pakistan to record highest growth rate in nine years", Islamabad, World
31 Bank.
- 32
33 Wu, K.-J., Tseng, M.-L., Chiu, A. S. and Lim, M. K. (2017), "Achieving competitive
34 advantage through supply chain agility under uncertainty: A novel multi-criteria
35 decision-making structure", *International Journal of Production Economics*, Vol.
36 190, pp. 96-107.
- 37
38 Yang, J. (2014), "Supply chain agility: Securing performance for Chinese manufacturers",
39 *International Journal of Production Economics*, Vol. 150, pp. 104-113.
- 40
41 Yusuf, Y. Y., Sarhadi, M. and Gunasekaran, A. (1999), "Agile manufacturing:: The drivers,
42 concepts and attributes", *International Journal of Production Economics*, Vol. 62 No.
43 1-2, pp. 33-43.
- 44
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Figure 1: Research Model

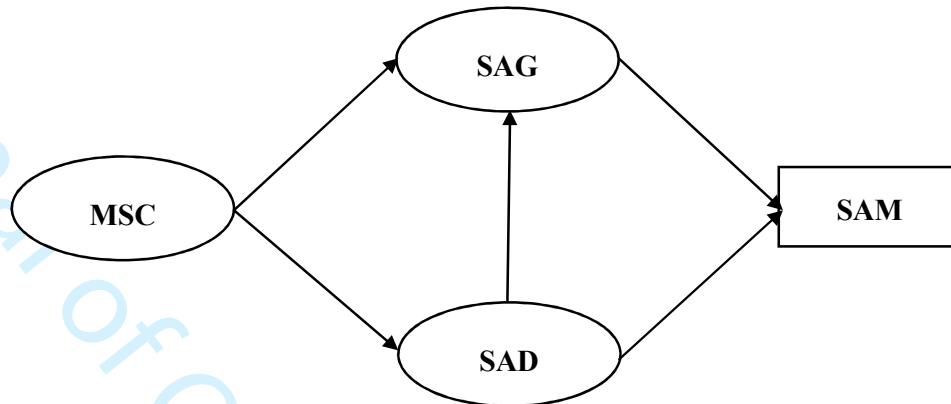


Figure 2: Research Findings

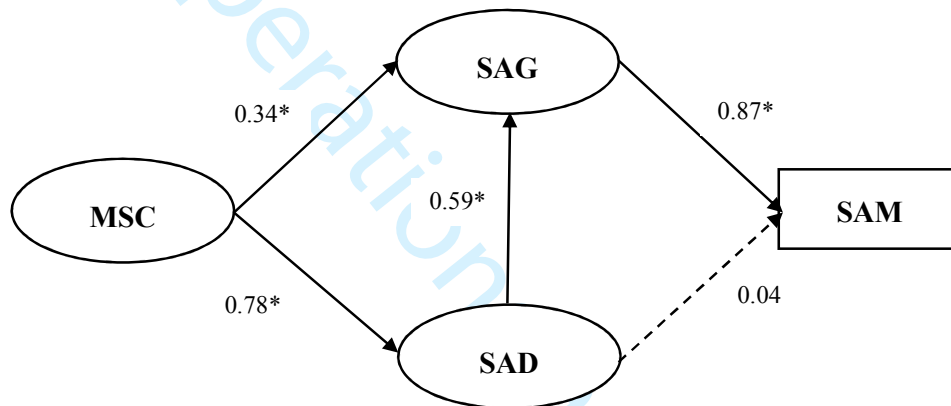


Table 1: Industries Represented in the Sample

Industry	Frequency	Percent
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 to 10 years	49	17.7
11 to 20 years	58	20.9
More than 20 years	126	45.5
Sales (In Pak Rupees)		
Less than 10m	6	2.2
10m to 50m	34	12.3
51m to 100m	29	10.5
101m to 200m	21	7.6
Greater than 200m	87	31.4
Not provided	100	36.1

Table 2: Respondent Profile

Designation	Frequency	Percent
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 to 5 years	63	22.7
6 to 10 years	79	28.5
11 to 20 years	78	28.2

Greater than 20 years	16	5.8
Not provided	32	11.6

Table 3: Measurement Model Validation-Reliability and Convergent Validity

Indicator (<i>Cronbach's alpha, Average variance extracted</i>)	Standardised coefficients
<i>Market Sensing Capability</i> ($\alpha=0.86, AVE=0.56$)	
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
<i>Supply Chain Agility</i> ($\alpha=0.84, AVE=0.57$)	
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
<i>Supply Chain Adaptability</i> ($\alpha=0.77, AVE=0.57$)	
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
<i>Supply Chain Efficiency</i> ($\alpha=0.77, AVE=0.53$)	
Total cost of resources used	0.728
Total cost of distribution, including transportation and handling costs	0.678
Total cost of manufacturing, including labor, maintenance and re-work costs	0.780
<i>Supply Chain Responsiveness</i> ($\alpha=0.87, AVE=0.69$)	
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 4: Correlations, Means, and Standard Deviations

	Mean	Standard Deviation	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

** Correlation is significant at the 0.01 level (2-tailed).

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The square root of the AVE is depicted on the diagonal in bold.

RESPONSE SHEET

Ms. Ref. No.: ID IJOPM-09-2017-0555

International Journal of Production & Operations Management

Dear Editor,

Many thanks for considering our manuscript and giving us an opportunity to undertake the requested revisions. We have undertaken extensive revision in the line of the valuable inputs of from the reviewers in order to improve the readability and enhance the value further. We have colored the changes made throughout the document in blue.

In addition to the requested changes from the reviewers, we also made the following changes to improve the readability of the manuscript, but also to make it more likely that the work is cited well. Here a quick summary of the additional changes:

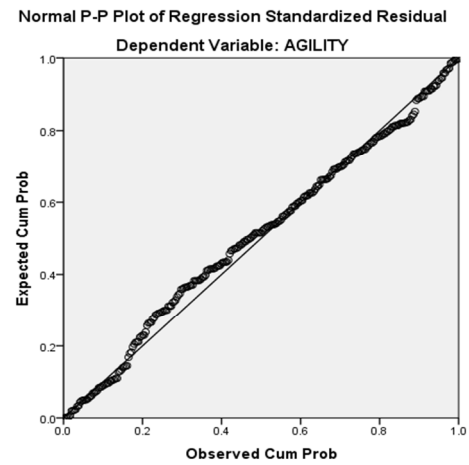
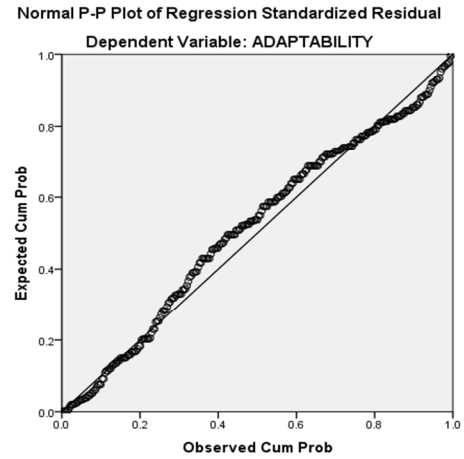
- Slightly rephrased title which reads now as follows: Dynamic Supply Chain Capabilities: how market sensing, supply chain agility and adaptability affect supply chain ambidexterity
- We cleaned up the introduction section to provide a better theoretical underpinning for our argument, and to nest our argument in the relevant management and operations management literature (as asked for by both reviewers).
- We have combined the Literature review and hypothetical model sections into one (section 2) to better build up the hypotheses (as asked for by reviewer 1), but also to deal with the word count as we identified some small overlaps in the original sections.
- We have removed the large amount of acronyms (SAD, SAM, MSC, SCA, DC, DCV) from the original manuscript, because we found these might confuse the reader (these terms are not introduced now until the research design section).
- We have edited the paper for clarity and sentence structure.

Reviewers Comments

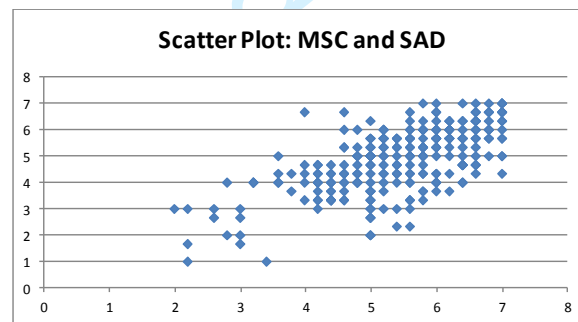
REVIEWER 1		
	Comment	Response
1	<p>An interesting empirical paper on agility, ambidexterity and dynamic capabilities.</p> <p>This paper aims to empirically test the ambidexterity concept and dynamic capabilities in the context of Pakistani supply chains. There are not too many papers working empirically with the agility, adaptability and ambidexterity, which justifies the topic.</p> <p>The method is based on theory and</p>	<p>Thank you kindly for your considerate comments – we trust that the revisions made to the paper will address all of your initial concerns.</p>

	<p>constructs are linked in SEM method. Five hypotheses are all clearly stated and linked to literature.</p>	
2	<p>Sampling procedure is a bit unclear, but at least the authors admit the challenges in this part. Response rate is appropriate for email survey considering the comparison to local business structure.</p>	<p>We appreciate this comment, but as you rightly highlight the sampling is difficult in markets like Pakistan. Nevertheless we made an effort to provide further detail in this section.</p>
3	<p>The literature section should be extended to cover more literature in the field of agile manufacturing, flexibility, responsiveness etc. There are case studies and surveys which have been done earlier.</p>	<p>The introduction section of the paper has been completely re-written to better support our argument that supply chains can be ambidextrous when supported by the dynamic supply chain capabilities of market sensing, supply chain agility and supply chain adaptability. We have gone to great efforts to acknowledge the range of literature on exploitation/exploration (March, 1991), operational trade-offs (De Meyer et al. 1987; Kannan 1998; Grant 1991; Hill 1993; Hayes and Wheelwright 1984; Skinner 1969, 1985); efficient versus differentiated value chains (Porter, 1980; 1985; Markides, 2006) as well as efficient versus responsive supply chains (Fisher, 1997).</p> <p>Moreover, we have combined the literature review and hypothetical model sections to provide a better theoretical base as well as literature support for each of the hypotheses. This section is now much more in-depth, acknowledging the literature on organisational ambidexterity (Adler, Goldoftas, and Levine 1999; Duncan 1976; Gibson and Birkinshaw 2004; Tushman and O'Reilly 1996), operational ambidexterity (Kortmann et al., 2014; Patel et al., 2012; Tamayo-Torres et al., 2017b) and the emerging body of literature around supply chain ambidexterity (Blome et al., 2013a; Im and Rai, 2008; Kristal et al., 2010; Lee and Rha, 2016; Rojo et al., 2016).</p> <p>As the body of literature in the field of agility, flexibility etc. is very broad we included some further citations from these fields including overview articles (e.g. Stevensen and Spring, 2007), but a full review of these literature streams is difficult, given the focus of the manuscript and the word count limitations.</p>
4	<p>The use of structural equation model is described very briefly and this part should be extended. A reader would like to know more about the linearity/non-linearity of the models and maybe some plots. Further details on this part would improve the</p>	<p>We appreciate your comment. All relevant information is provided in section 4. We decided that we won't include the plots in the original manuscript also due to space limitations, but paste them for your information here. In short, all basic assumptions were met.</p>

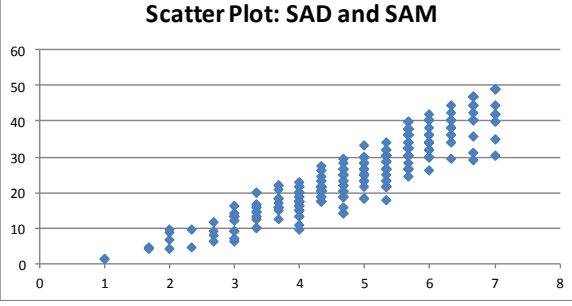
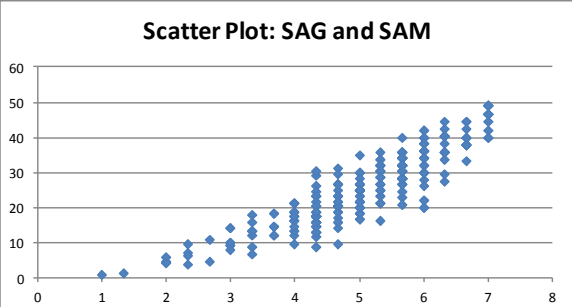
handling of the results.



In addition several scatter plots:



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5	<p>The discussion part is rather short and repeating the earlier parts of the paper. This part could link to managerial implications as well as contribution to theory. Overall the paper is clear and well written.</p>	<p>We agree that the discussion section of the original manuscript was too short and tended to repeat the earlier findings. We have now split the discussion section into a “Discussion” section and a “Contribution, limitations and future research directions” section—to make it clearer to the reader exactly how the paper contributes to theory and managerial practice.</p> <p>Section 5 now spends more time relating the findings back to the relevant literature and explains how we have addressed certain literature gaps with our findings. For example, in Section 4 we explain that 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 dynamic capabilities should have a positive relationship with performance outcomes, Pezeshkan et al. (2016) suggest that empirical evidence regarding this relationship is mixed, at best. In this section, we explain to the reader that 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. Supply chain agility allows firm’s to seize opportunities in the marketplace by providing a short-term and flexible 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</p>	

		<p>adaptability are only necessary if supply chain managers are able to sense market opportunities and threats in the first place. We go on to show how this dynamic supply chain capability cluster positively influences supply chain ambidexterity and allows firms to simultaneously achieve a flexible and efficient supply chain for one particular product.</p> <p>Moreover, we explain in the contribution to theory section that the paper introduces a new way of measuring supply chain ambidexterity by including traditional measures of responsiveness and efficiency, and combining them in a multiplicative way in-line with prior research in the area (see Gibson & Birkinshaw, 2004; Hill & Birkinshaw, 2014; Tushman, et al., 2010). 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.</p>
	REVIEWER 2	
1	<p>This is an interesting paper, in an area that is receiving increasing attention (supply chain ambidexterity). However, the paper needs to make much more clear its main contributions to theory in order to justify publication.</p>	<p>Thank you kindly for your comments. We agree that the original manuscript did not clearly state the contribution to theory. In light of your observations, we have completely rewritten the paper and spent significantly more time building up the theoretical base of our argument and nesting this argument in the existing management, and operations management literature.</p> <p>We now explain in the Contribution section (section 6) that our primary theoretical contribution is that 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. Supply chain agility allows firm's to seize opportunities in the marketplace by providing a short-term and flexible 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. We go on to show how this dynamic supply chain capability cluster positively influences supply chain</p>

		<p>ambidexterity and allows firms to simultaneously achieve a flexible and efficient supply chain for a one particular product.</p> <p>Moreover, we explain in the contribution to theory section that the paper introduces a new way of measuring supply chain ambidexterity, including traditional measures of responsiveness and efficiency, and combining them in a multiplicative way in-line with prior research in the area (see Gibson & Birkinshaw, 2004; Hill & Birkinshaw, 2014; Tushman, et al., 2010). 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.</p>
2	<p>The article does demonstrate adequate understanding of relevant literature. A stronger motivation for its main focus on supply chain ambidexterity (and a more thorough review of extant management theory on the topic) would, however, add significant value to the paper. This also applies to measurement scales previously used in relation to this concept.</p> <p>Associations between 'ambidexterity' and Fisher's (1997) trade-offs between efficiency and responsiveness should also be more carefully made, in light of the fact that an organisation could, for example, have a line of products that compete on cost, while others on 'responsiveness'. This could simply equate to having a wide portfolio of products managed through separate supply pipelines (some entirely focused on efficiency while others emphasising responsiveness).</p>	<p>We agree that the original manuscript did not adequately justify its primary focus on supply chain ambidexterity, nor did it support its arguments with a thorough review of management theory on the topic. In light of your comments, we have completely re-written the introduction and literature review/hypothetical model sections to address this important point.</p> <p>In the first instance, we have gone to great efforts to acknowledge the range of management literature on exploitation/exploration (March, 1991), operational trade-offs (De Meyer et al. 1987; Kannan 1998; Grant 1991; Hill 1993; Hayes and Wheelwright 1984; Skinner 1969, 1985); efficient versus differentiated value chains (Porter, 1980; 1985; Markides, 2006) as well as efficient versus responsive supply chains (Fisher, 1997).</p> <p>On page 3 of the introduction, we clarify that the notion of supply chain ambidexterity runs counter to those authors 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; Porter, 1980;1985). Instead, supply chain ambidexterity means</p>

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60</p>	<p>The paper should also better justify why 'market sensing' is used as a separate construct to 'supply chain agility', when previous research (even the early works of M. Christopher) already view it as an agile capability.</p> <p>Similar comments apply to the way the other constructs are developed. More clarity as to how the market sensing capability (which includes 'learning about customer needs and requirements') can be distinguished from 'evaluating ultimate customer needs' (adaptability) or 'spotting new supply bases and markets' (why combine supply and demand capabilities in one construct re: adaptability?).</p>	<p>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).</p> <p>Our argument is underpinned by positioning market sensing, supply chain agility and supply chain adaptability as a cluster of dynamic supply chain capabilities that allow firms to provide a short term flexible response to customer demand and to restructure the supply chain to achieve efficiencies over the longer-term when adjusting to market changes. Moreover, we have combined the literature review and hypothetical model sections to provide a better theoretical base and literature support for each of the hypotheses. This section is now much more in-depth acknowledging the literature on organisational ambidexterity (Adler, Goldoftas, and Levine 1999; Duncan 1976; Gibson and Birkinshaw 2004; Tushman and O'Reilly 1996), operational ambidexterity (Kortmann et al., 2014; Patel et al., 2012; Tamayo-Torres et al., 2017b) and the emerging body of literature around supply chain ambidexterity (Blome et al., 2013a; Im and Rai, 2008; Kristal et al., 2010; Lee and Rha, 2016; Rojo et al., 2016). We also spend more time in the Literature Review/Hypothetical model section positioning market sensing, supply chain agility and adaptability as distinct constructs.</p> <p>While we concede that some detailed conceptualizations of Agility have incorporated market sensing, we contend that this is by no means universal. First strategic management literature positions Sensing and Seizing capabilities as being distinct from one another (Helfat & Peteraf, 2009; Teece, 2007, 2014). Second, consider the following definitions from major studies in the area of agility:</p> <ol style="list-style-type: none"> 1) <i>"Respond to short-term changes in demand or supply quickly; handle external disruptions smoothly". (Lee, 2004, p. 4)</i> 2) <i>"Capability of an organization to adapt or react to marketplace changes or to seize/exploit market opportunities with speed and quickness" (Swafford, et al., 2006, p. 172)</i> 3) <i>"The capability of the firm, internally, and in</i>
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conjunction with its key suppliers and customers, to adapt or respond in a speedy manner to a changing marketplace, contributing to agility of the extended supply chain.” (Braunscheidel & Suresh, 2009, p. 126)

All three studies operationalize supply chain agility but do not consider market sensing as a component of agility. Specifically, Swafford et al. (2006) and Braunscheidel and Suresh (2009) are empirical studies that have developed measures for supply chain agility. Braunscheidel and Suresh (2009) use probably the most detailed operationalization of agility considering it as a scale consisting of multiple constructs. Yet none of the four components of agility in their study includes the meaning of market sensing. Furthermore, Handfield, et al. (2015) measure supplier agility as, “responsiveness to schedule delivery changes without excessive cost penalties, responsiveness to schedule volume changes without excessive cost penalties; ability to accept late “mix” changes in orders; modularization of supplier products”. Other studies which treat agility and sensing as discrete constructs include Um, et al.(2017), Dubey, et al. (2018), Tse, et al. (2016), Blome, et al. (2013), and Yang (2014) to name a few.

So although Gligor, et al. (2015) (and conceptual work of Dr. Christopher) have understood supply chain agility to include sensing capability, this ideology is not shared by some major empirical studies in the area. The empirical justification from our study is that Supply Chain Agility and Market Sensing appeared as distinct factors with acceptable levels of discriminant validity.

With regards to supply chain supply chain agility, we position it as a *seizing* capability based on a commonly cited definition from Swafford, et al.(2006): *Capability of an organization to adapt or react to marketplace changes or to seize/exploit market opportunities with speed and quickness* (p. 172). Similarly a justification for using supply chain agility as a seizing capability can also be found in Lee and Rha (2016).

Finally, the Supply Chain Adaptability construct is based on Dr. Lee’s arguments (Lee, 2004). These arguments are

		<p>mirrored in Dubey, et al. (2018) and Whitten, et al. (2012). Schoenherr & Swink (2015) develop an independent construct of supply chain adaptability. All these studies combine supply and demand side capabilities in the supply chain adaptability construct.</p> <p>We concede that the evaluation of customer needs is an area of overlap between market-sensing and supply chain adaptability as far as the immediate customer is concerned. However, supply chain adaptability refers to “<i>knowing ultimate customer needs</i>” and adjusting the resource base and supply chain structure to address these needs over the long-term. A concept which we capture in our measure of supply chain adaptability (See section 3).</p>
3	<p>The section would benefit from a stronger justification of the choice of research design employed. As it stands, it only states that 'survey research was relevant due to the theory-testing nature of the study'). Better justification of the choice of measures, particularly to avoid confusion between the constructs used, should be provided.</p> <p>It is also unclear how the authors emphasised the 'short term' vs 'long term' choice of strategies in their survey design (as mentioned in Section 5).</p>	<p>Justification for survey research has been added in the beginning of the methods section.</p> <p>Supply chain agility encapsulates a firm’s short-term response to market changes - a conceptualization which is considered in our validated variables for supply chain agility: <i>adapting services and/or products to new customer requirements quickly; reacting to new market developments quickly; reacting to significant increases and decreases in demand quickly; adjusting product portfolio as per market requirement</i>. All these deal with the quick (short-term) response to the market changes.</p> <p>Contrast this with our validated variables for supply chain adaptability: <i>spotting new supply bases and markets all over the world; evaluating ultimate consumer’s needs; determining the standing of company’s products in terms of technology cycles and product life cycles</i>. As evident from the above items, supply chain adaptability deals with the long-term changes (in supply chain design). Our discussion on short-term changes and long-term changes is based on these differences.</p>
4	<p>Section 5 should include clearer sections on theoretical implications / managerial implications and a stronger</p>	<p>We have now split the discussion section into a Discussion section and a “Contribution, limitations and future research directions” section to make it clearer to the reader exactly how the paper contributes to theory and managerial</p>

	set of conclusions.	practice. The discussion section now spends more time relating the findings back to the relevant literature and explains how we have addressed certain literature gaps with our findings. The contribution section now clearly outlines the study's contribution to theory and managerial practice –as explained in the comments above.
5	The paper is generally well written.	Thank you kindly for the comment, we trust the revised version of the paper is now clearly written and address all of your initial concerns.

References

- Blome, C., Schoenherr, T., & Rexhausen, D. (2013). Antecedents and enablers of supply chain agility and its effect on performance: a dynamic capabilities perspective. *International Journal of Production Research*, 51(4), 1295-1318.
- Braunscheidel, M. J., & Suresh, N. C. (2009). The organizational antecedents of a firm's supply chain agility for risk mitigation and response. *Journal of Operations Management*, 27(2), 119-140.
- Dubey, R., Nezih, A., Angappa, G., Constantin, B., Thanos, P., & J., C. S. (2018). Supply chain agility, adaptability and alignment: Empirical evidence from the Indian auto components industry. *International Journal of Operations & Production Management*, 38(1), 129-148.
- Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal*, 47(2), 209-226.
- Gligor, D. M., Esmark, C. L., & Holcomb, M. C. (2015). Performance outcomes of supply chain agility: When should you be agile? *Journal of Operations Management*, 33(1), 71-82.
- Handfield, R. B., Cousins, P. D., Lawson, B., & Petersen, K. J. (2015). How can supply management really improve performance? A knowledge-based model of alignment capabilities. *Journal of Supply Chain Management*, 51(3), 3-17.
- Helfat, C., & Peteraf, M. (2009). Understanding dynamic capabilities: progress along a developmental path. *Strategic organization*, 7(1), 91.
- Hill, S. A., & Birkinshaw, J. (2014). Ambidexterity and survival in corporate venture units. *Journal of Management*, 40(7), 1899-1931.
- Lee, H. L. (2004). The triple-A supply chain. *Harvard Business Review*, 82(10), 102-113.
- Lee, S. M., & Rha, J. S. (2016). Ambidextrous supply chain as a dynamic capability: building a resilient supply chain. *Management Decision*, 54(1), 2-23.
- Pezeshkan, A., Fainshmidt, S., Nair, A., Frazier, M. L., & Markowski, E. (2016). An empirical assessment of the dynamic capabilities–performance relationship. *Journal of Business Research*, 69(8), 2950-2956.
- Schoenherr, T., & Swink, M. (2015). The roles of supply chain intelligence and adaptability in new product launch success. *Decision Sciences*, 46(5), 901-936.
- Swafford, P. M., Ghosh, S., & Murthy, N. (2006). The antecedents of supply chain agility of a firm: scale development and model testing. *Journal of Operations Management*, 24(2), 170-188.

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3 Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable)
4 enterprise performance. *Strategic Management Journal*, 28(13), 1319-1350.
- 5 Teece, D. J. (2014). The foundations of enterprise performance: dynamic and ordinary capabilities in an
6 (economic) theory of firms. *The Academy of Management Perspectives*, 28(4), 328-352.
- 7 Tse, Y. K., Zhang, M., Akhtar, P., & MacBryde, J. (2016). Embracing supply chain agility: an investigation
8 in the electronics industry. *Supply Chain Management: An International Journal*, 21(1), 140-156.
- 9 Tushman, M., Smith, W. K., Wood, R. C., Westerman, G., & O'Reilly, C. (2010). Organizational designs
10 and innovation streams. *Industrial and Corporate Change*, 19(5), 1331-1366.
- 11 Um, J., Lyons, A., Lam, H. K., Cheng, T., & Dominguez-Pery, C. (2017). Product variety management and
12 supply chain performance: A capability perspective on their relationships and competitiveness
13 implications. *International Journal of Production Economics*, 187, 15-26.
- 14 Whitten, D., Green Jr, K. W., & Zelbst, P. J. (2012). Triple-A supply chain performance. *International*
15 *Journal of Operations & Production Management*, 32(1), 28-48.
- 16 Wilden, R., Devinney, T. M., & Dowling, G. R. (2016). The architecture of dynamic capability research
17 identifying the building blocks of a configurational approach. *The Academy of Management*
18 *Annals*, 10(1), 997-1076.
- 19 Yang, J. (2014). Supply chain agility: Securing performance for Chinese manufacturers. *International*
20 *Journal of Production Economics*, 150, 104-113.
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