

Dynamic Capabilities and Performance: A Supply Chain Perspective

Haris Aslam
Department of Operations and Supply Chain,
University of Management and Technology, Lahore, Pakistan
Email: haris.aslam@umt.edu.pk

Tashfeen M. Azhar
Department of Operations and Supply Chain,
University of Management and Technology, Lahore, Pakistan
Email: tashfeen@umt.edu.pk

Abstract

Ever changing market environment in terms of technology and competitive situation requires firms to continuously reconfigure their resource configurations. Based on the dynamic capabilities view of the firm, we propose the dynamic capabilities relevant in the context of supply chains. We conceptualize dynamic capabilities of a firm as consisting of multiple levels. Capabilities at the highest level affect the formation of first order dynamic supply chain capabilities. Furthermore, first order capabilities modify the operational capabilities. We propose constructs for second and first order dynamic supply chain capabilities. Performance implications of dynamic supply chain capabilities have also been empirically tested based on data from 275 managers from Pakistani manufacturing industry. The results show a support for the assertions by dynamic capability theorists.

Keywords: dynamic supply chain capabilities, dynamic capabilities, operational capabilities, supply chain performance, structural equation modelling.

1. Introduction

Resource based view (RBV) has been a dominant paradigm in strategy literature over three decades for explaining the sources of competitive advantage. It suggests that firm is a bundle of resources that is governed by managerial decision making (Penrose, 1959). According to RBV, firm's growth is a result of a strategy that counterbalances the exploitation of current resources with the exploration of new ones (Wernerfelt, 1984). However, not all resources are created equal. Only the resources that are valuable, rare, inimitable and non-substitutable (VRIN) can lead to competitive advantage (Barney, 1991). These VRIN resources can also exist in intangible form such as firm processes, managerial skills, routines, and knowledge (Barney, Wright, & Ketchen, 2001). Given the fact that firms are not endowed with similar (or same) resources at one point in time (Wernerfelt, 1995), it follows that superiority in firms resources could lead to sustainable competitive advantage. RBV thus explains differences amongst the competitive positions of the firms that are lasting and cannot be explicated by industry differences (Barney, 2001; Peteraf, 1993).

RBV has received strong criticism on the basis of its assumption about static nature of product market (Lengnick-Hall & Wolff, 1999; Eisenhardt & Martin, 2000; Teece et al., 1997; Priem & Butler, 2001). Furthermore, a resource in it of itself is not valuable; its value lies in performing activities in such a way that lead to market edge. This value can be taken away by changing technology, customer needs, and competitive situation (Porter, 1991). Increased globalization, technological change, and resulting rapidly changing markets in recent times have made it very difficult for the firms to sustain their superior competitive positions. Competing successfully in these markets requires firms to demonstrate responsiveness and product innovation while using their internal and external competencies optimally. This requires firms to demonstrate dynamic capabilities (DCs) (Teece et al., 1997). Dynamic capabilities view (DCV) is an extension of RBV and explains how firms achieve sustainable competitive advantage (Teece, 2007; Teece et al., 1997). It has become one of the most important views in the strategic management literature in recent times (Schilke, 2014b). DCs help firms detect changes in the markets and recognize market opportunities. DCs also help capitalizing on these market opportunities through deployment and redeployment of firm resources (Teece et al., 1997). DCV answers the question about how VRIN resources are formed and the current resources upgraded in dynamic environments (Ambrosini & Bowman, 2009). DCs create differences in competitive positions of firms in the same industries and cannot usually be equated across firms since these are formed by the idiosyncratic organizational processes, based on organizations' history and people (Teece, 2014b).

DCV has also been employed in the area of supply chain to understand the competitive advantage. This area however is considerably less explored. Defee & Fugate (2010) pointed out that important opportunities for explaining competitive advantage are missed when only firm level capabilities are considered. Important capabilities can be formed through joint planning and execution of supply chain partners. Recent studies have shown that supply chain related DCs or dynamic supply chain capabilities (DSCCs) have a positive impact on operational performance (Eckstein et al., 2015; Fawcett et al., 2011), cost performance (Eckstein et al., 2015), profitability, growth, customer satisfaction (Fawcett et al., 2011; Allred et al., 2011).

In this research, we study the antecedents and consequences of DSCCs. Previous research has indicated that empirical evidence on DCs-performance relationship is not conclusive (Pezeshkan et al., 2016). Therefore more research is required in this area. Also, how DCs are purposely built and how they influence the firm performance still requires more research (Ambrosini & Bowman, 2009). We further investigate whether the relationship between DSCCs and supply chain performance (SCP) is direct or it is mediated by operational capabilities (OCs) as suggested by many researchers (Peteraf et al., 2013; Protogerou et al., 2012; Zahra et al., 2006). Previous research has indicated that capabilities of the firm exist at various levels (Collis, 1994; Winter, 2003; Zahra et al., 2006). The need has also been identified for describing new DCs relevant to supply chains (Beske et al., 2014). In this respect, we propose supply chain related operational and dynamic capabilities that operate at various levels of capability hierarchy.

We study the antecedents and consequences of dynamic supply chain capabilities based on a survey from 275 Pakistani managers working in manufacturing firms. The results provide a general support for the research model. We contribute to the literature by proposing new constructs for dynamic capabilities suitable for supply chain environment. Furthermore, we provide empirical evidence for the fact that capabilities exist at various levels and higher-order capabilities modify the capabilities at the next level. This also provides a direction to managers working in the supply chain area as to which capabilities are relevant for day to day operations (i.e. operational capabilities) and which ones for long-term competitive advantage (i.e. dynamic capabilities). Furthermore, our study suggests that road to building dynamic supply chain capabilities starts from building higher-order capabilities.

This paper is organized in the following manner. Next section reviews the literature relevant to the study and provides research hypotheses. Section 3 discusses the research methods. Section 4 provides the results of the study. Discussion of results and conclusion of the study is provided in the last section.

2. Theory and Hypotheses

2.1 *Dynamic Capabilities View of the Firm*

A dynamic capability is “the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece et al., 1997). DCs are formed when teams and individuals use their skills and knowledge to obtain, combine and transform resources available with the firm (Morgan, 2012). Teece (2014b) emphasized that long term success of a firm is dependent upon good strategy, possession of (or access to) VRIN resources and strong DCs. DCs allow the firm to deploy resources, a capacity that usually requires both explicit and tacit elements and hence is not transferable easily (Wang & Ahmed, 2007).

A body of knowledge has developed that points out “not all capabilities are created equal”. Helfat (2007) reasoned that DCs are a part of the resource base of an organization. At the same time these are used to “create, modify, or extend” the organizational resources. It follows that DCs can also “create, modify, or extend” other DCs. It is evident that DCs operate at various levels. For example Collis (1994) identified four distinct levels of capabilities, while Schilke (2014b) classified the DCs as first order and second order DCs. Others classify the levels of capabilities as; the ordinary (Teece, 2014b) zero level, operational (Winter, 2003; Wu et al., 2010; Zollo & Winter, 2002) or substantive (Ali et al., 2012; Zahra et al., 2006) and first order capabilities (Winter, 2003) or dynamic capabilities (Teece, 2014b; Zahra et al., 2006). Here higher level (dynamic) capabilities operate to modify the ordinary or operational capabilities (OCs) according to the market needs.

DCs have also been studied from the perspective of supply chains (Allred et al., 2011; Eckstein et al., 2015; Blome et al., 2013; Fawcett et al., 2011). A number of empirical studies have been conducted to study the influence of DCs on various indicators of supply chain performance. Allred, et al. (2011) for example studied the role of collaboration (both internal and external) in organizational performance. The results of their mixed method

study showed that collaboration mediated the relationship between customer/supplier orientation and organizational performance. Chiang et al. (2012) considered supply chain agility as a DC. Based on a survey they showed that strategic sourcing and strategic flexibility are key contributors towards supply chain agility. In another study, Eckstein, et al. (2015) showed that supply chain agility and adaptability have a significant impact on firm's cost and operational performance. Working in the area of sustainable supply chain management (SSCM), Mathivathanan et al. (2017) suggested that development of DCs through SSCM is important in order to deal with the future needs. Hong et al. (2018) studied the relationship between SSCM practices, DSCCs and various indicators of performance. Their results showed that DSCCs influence the firm's environmental performance. Furthermore, DSCCs also mediate the relationship between SSCM and enterprise performance.

2.2 Supply Chain Learning

Learning is an ever-present element of individual and organizational behavior. It occurs especially when; there is a systematic display of bounded rationality by individuals and task environment displays continuous change due to external environmental changes (technological) or internal (behavioral) changes through innovation (Dosi & Marengo, 2007). Sources of learning include experience, experience interpretation, and learning from other's experience (Levitt & March, 1988). Simon (1991) argued that the concept of organizational learning is metaphorical as learning in organizations can only take place in two ways; (1) by the learning of its members, or (2) by the joining of new members who bring knowledge from their previous organizations. However, there is a collective view of organization learning also. According to collective view, organizational learning occurs socially and is not reducible to individual members of the organization (Fiol & Lyles, 1985). Furthermore, knowledge acquired through learning processes is integrated into not only the members individually, but also within the routines and artefacts that shape individual and organizational behaviors (Dosi & Marengo, 2007).

Learning contributes to the development of signature processes that lead to firm's competitive advantage. These processes emerge through frequent communications between members of a supply chain (Teece, 2014a). Supply chain members form a value stream whose competitiveness relies on learning and development of the whole system instead of one or a few links in the chain (Bessant et al., 2003). Supply chain learning (SCL) refers to the degree to which firms indulge in joint learning process with supply chain partners (Flint et al., 2008). Learning contributes to the improvement of performance at firm level as well as supply chain level (Spekman et al., 2002). Previous research has shown that learning contributes to the development of DCs (Helfat et al., 2007; Sandberg & Åman, 2010). It helps in shaping and modifying capabilities to generate appropriate response to market changes (Huang et al., 2013; Morgan, 2012). We thus hypothesize that SCL will impact the successful development and deployment of DSCCs.

- **H₁:** SCL will positively impact DSCCs

2.3 *Dynamic Supply Chain Capabilities*

Optimization of current processes has very little influence on the success of modern firms. It is mostly affected by the ability of the firm to sense the market opportunities and capitalize on these opportunities. Market focused firms learn about their competitors, channel members, and customers, in order to understand current and prospective events. Stronger the market focus, stronger the capability to gather, interpret and use the market information (Day, 1994). After identifying a new potentially profitable opportunity, firms need to capitalize on it through the design of new products, services, or processes. This requires firms to reconfigure their technological assets and capabilities and then invest heavily in the designs and technologies when the time is right (Teece, 2007). From the supply chain perspective this requires the ability to not only handle the variation coming from the customer side but also the variation that is caused by the suppliers. It can be attained by continuous information sharing with supply chain partners about demand and supply, forging collaborative relationships with supply chain partners, postponement, keeping inventories of small items that can cause bottlenecks, building logistics systems that can respond quickly to unexpected events, and building teams that can make and execute contingency plans quickly (Lee, 2004).

A significant discussion regarding DCs is their affect on the performance. Early contributions in the area proposed a direct affect on performance (see for example Teece et al., 1997; Teece, 2007; Makadok, 2001). Teece, et al. (1997) articulated that competitive advantage is the outcome of “high-performance routines operating inside the firm”. Teece (2014b) reiterated this point by suggesting that the purpose of creating DCs framework was to guide academicians and practitioners about the basis of competitive advantage. Thus we suggest:

- **H₂:** DSCCs will positively impact SCP

2.4 *Operational Capabilities*

The idea of capabilities in the field of operations management has been adopted from the RBV in strategic management (Peng et al., 2008). Operational capability of the firm “is its capacity to purposefully bundle its resource base in ways that enable the organization to perform the ongoing task of transforming inputs into outputs” (Coltman & Devinney, 2013). OCs are required for problem solving as well as conducting day to day activities (Winter, 2003; Zahra et al., 2006). OCs comprise of both explicit elements such as firm resources and routines and tacit elements such as skills, leadership system, and know how (Flynn et al., 2010). OCs are fundamental to a firm’s existence and can be a source of competitive advantage for a long time especially from developing country perspective (Teece, 2014b).

OCs allow firms to perform routine activities. DCs on the other hand, modify OCs in pursuit of higher returns. DCs allow firms to configure and reconfigure internal and external resources to achieve and maintain competitiveness in dynamic markets. OCs in contrast are more efficiency focused. DCs allow firms to stay abreast of market and technology changes. OCs are relevant to the current competitiveness of the firms while DCs are relevant to the sustenance of this competitive position (Teece, 2014b).

A strong body of literature proposes an indirect relationship between DCs and performance. It suggests that OCs mediate the relationship between DCs and performance i.e. DCs modify OCs according to the market changes and OCs affect the firm performance positively. Zollo and Winter (2002) defined DCs as controlled sets of activities that form and adjust OCs. Zott (2003) also suggested an indirect relationship between DCs and performance through assets and operational routine modification. Zahra et al. (2006) also proposed an indirect relationship between DCs and performance through the modification of substantive (operational) capabilities. Eisenhardt & Martin (2000) articulated that DCs are necessary but not sufficient for competitive advantage. DCs though can be used to ammend resource configuration resulting in competitive advantage. We thus hypothesize for a mediating role of OCs between DSCCs-SCP relationship.

➤ **H₃:** OCs will positively mediate the relationship between DSCCs and SCP

3. Research Methods

We used survey method for data collection in order to test the hypotheses in this study. It was necessary because variables required to test the hypothesized model were not available from annual reports. Furthermore, research has shown a high correlation between objective and subjective measures of variables (Protogerou et al., 2012). We used established scales to construct the questionnaire for data collection taking the advice of Schminke's (2004) of using "other people's measures" where possible. Comprehensive literature review was performed to identify the relevant scales. We measured independent variables Likert-type seven-point scales with "1" indicating strongly disagree and "7" strongly agree. SCL orientation scales was adopted from Flint et al. (2008) and consisted of six items. Dynamic supply chain capabilities scale was a five-item scale adopted from Blome et al. (2013). Operational capabilities scale was a four-item scale adopted from Wu et al. (2010). Supply chain performance was measured using a four-item scale with 1 (= far worst than competitor) to 7 (= far better than competitor). It was adopted from Sezen (2008).

Business units of manufacturing firms in Pakistan were the population for this study. Survey in this study was conducted using self-administered questionnaires delivered through email as well as post. All surveys were accompanied by a cover letter briefly introducing the research and highlighting the importance of respondent's cooperation. Respondents were also offered the results report if they share their email addresses. There was no comprehensive frame for identifying manufacturing organizations in the country. Thus, an effort was made to capture the complete variety of observations possible (Hazelrigg, 2004). This was achieved by making the sample more representative of Pakistan's major industries such as Textile, FMCGs, Surgical Goods, Sports Goods, Pharmaceuticals etc. and ensuring that whole breadth of major industries is covered. The list of organizations to be included in the frame was constructed using various sources such as; supply chain alumni list, university alumni list, and list of manufacturing firms available with placement office at a private university in Lahore. Other sources included; list of managers available with quality and productivity society of Pakistan, yellow pages and websites of associations for the leading industries. Email addresses from all these sources

were combined and multiple waves of emails were sent between February and July 2016. Discounting the emails that remained undelivered, 3375 emails were sent. In all 275 usable responses were received after this effort. The respondent's industry profile is shown below:

Table 1: Sample Description

Industry	Frequency	%
Textile	69	25.1
FMCG	47	17.1
Surgical Instruments	25	9.1
Pharmaceutical	19	6.9
Packaging	16	5.8
Sports Goods	13	4.7
Auto and Parts Manufacturing	12	4.4
Chemical	11	4
Leather Garments	9	3.3
Electronics	8	2.9
Other	35	12.7
Not Provided	11	4
Total	275	100

3. Results

We performed the analysis of this study in two steps. First we performed measurement model evaluation. Next, hypotheses testing was performed. We used SPSS-AMOS v22 in both steps. Measurement model evaluation was performed through confirmatory factor analysis. Model evaluation criteria about validity was based on the guidelines provided by Hair et al. (2014) and Fornell & Larcker (1981). Results for the CFA are provided in Table 2 and 3. Convergent validity was established based on high factor loadings (i.e. averaging to about 0.7 on a construct) and average variance extracted (AVE) greater than 0.5. The discriminant validity was established by comparing square-root of AVE with bi-variate correlations of the constructs. The results are shown in Table 3. The square-roots of AVE are shown on the diagonals of the table in bold. As evident from the table, square-root of AVE for each construct was greater than associated bi-variate correlations. Hence, discriminant validity was established. Reliability was estimated using composite reliability measure for internal consistency. Table 2 provides the reliability measures. As evident from the table, all the reliability measures were well above the minimum threshold of 0.7, hence the scales had suitable reliability and validity. After establishing the validity and reliability of the scales we moved to hypotheses testing.

Table 2: Convergent Validity and Reliability

	Standardized Loadings	Mean	S. D	AVE	Composite Reliability
<i>Supply Chain Learning</i>		5.04	1.06	0.561	0.864
SCL1	0.847				
SCL2	0.677				
SCL3	0.753				
SCL5	0.666				
SCL6	0.745				
<i>Dynamic Supply Chain Capabilities</i>		5.01	1.02	0.541	0.854
DC1	0.735				
DC2	0.719				
DC3	0.744				
DC4	0.671				
DC5	0.668				
<i>Operational Capabilities</i>		4.8	1.16	0.577	0.845
OC1	0.755				
OC2	0.817				
OC3	0.776				
OC4	0.762				
<i>Supply Chain Performance</i>		4.96	1.03	0.534	0.774
SCE1	0.771				
SCE2	0.679				
SCE3	0.739				
Model Fit Statistics $CFI=0.969$, $NNFI=0.960$, $GFI=0.925$, $RMSEA=0.050$, $p<0.05$					

Table 3: Discriminant Validity

	SCL	DSCCs	OCs	SCP
SCL	0.749			
DSCCs	0.626	0.735		
OCs	0.506	0.641	0.759	
SCP	0.568	0.634	0.594	0.731

Figure 1 shows the structural model tested in the study with standardized estimates. Table 4 provides results in the tabular form. H₁ suggested a significant positive relationship between SCL and DSCCs. The results showed that this relationship was significant ($\beta=0.56, p<0.01$). In second hypothesis, we hypothesized a direct relationship between DSCCs and SCP. The results of the structural model showed that this relationship was also significant ($\beta=0.92, p<0.01$). Our last hypothesis related to the mediating role of OCs in the DSCCs-SCP relationship. In order to test this hypothesis, we used bootstrapping technique (Hayes, 2013) using 5000 bootstrap samples in AMOS (Gaskin, 2017). Results showed a significant but weak mediation affect ($\beta=0.18, p<0.10$). Discussion of these results is provided in the next section.

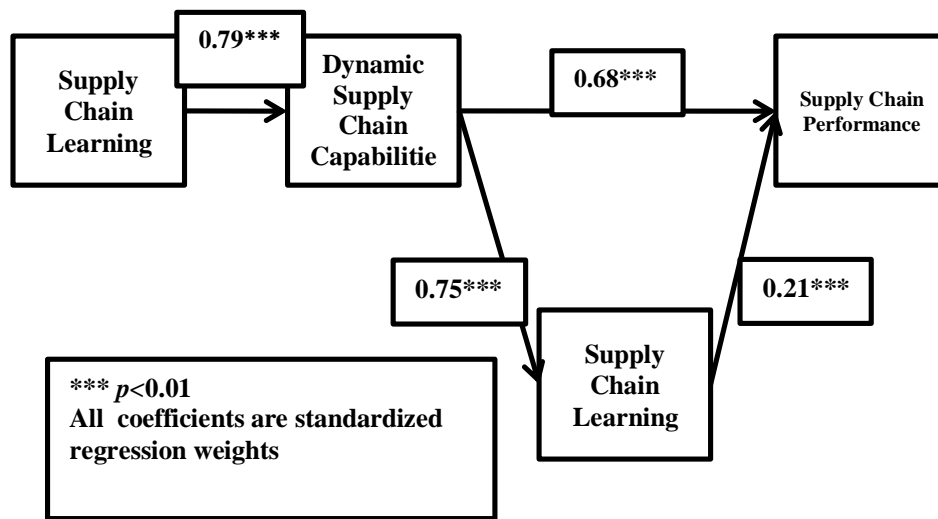


Figure 1: Structural Model

Table 4: Structural Model Results

			Estimate	Standard Error	t	P
DSCCs	<---	SCL	0.558	0.057	9.751	0.000
OCs	<---	DSCCs	0.919	0.105	8.747	0.000
SCP	<---	DSCCs	0.76	0.122	6.239	0.000
SCP	<---	OCs	0.191	0.084	2.276	0.023
*** $p < 0.01$						

4. Discussion and Conclusion

This study was conducted to empirically test the assertions of DC theorists who suggest that capabilities exist at various levels where capabilities at each higher-level modify or reconfigure the lower-order capabilities. Based on the results of this study we find support for these assertions. Furthermore, we set out to settle the debate about whether DCs-Performance relationship is direct or indirect. Results of our study show that even though support can be found for both types of relationships, the indirect relationship is considerably weaker than the direct relationship. These results thus support the contention of Teece (2007, 2014b) that DCs are imperative to building firms competitive advantage and directly influence the firm competitiveness. Our results also provide a general support for RBV suggesting that VRIN capabilities lead to higher levels of performance.

4.1 Supply Chain Learning and Dynamic Supply Chain Capabilities

In H_1 , we hypothesized that SCL would positively impact DSCCs. Our results showed that this relationship is significant. Previous studies have also suggested that learning is an antecedent to the success of DCs (Kale & Singh, 2007; Lei et al., 1996; Schilke, 2014a). Supply chain managers involved in constant learning find better ways to work with other members of the supply chain and are better equipped to learn the changes in market needs and customer preferences. This allows them to contribute towards the deployment of capabilities that provide a rapid response to market changes in short term and adjust the supply base according to the market trends in the long run.

4.2 Direct versus Indirect Relationship of Dynamic Supply Chain Capabilities

Second and third hypotheses of this study were related to the performance implications of DCs. We investigated both direct and indirect relationship of DCs on SCP. Indirect relationship was studied by considering OCs as mediating variable. Our results showed that DSCCs had a significant direct effect on SCP. Furthermore, indirect effect while significant was considerably weaker. These results are in line with previous studies that have argued for a direct relationship between DCs and performance (Li & Liu, 2014; Lin & Wu, 2014; Schilke, 2014a; Wilden, Gudergan, Nielsen, & Lings, 2013). Better understanding of market i.e. customers, competitors, supply chain partners, and environment leads to more informed decision making about how to capitalize on new

market opportunities and neutralize threats. This is achieved through DSCCs. DSCCs allows firms to modify quality and quantity of products and services quickly and according to customer requirements. Firms with DSCCs are also better able to absorb pressures faced due to supply side problems. This can result in enhanced SCP. While the indirect impact of DSCCs was weaker, it does not disregard the role of OCs. According to Wu, et al. (2010), OCs are firmly rooted in firm's operations management system. This firmness results from the relationship between OCs, operational practices, and resources and day to day problem solving activities performed by firm's operations function. This hidden aspect creates tacitness in the nature of OCs. However, even though OCs are necessary for success, they are not sufficient. Firms cannot sustain superior competitive positions by merely exploiting existing capabilities. DCs allow the firms to transform the OCs as and when required to achieve capability modification and revitalization according to market needs (Protopogerou et al., 2012; Zahra et al., 2006).

4.3 Theoretical Implications

This study makes some important contributions to the DCs literature in general and DSCCs literature in particular. First, in line with the previous literature we propose new suitable constructs to measure capabilities at various levels of "capability hierarchy". We provide empirical support for the proposed relationships between capabilities at different levels. Second, this study contributed to the better understanding of hierarchical order of capabilities by going one step further than any of the previous studies (e.g. Schilke, 2014b). This way it contributes to the development of understanding about the relationship of higher-order capabilities with the capabilities at the next level. To the best of our knowledge, no previous study has considered hierarchical order of capabilities in such detail. This does not necessarily solve the problem of infinite regress as suggested by Collis (1994) and Teece (2014b). The question still remains as highlighted by Schilke (2014b), given the continuous pursuit of higher-order capabilities should the researchers continue to look for still higher-order capabilities (Third or higher order). Alternatively, should the researcher go for most realistic picture or should parsimony dictate the choice of variables in the research model. Schilke suggested that decisions regarding this dilemma can only be made while considering the context of the studies. Thus, future studies in the area should make context specific decisions about whether considering a still higher level of capabilities adds any value to the explanatory power to the study.

4.4 Managerial Implications

This study has various implications for managerial practice. The support for higher-order capabilities and DSCCs shows the importance of SCL capability. SCL provides the basis for DSCCs to become market focused. Support for direct relationship between DCs and performance highlights the significance of investing in DCs. This study also shows that DCs are also relevant in developing countries such as Pakistan and thus provide a new context for the performance of DCs. It was important to study the relevant capabilities in Pakistani environment because previous researchers have highlighted that developing country firms typically show "dysfunctional competitive behavior". There are bound to be differences between how DCs are manifested (Li & Liu, 2014). The model proposed in the

study provides practice based guidelines to the managers as to how DCs are successfully deployed which can easily be transferred to managerial practices. As emphasized by previous researchers (e.g. Schilke, 2014a) building DCs is not enough, DCs should also be used to transform a firm's operational capabilities, thus managers need to exploit these capabilities through the modification of operational capabilities in order to achieve sustainable competitive advantage.

4.5 Limitations and Future Research Implications

The findings of this study should be interpreted in the light of its limitations. These limitations could also point out some avenues for future research. First, we used self-reported data of managers for measuring both independent and dependent variables. Although this practice is not uncommon in management research, self-reporting bias cannot be totally ruled out. Future studies may use secondary data to study these relationships if possible. Second, the study used cross-sectional research design. Therefore usual issues of this design apply to this study as well. Future research may consider longitudinal research design to ground the causal logic of relationships. Third, this study employed operational capabilities from the operations management area of the organization. Future research could consider marketing, logistics, and technological capabilities combined to study the intervening role of operational capabilities.

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