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Conference Paper

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Provided in Cooperation with:

Hamburg University of Technology (TUHH), Institute of Business Logistics and General Management

Suggested Citation: Grilec Kaurić, Alica; Miočević, Dario; Mikulić, Josip (2014) : Dynamic Capabilities and Firm Effectiveness: The Mediating Role of Supply Chain Performance, In: Blecker, Thorsten Kersten, Wolfgang Ringle, Christian M. 978-3-7375-0341-9 (Ed.): Innovative Methods in Logistics and Supply Chain Management: Current Issues and Emerging Practices. Proceedings of the Hamburg International Conference of Logistics (HICL), Vol. 18, epubli GmbH, Berlin, pp. 391-412

This Version is available at:

<https://hdl.handle.net/10419/209240>

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Dynamic Capabilities and Firm Effectiveness: The Mediating Role of Supply Chain Performance

Alica Grilec Kaurić, Dario Miočević and Josip Mikulić

Abstract

Dynamic capabilities (DCs) have been in the recent focus of mainstream strategy research. Recent theoretical advances have seen the advent of DCs in supply chain management research, where DCs have been identified as enhancers of supply chain performance and firm's effectiveness. However, the literature predominantly lacks studies that empirically integrate the DCs, supply chain performance and firm's effectiveness in single theoretical framework. Building on this gap in the literature, this paper investigates the interplay between DCs, supply chain performance and firm effectiveness. The study was carried out on a sample of 85 medium and large manufacturing firms in Croatia. This study contributes to the literature by offering empirical evidence that the DCs (agility, adaptability and alignment) higher value-added impact on firm's effectiveness in the presence of supply chain performance as a mediator. In the end, this study offers valuable theoretical and practical implications as well as suggestions for further research.

Keywords: dynamic capabilities, supply chain performance, companies' effectiveness, manufacturing industry

1. Introduction

In recent years, the field of business research has seen supply chains as a source of sustainable competitive advantage (Motedel, Toloie-Eshlaghy and Halvachi-Zadeh, 2011, Wu and Barnes, 2011) and thus identified it as a driver that improves financial performance of the focal company (Oh et al, 2013). The most recent studies in the field have confirmed the positive relationship between supply chain management and firm performance (Kim, 2006, Ou et al, 2009). However, the open question remains: What are the key factors that contribute to the performance of the firm engaged in the supply chain?

One of the fields that has shown a great interest in researching the sources of competitiveness is resource-based view (RBV). In the tradition of RBV, above average performance of a firm is achieved by utilizing various resources in forms of assets, organizational processes, intangibles, information, knowledge, etc. (Barney, 1991). Though, due to imitability, some authors argued that physical resources are not deemed to become a source of sustainable competitive advantage. Hence, theoretical advances in the field of strategy have started to stress the importance of dynamic capabilities (DC) in building the firm's competitive position (Teece et al, 1997). DCs represent higher level organizational and strategic competences, by which managers create, integrate and recombine lower level internal and external resources and capabilities with a goal of implementing value-creating strategies in rapidly changing business environments (Eisenhardt and Martin, 2000, Teece et al, 1997). Although the DCs have shown predominant focus in the context of focal firm, many authors have studied DCs in the context of supply chains (Wu et al, 2006, Chmielewski and Paladino, 2007, Wilden et al, 2013). However, despite the growing interest of supply chain researchers for DCs, the literature is still scarce on these issues (Beske, 2012).

Some authors indicate that the DCs are the key factor that distinguishes the typical from the excellent supply chain (Mehrerdi, 2009). In excellent supply chains, firms employ DCs that enable them to achieve efficiency through

achieving exceptional results in the speed, quality and cost (Ketchen et al, 2008, Mehrjrudi 2009th). In his seminal work, Lee (2004) proposed that all effective supply chains need to have three distinctive DCs: agility, adaptability and alignment. These DCs have been integrated in the framework known as 3A supply chains (Lee, 2004). Each of the defined DCs has a direct impact on a particular area of business performance. Yet, most of the previous work in the field has inspected these DCs separately. For instance: agility (Christopher, 2000, Alastair, 2003, Ismail and Sharifi, 2006, Motadel Toloie-Eshlaghy and Halvachi-Zadeh, 2011, Wu and Barnes, 2011), adaptability (Duclous et al, 2003, Stevenson and Spring, 2007, Wang, 2008, Oh et al, 2011) and alignment (Ryu et al, 2009).

Therefore, the main goal of this study is to determine the influence of 3A dynamic capabilities (agility, adaptability and alignment) on supply chain performance and focal firm's effectiveness. By contextualizing our study within the supply chain management field, we seek to contribute to the theory in several ways. First, the study aims to theoretically and empirically validate the importance of 3A DCs for performance outcomes of supply chain as a whole. Second, this study provides empirical evidence that higher supply chain performance is an important precedent to higher firm effectiveness. Third, the value-added of this study is the empirical assessment of indirect effects in the model in which the supply chain performance is seen as a mediator in the link between 3A DCs and focal firm's effectiveness. Fourth, most studies in the field of supply chain management are still being conducted in the context of developed markets; therefore, in this study we show that the philosophy of supply chain management is equally important for the firms originating from emerging and developing economies.

The rest of the paper is structured as follows. First, the theoretical framework along with the research hypotheses is presented. This is followed by a detailed description of the methodology and main study findings. Finally, this paper concludes with a discussion of research findings, managerial implications, limitations and suggestions for further research.

2. Literature review

2.1 Dynamic capabilities in the supply chain context

Firm capabilities (dynamic and static) along with the assets, organizational processes, attributes of the company, informations, knowledge etc. comprise the firm's resources (Barney, 1991). Resources are controlled by the firm and they allow the firm to design and implement a strategy that will help them achieve business efficiency and effectiveness (Barney, 1991). On the other side, capabilities represent firm's immaterial (intangible) assets. According to Barney (2001), firms that build their strategies on intangible assets are more superior than firms that build their strategy on the platform of tangible assets (Barney, 2001).

Dynamic capabilities (DCs) are defined as capabilities that integrate, build and reconfigure both internal and external resources in a changing business environment. DCs represent the firm's ability to achieve new and innovative forms of sustainable competitive advantage (Teece et al, 1997). In academia, DCs became popular in 1997 after Teece and colleagues published their seminal paper in which they set out the theoretical framework for DCs applicability in the firm context (Cepeda and Vera, 2007). As an important determinant of firm's competitiveness, DCs are related with the firm's business performance (Wu et al, 2006, Chmielewski and Paladino, 2007, Wilden et al, 2013).

In the supply chain context, however, DCs are defined as *"the ability of the companies to identify, use and adapt to internal and external resources/information in order to facilitate all activities in the SC"* (Wu et al, 2006).

In the available literature, only three DCs were highlighted as the drivers of supply chain excellence, namely the 3A DCs. According to Lee (2004), all supply chains should have three key dynamic capabilities in order to be successful: **agility**, **adaptability** and **alignment**. Each of these DCs has an impact on a particular area of supply chain performance. Agility has a goal to accelerate the supply chain response to changes in supply and demand (Christopher, 2000, Alastair, 2003, Ismail and Sharifi, 2006, Thomas et al, 2009, Motadel, Toloie-

Eshlaghy and Halvachi-Zadeh, 2011, Wu and Barnes, 2011); adaptability has a goal to adapt the supply chain to current market conditions (Duclos et al, 2003, Stevenson and Spring, 2007, Wang, 2008, Oh et al, 2013), while alignment has a goal to align the interests of all firms present in a supply chain with the interests of their own firms (Ryu et al, 2009). In accordance with the opinion of Tang and Tomlin (2008), strategy based on 3A DCs (Lee, 2004) reduces all potential supply chain risks and possible negative consequences. For example, the risk of economic and political factors can be reduced by supply chain adaptability and the risk of demand or supply can be reduced by supply chain agility.

Agility represents the ability of the SC that brings growth and survival in the market (Lin, 2006, Motadel, Toloie-Eshlaghy and Halvachi-Zadeh, 2011), and has a goal to „*quickly respond to short-term changes in supply or demand*” using the following methods (Lee, 2004): 1) continuously providing information about the changes in supply or demand to the supply chain partners so they could react quickly; 2) collaborate with suppliers and customers in order to redesign processes, parts and products in a way which would provide them with a better starting position. **Adaptability** is defined as ability to reduce total costs and also resolves the weaknesses of the make-to-order strategy (Chan and Chan, 2010). In other words, it is the ability with the goal to “*modify design/shape of the supply chain in order to adapt to the market changes*” using the following methods (Lee, 2004): 1) monitoring changes in the economic environment; 2) using intermediaries to achieve growth in the market; 3) providing that different products use the same parts and manufacturing processes; 4) creating different supply chains for different product lines in order to optimize all market opportunities (for example, small products series are produced close the domicile market, while large in countries with low production costs). **Alignment** includes the interests of supply chain members and without it, superior supply chain performance is not possible (Lee, 2004). It is the ability with the goal to “*to encourage the initiative of the supply chain partners to increase supply chain performance of the entire supply chain*” using the following methods (Lee, 2004): 1) to ensure equal access to forecasts, sales data and plans to all partners; 2)

clarify the roles and responsibilities of all partners in order to avoid conflicts; 3) redefine the terms of the partnership in order to share the risks, costs and rewards for improving supply chain performance; 4) to align the initiatives so “players” could maximize overall supply chain performance and at the same time maximize the return from the partnership. In the next chapter, we discuss the research model and hypotheses.

2.2 Research hypotheses

The utilization of DCs should lead to a more responsive, adaptive and efficient supply chain (Defee and Fugate, 2010). The role of DCs in the supply chain is to identify, use and adapt internal and external resources in order to improve all activities in the supply chain (Wu et al, 2006). Put differently, supply chain excellence depends on the utilization of 3A DCs, as suggested by Lee (2004). In previous studies, 3A DCs were related to various organizational outcomes in supply chain management, namely: with indicators of business performance (Cagliano et al, 2004, Yusuf, 2004, Swafford, 2008, Qrunfleh and Tarafdar, 2014), with indicators of supply chain performance (Sukati et al, 2012, Qrunfleh and Tarafdar, 2014), with structural properties of logistics and supply chain networks (Busquets et al, 2009, Chan et al, 2009, Ivanov et al, 2010), and with core management processes (Sussland, 2003). Yet, in recent literature only one empirical study linked the integrated concept of 3A DCs with supply chain and firm performance (Whitten et al, 2012). Following their conceptual properties, 3A DCs directly enhance supply chain performance indicators: higher **quality** (the supply chain will be able to precisely deliver products to the final customer); better **visibility** (the supply chain will have continuous and effective communication flow – from the product idea to the customer), better **flexibility** (the supply chain will be able to quickly produce and deliver non-standard orders), better **innovativeness** (the supply chain will be able to introduce new products more quickly), lower **costs** (due to lower inventory costs, the supply chain will minimize total costs of the final product). Departing from the previously

discussed theoretical and empirical background, we propose the following hypothesis:

H1: 3A dynamic capabilities are directly and positively related to supply chain performance.

By integrating to supply chain, firms expect to enhance their business result through various outcomes such as: improved price/cost ratio, enhanced product quality, increased reliability of delivery, improved product innovation, and the shorter time required for placing the products on the market (Li et al, 2006). According to previous studies, the most common goals of supply chains are: customer satisfaction (Martinez-Olvera, 2008), profit maximization for all supply chain members (Samanovic, 2009), provision of value-added services to final customers (Chan, 2003), and simultaneous enhancement of supply chain and single firm performance (Li et al, 2006). Therefore, the ability of supply chains to produce and deliver products that satisfy the needs of final customers will result in greater business success for all firms in the supply chain (Qrunfleh and Tarafdar, 2014). Based on the preceding theoretical arguments, the following hypothesis is proposed:

H2: Supply chain performance is directly and positively related to firm effectiveness.

In today's business environment, firms are aware that cooperation with other firms in supply chains brings benefits to them only if all firms operate successfully (Lummus and Vokurka, 1999). This theoretical argument supports the notion that overall supply chain success inevitably influences how the focal firm's organizational processes influence its business performance. Therefore, we propose the following hypothesis:

H3: Supply chain performance significantly mediates the relationship between 3A dynamic capabilities and firm effectiveness.

3. Methodology

3.1 Operationalization

For the purpose of this study we use construct operationalizations from previous studies. The agility scale was adapted from Whitten et al (2012) and Zelbst et al (2010). The adaptability scale was adapted and modified to a lesser extent from Whitten et al (2012), and Swafford et al (2006). The alignment scale was adapted from Whitten et al (2012) and was complemented with some scale items from Ryu et al (2009), and Power et al (2001). To measure supply chain performance, we relied on the ideas suggested by Chan (2003) who provides the most comprehensive measurement framework and classifies supply chain performance indicators at quantitative level (cost, resource utilization) and qualitative level (quality, flexibility, visibility, trust and innovativeness) (Chan, 2003). We complemented this scale with items from other studies (Green et al, 2012, Qrunfleh and Tarafdar, 2014, Swafford et al, 2008).

To measure firm effectiveness we relied on the guidelines of Robbins and Coulter (2005), and Ruekert et al (1985) and defined several indicators of firm effectiveness: i.e. overall business result, customer satisfaction, and time to market. The respective scale items were adapted from previously published studies (Krohmer et al., 2002, Lee and Choi, 2003, Kim, 2006, Zhang et al, 2006, Li et al, 2006).

3.2 Sample and data collection

For the purpose of data collection, we developed an online questionnaire which we e-mailed to 722 managers of manufacturing companies listed in the Business Registry of the Croatian Chamber of Commerce. In developing the sample frame, we applied the following criteria: 1) firms are active, and 2) firms have more than ten employees. E-mail invitations to participate in the survey were sent out over a period of three months. After a third reminder, 85 useful responses were received, which accounts to a response rate of 11.77 percent which is deemed satisfactory. Table 1 presents an overview of the sample according to firm size.

Nr of employees	Frequency	%
51-250	53	62.35
> 251	32	37.65
Total	85	100

Tab. 1: Sample according to company size

3.3 Data analysis

In order to test our hypotheses we applied partial least squares structural equation modelling (PLS-SEM). PLS-SEM is considered advantageous over covariance-based SEM with regard to the robustness of estimations and statistical power when applied to smaller sample sizes, as is the case in our study (Reinartz, Haenlein and Henseler, 2009). Moreover, PLS-SEM deals more efficiently with non-normal data and facilitates model estimations with both reflectively and formatively identified variables (Ringle, Sarstedt and Straub, 2012).

For the purpose of our study, we used the sequential latent variable score method (Wetzels, et al., 2009, Hair, et al., 2013). Accordingly, first, we calculated latent variable scores (LVS) of the first-order reflective constructs (e.g., Agarwal and Karahanna, 2000). The number of factors to be extracted for each first-order construct was fixed to one. Second, the calculated LVSs were then used as manifest formative indicators of the respective second-order construct in the main model (i.e. 3A DCs, Supply chain performance, Effectiveness). An advantage of the sequential LVS method is that it yields a parsimonious model that encompasses only focal higher-order constructs. In our study, all first-order latent variables yielded appropriate levels of internal consistency.

Structural model estimations in this study were conducted with SmartPLS 2.0 software (Ringle, Wende and Will, 2005). We used mean-centered data and the path weighting scheme, missing data were excluded case-wise.

In order to test for possible mediation we assessed two models, i.e. one without the mediator (i.e. Supply chain performance) and a direct relationship between 3A DCs and Effectiveness, only, and the other model with additional links between a) the predictor and the mediator, and b) the mediator and the dependent variable included. If these relationships prove statistically significant, and if inclusion of the mediator results in a decrease of the direct effect size between the predictor and the dependent variable, then this indicates the presence of a mediating effect.

4. Findings

A graphical presentation of the single cause-effect model and the mediator model is provided Figures 1 and 2, respectively.

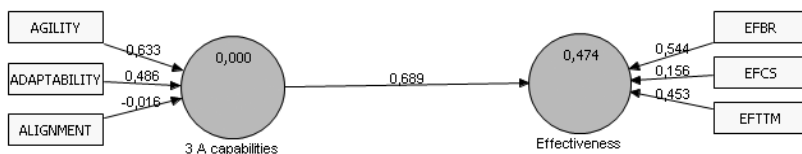


Fig. 1: Simple cause-effect relationship between 3 A capabilities and Effectiveness

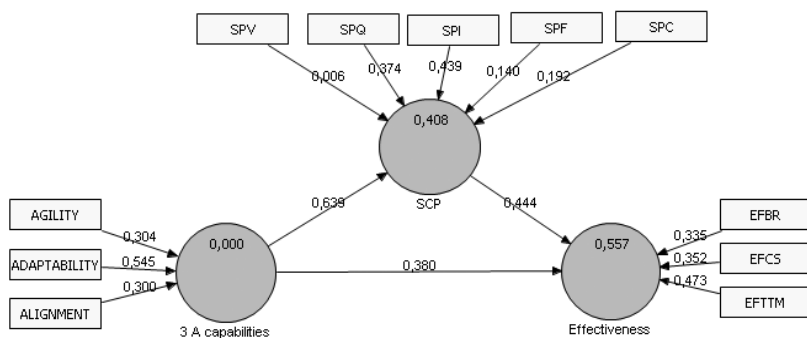


Fig. 2: Mediating role of the supply chain performance

4.1 Assessment of the Measurement Model

The quality of the formative measurement model was assessed by examining the magnitude and significance of indicator weights. To obtain significance-levels we applied bootstrapping to calculate standard errors and respective t-statistics (Tenenhaus, et al, 2005). We set the number of bootstrap samples to 5000 and the number of cases equal to the number of cases in the original sample. The results of this analysis are presented in Table 2.

Table 2 reveals that most of the formative indicator weights are significant at the 0.01 or 0.05 level. Lowest significance levels are reported for SPV and SPF (t-value = 0.039 and 0.817, respectively). Interesting to note, inclusion of the mediator significantly increases the significance level of Alignment as a component of 3A DCs.

	Original Sample	Sample Mean	Standard Deviation	Standard Error	T Value
ADAPTABILITY -> 3A DCs	0,545	0,530	0,148	0,148	3,677
AGILITY -> 3 DCs	0,304	0,323	0,163	0,163	1,864
ALIGNMENT -> 3 DCs	0,300	0,285	0,160	0,160	1,878
EFBR -> Effectiveness	0,335	0,326	0,138	0,138	2,428
EFCS -> Effectiveness	0,352	0,328	0,160	0,160	2,203
EFTTM -> Effectiveness	0,473	0,492	0,144	0,144	3,275
SPC -> SCP	0,192	0,215	0,152	0,152	1,257
SPF -> SCP	0,140	0,120	0,171	0,171	0,817
SPI -> SCP	0,439	0,443	0,163	0,163	2,699
SPQ -> SCP	0,374	0,350	0,161	0,161	2,326
SPV -> SCP	0,006	0,008	0,150	0,150	0,039

Tab. 2: Bootstrap results for the outer model

4.2 Assessment of the Structural Model

The coefficients of determination (R^2) of the endogenous variables were assessed to evaluate the model's predictive power. In the simple cause-effect model (without the mediator) the dependent variable (Effectiveness) yields an R^2 score of 0.474. In the mediating effect model, the mediator variable (SCP) and the dependent variable (Effectiveness) yield R^2 scores of 0.408 and 0.557,

respectively. In both models, thus the R2 scores exceed the cut-off value of 0.4 which indicates substantial path structures in the inner model (Chin, 1998). We further examined Stone-Geisser's Q2 statistic to evaluate the predictive relevance of the model, i.e. to see how well exogenous variables explain endogenous variables (Chin, 1998; Hair, et al., 2013). This statistic, which is reported as cross-validated redundancy in SmartPLS 2.0, should be above zero. Moreover, scores of cross-validated communality (q2) were examined to assess the model's ability to predict the manifest indicators from the calculated latent variables (Tenenhaus, et al., 2005). q2 scores of 0.02, 0.15 and 0.35 are indicative of a weak, moderate, and strong degree of predictive relevance of each effect, respectively. Scores of cross-validated communality and redundancy were obtained through blindfolding and jackknife re-sampling approaches. The findings in regard to predictive relevance of the model are presented in Table 3.

	CV redundancy (Q2)	CV communality (q2)
3 A DCs	0.741	-
Effectiveness	0.734	0.265
SCP	0.707	0.294

Tab. 3: Analysis of predictive relevance

The Q2 statistic indicates predictive relevance of the inner model variables (Henseler, et al., 2009). The q2 statistic further indicates a medium level of predictive relevance for the mediator (SCP) and the dependent variable (Effectiveness).

Finally, significance-levels of the inner model path coefficients were estimated. The bootstrap procedure described earlier was again applied. The results for the single cause-effect model and the mediator model are provided in Table 4.

	Original Sample Mean	Sample Mean	Standard Deviation	Standard Error	T Value
Single cause-effect model					
3A DCs -> Effectiveness	0.689	0.705	0.067	0.067	10.293
Mediator model					
3A DCs -> Effectiveness	0.380	0.351	0.153	0.153	2.478
3A DCs -> SCP	0.639	0.648	0.080	0.080	7.990
SCP -> Effectiveness	0.444	0.469	0.183	0.183	2.429

Tab. 4: Bootstrap results for the inner model

The findings reveal that 3A DCs have a statistically significant effect on Effectiveness in both the single cause-effect model and the mediator model. The t-value, however, significantly decreases in the mediator model (t = 10.293 and 2.478, respectively).

Furthermore, 3A capabilities have a significant effect on SCP, and SCP has a significant effect on Effectiveness in the mediator model. Given the increase of explained variance in Effectiveness in the mediator model, and the decrease of the direct effect of 3A capabilities, our results indicate that Supply chain performance partially mediates the relationship between 3A capabilities and Effectiveness.

5. Conclusion and Implications

In today's business environment, supply chains represent a form of integrated inter-firm networks. The transformation into excellent supply chains requires

utilization of 3A DCs - agility, adaptability and alignment, which are the basis for sustainable competitive advantage of the whole supply chain. The goal of this study thus was to examine whether 3A DCs exhibit a positive impact on supply chain performance and to see how this potentially reflects on firm effectiveness. According to the study findings, we found strong support for our hypotheses.

The relationship between 3A DCs and supply chain performance was found to be direct and positive which suggests that 3A DCs are an inevitable pillar of supply chain competitiveness. By implementing the 3A DCs in everyday business, each individual supply chain member strengthens the competitive position of the supply chain as a whole. Eventually, such synergistic acts result in higher supply chain performance. Our study provided empirical evidence for this which led to acceptance of H1.

With regard to H2, our results indicate that supply chain performance has a direct and positive impact on firm effectiveness. This finding is not surprising, but it has so far not been reported in greater detail in previous studies. Hence, it is crucial to consider the spill over effect that supply chain performance exhibits on the individual performance outcomes of member firms in the supply chain. Nevertheless, this notion is even more evident in H3, where our data shows that supply chain performance partially mediates the relationship between 3A DCs and firm effectiveness. The DCs are internal intangible and "soft" assets embedded in managerial competencies and certainly yield a positive effect on firm business outcomes. Yet, by inspecting the indirect effects in the model, we can conclude that the relationship between 3A DCs and firm effectiveness is better explained by the intervention of supply chain performance as a mediator variable.

This study brings some implications to managerial attention. In order to create an excellent supply chain, firms must value the importance of the supply chain for their focal business in terms of business performance outcomes. Therefore, the managers need to utilize 3A DCs (agility, adaptability and alignment) to successfully manage flows in the supply chain. From a practical standpoint, firms should apply various initiatives that enhance supply chain excellence such as:

continuous monitoring of the needs of end customers, customization of products according to latest customer preferences, clarifying the roles, tasks and responsibilities for other members of supply chain (suppliers and customers), implementing system that will support equitable risk sharing, costs and benefits with other partners in the supply chain. On the bottom line, cooperation between partners in the supply chain is the most important mechanism for the development and improvement of DCs and should not be hindered.

This study has several limitations. First, we relied only on data provided by single firms in the supply chain. Therefore, future studies could incorporate data from the other sides of the supply chain dyad (e.g., customers and suppliers of the focal firm), and by using a more in-depth, qualitative approach. Second, we relied only on single informants from the companies in our study. Future studies should survey different managerial positions (e.g., financial managers) in regard to supply chain issues. Third, it would be interesting to conduct the same study on the example of other sectors.

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