

The dual embeddedness of global corporations through their supply and internal networks: Performance implications

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Abstract

Firms are embedded in two separate networks: the internal network consisting of the parent company and its subsidiaries, and the supply network consisting of suppliers and their subsidiaries. Incorporating two theoretical perspectives: social network theory and dual embeddedness, this study examines the link between collocation with supply networks, geographic dispersion of the internal network and performance. A dataset consisting of 116 companies from the electronics industry is collected from Bloomberg and Orbis in order to operationalize the network constructs. Our empirical analyses reveal that collocation with suppliers positively impacts firm performance only when level of internal geographic dispersion is low.

Keywords: Supply network, internal network, embeddedness

Introduction

In today's business environment, that is characterized by an increased dependence on supply networks, the embeddedness of a focal firm in its network is arising as a very important aspect to be considered in the research on the performance of the focal firm. Although the firms in the supply chain are now starting to look towards their suppliers as additional sources of flexibility and improvement, their performance could be improved by their internal capabilities. Supply chains are comprised of networks that consist of not only the direct ties of the focal firm to each of its supply network partners such as suppliers and customers but also of the ties to the subsidiaries that form the internal network of the focal firm (Demeter et al., 2016). Demeter et al (2016) pointed at an unresolved issue concerning the unknown complementarities through which the internal network interrelates and interacts with the overall supply network. They also stated that no prior research study has recognized dual embeddedness where both internal and external networks are considered as an integrative system rather than as separate parts. In

line with this, Demeter et al (2016) have suggested that, in practice, firms operate as members of two distinct networks (see figure 1): internal network composed of several subsidiaries belonging to the same company, and external supply network identified through information and material flows between different companies that cooperate in a supply chain.

Both anecdotal evidence and research on supply networks highlight the operational benefits of effectively managing a supply network. The need for more research on supply networks has been recently emphasised in the operations and supply chain management literature (Kim, 2014; Bellamy et al., 2014). Supply networks have, therefore, gained considerable attention but, to date, no empirical studies have considered the interaction of the supply network of the firm and its internal network of geographically dispersed subsidiaries. These arguments suggest that the firm dual embeddedness in its supply and internal network should be investigated. And given that focal firms are embedded in these two distinct networks, it is important to consider both networks when studying the performance of a buying firm.

On one hand, extending a company's supply network to dispersed geographic locations is commonly perceived as a managerial decision to improve sourcing performance (Demeter, 2013). When focal firms rely on global suppliers, the relationship with them needs extensive coordination efforts and reaching them as fast as possible has become an essential and valuable strategy (Droge et al., 2004). Previous research has discussed how supply chain proximity or collocation enhance the firm's ability to provide better customer service, control the flow of material and better coordinate plans to be responsive to demand fluctuations (Narasimhan and Nair, 2005).

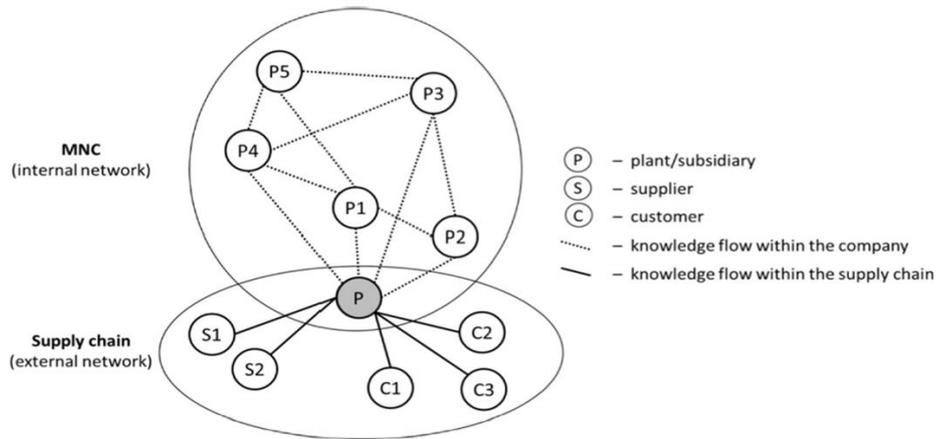
While global supply chains enable the integration of a global portfolio of suppliers, they also allow integrating geographically dispersed internal processes to gain advantages of diverse location benefits. Hence, supply chains are not just a combination of buyers and suppliers' relationships, but they consist of extended internal networks that operate globally. Yet, the supply network coordinates not only with the firm as one entity but with its several subsidiaries as well as its headquarters.

On the other hand, extending a company's subsidiary network to dispersed geographic locations is commonly viewed as a way to strengthen the competences of the company and reach high performances (Tsai, 2001). As a consequence, multinational companies (MNCs) operate international networks of subsidiaries that are dispersed around the world (Ghoshal and Bartlett, 1990). The reason for their existence is their ability to transfer, recombine, and exploit resources through several contexts and between countries (Meyer et al., 2011). Other scholars suggested that globalization increases the complexity in networks they are being exposed to several risks when being globally spread (Bozarth et al, 2009; Bode and Wagner, 2015).

Although it is intuitive that collocation with supply networks is likely to have positive impacts on firm performance, most of the evidence that we have seen in the literature does not include the complexity of internal networks.

Therefore, it is essential to improve our understanding of the interaction of the supply network and the internal network of geographically dispersed subsidiaries and establish whether collocation with suppliers and geographic dispersion of internal operations influence the overall performance of the focal firm in the network.

Figure 1: Dual embeddedness



*adopted from Demeter et al (2016)

Literature Review and theoretical standpoints

Social network theory (SNT)

The supply chain management research is increasingly examining supply chain relationships beyond the traditional buyer-supplier dyad, looking instead on the supply network (Wagner and Neshat, 2010; Giannoccaro et al., 2017). Supply chain management is not just dyadic; it considers paths through a network of firms. Indeed, previously, the focus has been on paths between just two nodes: supplier to focal firm, and focal firm to customer. Given that a supply chain is a network of companies and thus comprises several interrelated parties, Choi et al (2001) stated that social network perspective could be an appropriate approach to study supply networks. Also, many studies in the supply chain management literature have shown the salience of social network analysis to study supply networks (Borgatti and Li, 2009; Kim et al., 2011; Kim, 2014).

Social network analysis, which has theoretical roots in sociology, is a theory and an analytical method that permits for an in-depth study of the structural characteristics and the relationships of networks that are not completely understood if studied using links between two nodes (Choi et al., 2001; Kim et al., 2011). SNT highlights the advantages resulting by viewing a company as embedded within a bigger network of relationships. Granovetter (1985) defined a social network as “a set of actors and the set of ties representing some relationship or lack of relationship between the actors”. The assumption that organizational entities are embedded within a network of relationships is fundamental to the social network analysis approach (Lin and Kede, 2011). Social network models consider actors such as firms or individuals as being interdependent instead of independent, conceive relational links between actors as means for transfer of resources and perceive the network structures as offering opportunities or constraints for the actors, their decisions and their actions (Granovetter, 1985).

Researchers have called for further research that uses the key concepts in social network analysis and that could be helpful to the supply chain management field. In fact, social network analysis provides a practical model that identifies how network actions and processes are linked to network outcomes, and how network characteristics under the control of management influence network outcomes. This view allows understanding the benefits gained from reach of resources, knowledge and information sharing within a network of interdependent entities (Granovetter, 1985).

Previous studies that used SNT have not considered the internal network of firms that consists of globally dispersed subsidiaries and whether these networks interact with the supply network to have a combined impact. The research area on the interaction of such networks is still nascent. Therefore, taking a social network view will enable our study to better represent supply chains and their structure to study the characteristics of the two networks.

Dual embeddedness

To understand the behaviour of any single firm in a network, it is necessary to explore the concept of embeddedness. Embeddedness refers to the extent to which a firm depends on its network partners in any specific network structure (Granovetter, 1985; Uzzi, 1997). Granovetter (1985) divided embeddedness into structural and relational aspects. Structural embeddedness stresses on the configuration of an entity's network of relationships, while relational embeddedness emphasises the role of quality of those relationships (Rowley et al. 2000).

In this study, the focus is on the structural embeddedness of the focal firm and mainly on the configuration of the network ties by integrating the firm's supply and internal network together (dual embeddedness) and looking at structural characteristics of both. The concept of structural embeddedness asserts that companies are affected not only by the nodes they are directly connected to but also by distant nodes they are indirectly connected to (Uzzi, 1997). In other words, being embedded implies being embedded in both direct relationships such as suppliers and indirect relationships such as suppliers 'subsidiaries. In line with this, embeddedness forms the social network, in which specific resources and regulations that bring benefits constitute the social capital (Lin and Kede, 2011).

Most studies focus on the likely positive effects of embedded relationships (Bellamy et al, 2014); however, some researchers have found many negative effects on firm performance such as opportunism, redundant information, relationship inertia that leads to higher relationship costs and maintenance cost and, therefore reducing the positive impact of relational and structural embeddedness (Uzzi, 1997; Rowley et al., 2000). In line with this, Nell and Andersson (2012) called future research to capture structural embeddedness characteristics of a business network such as density and complexity and examine their influence on network performance. In the international business literature, the term dual embeddedness refers to the simultaneous integration of a company into its internal and external network (Figueiredo, 2011; Meyer et al., 2011). Dual embeddedness is defined as the dual linkages used by the firm to create capabilities to achieve better performance (Ciabuschi et al., 2014). It indicates that subsidiaries simultaneously sustain a positive relationship and efficient communication with both headquarters and local companies in host locations. Subsidiaries have to be sufficiently close to the supply network within the local environment to generate access and inflows, and simultaneously be sufficiently close to the MNC's internal network for the knowledge to be successfully transferred and exploited through the MNC (Meyer et al., 2011). This may require proximity and collocation between the units. Meyer et al, (2011) have noted that there has been rarely any empirical research studying the simultaneous impact of internal and external network.

This study, therefore, answers to the call for research on subsidiary dual embeddedness (Demeter et al., 2016) and does so by investigating the relationship between collocation with supply network and performance and the moderating effect of geographic dispersion of internal networks of a set of firms and their subsidiaries from the electronics industry.

Conceptual Model and Hypothesis Development

Collocation

Collocation with suppliers has been widely regarded as an effective way to improve buyer performance (Narasimhan and Nair, 2005; Dou et al., 2018). Mechanisms like frequent team meetings, supplier conferences, cross-functional teams are suggested to managers as ways of improving business outcomes (Cousins et al., 2008). Narasimhan and Nair (2005) defined supply chain proximity as “the physical closeness of the buying and supplying firm” and proved that it is positively associated with the formation of strategic alliance program and firm performance. In fact, buyers who locate close to their customers and who require their suppliers to locate close to them implicitly value the physical proximity because it enhances their ability to provide superior customer service, better control the flow of materials, better coordinate production schedules to be very responsive to changes in demands (Narasimhan and Nair, 2005; Dou et al., 2018). In addition to that, the advantages of geographic proximity are valuable as the need to use firm assets is reduced when the parts and facilities of the production are on the same location, this would be the case for automobile and phone makers, for instance. These advantages operate as incentives since they provide not only economies of scale, but also financial rewards to buyers. The collocation of buyers and suppliers allows to easily monitor suppliers and to lower monitoring costs (Cousins et al, 2008; Bray et al, 2019), it also facilitates the development of local norms and makes it easier for headquarters to monitor and acquire information about plants (Dou et al., 2018). Bray et al. (2019) explain that proximity provides a chance to develop or improve the relationship with supplier leading to an adaptation of the product design to co-create solutions to problems, or even co-design when developing new components for the local environments. These mechanisms help to reduce operational costs and improve the quality of a product, which gives direct and indirect financial efficiencies to the buying firm.

Moreover, collocation of buyers, their suppliers and the subsidiaries of both, in a given country, facilitates a deeper understanding of that country, this mechanism allows these companies to search deeply and understand the relevance of new knowledge for problem-solving (Alcácer and Zhao, 2012; Dou et al., 2018). Collocation increases the opportunities of identifying technologies that are not always apparent to firms that are less committed to a certain country or region and helps them reach a richer knowledge structure. Since firms with strong ties can better assimilate external knowledge with internal technologies (Alcácer and Zhao, 2012), collocation enables a subsidiary to achieve the focus required to integrate external knowledge into the parent company’s routines and technologies (Tsai, 2001), to accelerate organizational learning and to increase the contributions of external knowledge to the company performance.

Moreover, a local firm is considered as a primary source of local knowledge. A local firm or partner is likely to have more in-depth knowledge about several features of the host country environment, in comparison with other partner options. A local firm is familiar with the requirements and concerns of the local customers, it has the appropriate information about local competitors and has the local links to contacts that can offer timely information. Altogether, collocation with a supplier can reduce local knowledge deficiencies, help to identify suitable solutions, and are more likely to have the essential astuteness to propose solutions and strategies that can be effectively and rapidly developed and implemented. (Alvarez-Garrido and Guler, 2018). This, in turn, is highly likely to make the utilisation of external knowledge more effective and to enhance its effect on firm financial performance.

All of the aforementioned studies seem to agree on the positive effects on firm performance. Therefore, we expect higher levels of collocation to enhance its effects on firm performance.

Hypothesis 1: There is a positive relationship between collocation of internal and supply networks and firm performance.

Geographic dispersion

In our first hypothesis, we argued that firm financial benefits are expected from collocation of internal and supply networks, we also posit a negative effect of the interaction of collocation and geographic dispersion of internal network on firm performance output. In particular, firms that are collocated with their supply networks but that possess internal networks with high levels of geographic dispersion should experience lower financial benefits. We believe that it is important to consider the complexity of the internal network of supply chain members when studying their collocation. Geographic dispersion is strongly associated with the spatial complexity of companies, Bode and Wagner (2015) defined spatial complexity as the extent of the dispersion among members within the network. O’Leary and Cummings (2007) suggest that geographic dispersion has generally been defined in spatial terms, drawing on measures that take into consideration physical distances, number of countries, sites or locations. In this study, the geographically dispersed network of subsidiaries that form the internal network of supply chain members is interpreted as a measure of internal complexity.

Nell and Andersson (2012) defined the network complexity of business relationships as the degree to which a wide range of other actors outside the direct relationship between the firm and its partners interact on the business relationships. Those other actors include the subsidiaries of the buyers and the subsidiaries of their suppliers which form what we are calling the internal network of each parent company. Therefore, the number of subsidiaries, their geographical spread, the number of countries they are located in and other factors related to the internal networks of each entity in the supply chain increase the internal network complexity which, in turn, increase the overall network complexity.

Network complexity may cause lower network performance because it increases the interdependence among firms, which, in turn, leads to a higher need for coordination, conflicting goals, and trade-offs that are not easily resolved (Giannocarò et al., 2017). Our idea of dual embeddedness suggests that it is important to consider the internal network of focal firms that are collocated with their supply networks and examine whether it affects performance returns by increasing their internal complexities. High degrees of complexity in the network may cause high levels of risks and/or costs to buyers when they consider maintaining or further increasing the relation to specific investments, i.e. embeddedness. However, the simultaneous embeddedness in internal networks of diversifies subsidiaries and external networks of suppliers is being overlooked despite its potential and combined large impact on performance. Bausch and Krist (2007) indicated that the ability to manage complexity is a key success feature, we believe that greater levels of collocation contribute positively to firm performance only if there is not high internal complexity. This implies that companies should appropriately manage internal systems while being able to deal with external networks to enable knowledge acquisition and performance benefits.

Therefore, it is conceivable that collocation benefits are influenced by geographic dispersion such that higher performance is likely to occur due to collocation only if the level of geographic dispersion of internal network is low. In line with this, we hypothesise

a negative interaction effect between the geographic dispersion of internal networks and collocation with supply networks on firm performance.

Hypothesis 2: The geographic dispersion of the internal network negatively moderates the relationship between collocation and firm performance.

Research methodology

This study is using a dataset of 116 focal firms in the electronics industry, the focus is on this industry because it embodies aspects such as high market unpredictability, short product lifespans, and globalization of its networks (Sodhi and Lee, 2007) relies heavily on suppliers for integrating knowledge and technology (Bellamy et al., 2014). Supplier data was collected from Bloomberg SPLC while subsidiary data was collected from Orbis. The financial ratios: Return on Assets (ROA), Return on Sales (ROS), Profit Margin (PM) and Cash Flow divided by Operating Revenues (CF/Oprev) were used to tap the financial performance of the firm. Collocation (B_SN) is captured by the number of suppliers and their subsidiaries being collocated in the same country with buyers and their subsidiaries. A dispersion measure (GDsubsC) incorporating both geographic breadth and depth of a firm's multinational network is used as an indicator of geographic dispersion. The breadth of the firm is measured by the number of foreign countries in which the buyer has at least one subsidiary whereas the depth is captured by the total number of subsidiaries per foreign country. Extraneous effects are controlled by three variables related to firm size, firm age, and firm in-degree centrality. We used a multilevel hierarchical regression analysis to test our hypotheses using version 25.0 of SPSS (IBM Corporation, 2015). To reduce the concern of multicollinearity, in line with established procedures, especially in the presence of interaction terms, related variables were mean centered before calculating the proposed interaction term that is used to test the hypotheses.

Table 1: Hierarchical regression for the interaction effect between collocation and geographic dispersion on performance

	ROA	ROS	PM	CF/Oprev
Control Variables				
Firm size	-2.274 (1.56)	-2.746 (1.910)	-0.023 (0.091)	0.047 (0.085)
Firm age	-0.02 (0.027)	-0.035 (0.033)	0.000 (0.002)	-0.002 (0.002)
Nbr of suppliers	0.028 (0.065)	0.001 (0.079)	-0.003 (0.004)	-0.003 (0.004)
Predictor Variables				
B_SN	18.222** (5.799)	28.581** (7.10)	0.831** (0.342)	0.609* (0.321)
GDsubsC	-24.154** (9.93)	-23.805* (12.158)	-1.747** (0.610)	-1.492** (0.560)
GDsubsCxB_SN	-139.065** (55.31)	-150.782** (67.719)	-6.450** (3.380)	-6.979** (3.153)
Intercept	20.354** (6.980)	25.504** (8.436)	1.044** (0.403)	0.907** (0.378)
R ²	22.9 %	25.9 %	20.0 %	18.7 %
Adjusted R ²	17.8 %	21.1 %	14.5 %	13.2 %
F statistic	4.547**	5.364**	3.635**	3.412**
Change in R2 related to moderator	5.3 %	4.0 %	3.3 %	4.5 %
F statistic for change	6.322**	4.958**	3.642*	4.898**
N	99	99	99	99

** $p < 0.05$

* $p < 0.10$

Data analysis and results

With respect to our first hypothesis, which postulated a positive relationship between collocation and buyer's performance, we found support suggesting an increase in buyers' financial performance in terms of ROA ($\beta = 18.222, p < .05$), ROS ($\beta = 28.581, p < .05$), PM ($\beta = 0.831, p < .05$) and CF/Oprev ($\beta = 0.609, p < .1$) as collocation with their supply networks increases. Beyond these direct effects, the predictive power of the interaction effects, proposed in our second hypothesis, is tested. It suggests synergies or complementarities among the two variables; that is, beyond their individual effects, they together complementarily affect the buyer's performance. This added interaction effects significantly increased the R-square in Table 1 for ROA ($\Delta R^2 = 0.053, p < .05$), ROS ($\Delta R^2 = 0.04, p < .05$), PM ($\Delta R^2 = 0.033, p < .1$) and CF/Oprev ($\Delta R^2 = 0.045, p < .05$), thus providing support for the influence of our proposed interaction terms and for hypothesis 2. In particular, our results suggest that the geographic dispersion of the buyer's internal network negatively impacts the relationship between collocation with supply networks and performance in terms of ROA ($\beta = -139.065, p < .05$), ROS ($\beta = -150.782, p < .05$), PM ($\beta = -6.450, p < .05$), and CF/Oprev ($\beta = -6.979, p < .05$). All results were consistent over our four dependent variables as shown in Table 1.

Using data from the electronics sector, the current study found support for a positive linear relationship between collocation with supply network and firm performance. That is to say, the buyer's performance increases as the collocation of the buyer and its supply network increases. More importantly, the results show that the interaction effect between supply and internal networks is the most appealing; the relationship between collocation with suppliers and firm performance is negatively moderated by the geographic dispersion of the firm's internal network such that when the geographic dispersion of the internal network is low, firm performance increases as its collocation with its supply network increases. However, when the geographic dispersion of the internal network is high, firm performance decreases as collocation increases. In other words, the collocation of internal and supply networks is positively linked with firm performance only when a firm's internal network has low geographic dispersion.

One possible explanation is that dual embeddedness can be too complex due to a combination of internal and external complexities, and this can produce difficulties that would not occur if the embeddedness were simple. Higher embeddedness associated with high collocation with suppliers together with high levels of a firm's geographic dispersion were found to reduce firm performance. In fact, high geographic dispersion of subsidiaries creates complexities in the internal network, and this constrains the firm to gain from high diversification and from its high collocation with suppliers. A growing internal spatial complexity due to high geographic dispersion will eventually exhaust managerial capacity leading the firm to face difficulties and expenses (Lu and Shang, 2017), that might, at least partially, offset the financial gains from being close to suppliers. This implies that some aspects of embeddedness might create unexpected outcomes and costs. Indeed, collocation with supply network seems to be essential to guarantee the coordination of physical and information flows between the supply chain activities and to acquire shared resources that allow for an efficient solution of the day to day problems (Narasimhan and Nair, 2005; Cousins et al., 2008). However, when complexities continue to grow, the relative benefits of this physical contiguity are impeded, and in turn, the profitability of collocated activities is reduced. Lower geographic dispersion of subsidiaries seems to be more profitable than higher dispersion when the collocation with supply network is high. Our results also relate to the concept of structural embeddedness which indicates that the network configuration might allow for important new information to reach the network (Uzzi, 1997). However, a complex configuration can

invite more ambiguities than benefits. Therefore, it is important for multinational companies to be aware of potential high levels of internal complexities and to actively manage their networks to avoid negative effects. An upper level of those network management skills might urge firms to increase understanding of interdependencies within both networks, to recognize that decreasing network embeddedness might be profitable.

Conclusion

Our research has demonstrated the importance of considering a firm's supplier and internal networks simultaneously when predicting embeddedness-related performance effects. Although many papers have studied the relationship between supply chain proximity and buyer's performance, the extant literature has only considered the entities in the supply chain as one unit rather than a network of headquarters and subsidiaries. In addition, this research has provided explicit and quantified evidence on the interaction between supply and internal network and its effect on performance in the supply chain context, as well as offered new insight into the relative importance of dual embeddedness within the supply chain.

Our results proved that being close to their suppliers and suppliers' networks is crucial for buyer's financial performance. This is mainly done to be able to manage the increasing complexities of global supply networks that is a burden for many companies (Bozarth et al., 2009). To do this effectively, our results showed that a firm has to consider the complexity of its internal network beyond just building relationships and collocating with key suppliers. To the best of our knowledge, this is one of the first studies that offer an understanding of the possible interplay of internal and supply network of a buying firm and the effect on performance. Finally, this is a large-scale study based on secondary data to highlight the role of the characteristics of actual supply networks, along with location variables, in improving a firm's performance.

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