The role of national culture in plants' production network integration

Maricela C. Arellano (marellano@ethz.ch)
Chair of Production and Operations Management, D-MTEC, ETH Zurich. Switzerland

Cristina Sancha
OBS Business School, Spain

Torbjørn H. Netland
Chair of Production and Operations Management, D-MTEC, ETH Zurich. Switzerland

Cristina Gimenez Thomsen
ESADE Business School, Spain

Abstract

This paper studies the effects of national culture on a plant's integration in the production network and the contingent effects of two types of distance, cultural and geographic, on this relationship. Our arguments are grounded on an institution-based view that accounts for the dual institutional, social environment in which plants are embedded. Our results highlight the importance of the plant's local informal institutional context. Masculine, long-term oriented and indulgent cultures harm plants' network integration. Also, the significant moderator role of cultural and geographic distances shows that plants may follow their local values rather than the ones inculcated by the headquarters.

Keywords: Manufacturing networks, National culture, Multilevel regression

Introduction

Plants belonging to multinational firms are usually required to engage in the coordination of materials, information, and resources with other plants in the production network (Cheng et al., 2016, Cheng et al., 2015, Ferdows, 2014). Can it be that the location of a plant—with its distinctive national culture characteristics—influences the extent to which the plant engages in such coordination? If so, it would be important for corporate managers in the headquarters to be aware of these effects. In this paper, we investigate the role of national culture on plants' integration in global production networks.

In an organizational context, the different characteristics of national cultures are reflected in managerial values, beliefs, practices and business mindsets (Hofstede and Hofstede, 2005). Several authors have suggested that differences in national culture calls for differences in the type of OM practices and their impact on performance (e.g., Pagell et al., 2005, Wiengarten et al., 2011, Wong et al., 2017)—see Boscari et al.

(2018) for a recent literature review. Following this argument, it can be expected that the national culture of the country in which the plant is embedded would affect the coordination of the flows to and from other plants in the network. This relationship is expected to be influenced by an array of other factors but of particular interest in this study are cultural distance and geographic distance. Our paper differs from prior research in this field by looking into interplant coordination from an institution-based perspective (Peng et al., 2008), in which institutional fields "determine the socially acceptable patterns of organizational structures and actions" (Kostova et al., 2008: 997). Fields are different to industries and supply chains, they are "those organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services and products" (DiMaggio and Powell, 1983: 148). Plants are embedded in two institutional fields: the host country, composed of the local organizations, and the global production network, composed of the headquarters and plants belonging to the same company. Each of them built upon *institutions* that provide a basis of social order (Scott, 1995). In this paper, we focus on informal institutions, which are composed of cultural-cognitive elements (Scott, 1995). In line with prior studies, we use national culture to represent the informal institutional environment "since it refers to the "assumptions and conceptions of the 'way the world is'" (Scott, 2010: 7) that distinguish one group of people from another (Hofstede and Hofstede, 2005). We ask the following two research questions:

- RQ1: What is the role of national culture on the plant's integration level with other plants in its network?
- RQ2: To what extent do cultural and geographic distances moderate the relationship in RQ1?

Theoretical background and hypothesis development

A plant's network integration refers to a focal plant's coordination activities related to the plan and control of the physical and non-physical exchanges with other plants in the production network. To date, research on interplant integration has largely focused on case studies that describe companies' practices, optimization models of product volume allocation among plants, and, to a lesser extent, case studies that explain how and when plants share knowledge among them (Cheng et al., 2016). Overall, a plant's network integration has been related to the network configuration, plants' properties, and sender-receiver similarities (Ferdows, 2006, Deflorin et al., 2012, Scherrer and Deflorin, 2017). The theoretical foundations of these studies are twofold. First, integration is seen as a result of the company's need for developing and maintaining operational capabilities at the network level such as mobility and learning (Thomas et al., 2015). Second, integration commonly refers to the plant's quasi-automatic, rational response to increase operational performance. While these studies have confirmed the facilitating role of headquarters—which provide information communication technologies and organize regular periodical— and the importance of network performance, the view of the plant and its environment is still missing.

In this paper, we thus adopt different theoretical lenses. Instead of using a resource-based view, we introduce a broader social perspective to account for the plant's embeddedness in the host country as well as the plant's organizational bond with the headquarters. Respectively, we study the influence of the informal institutional environment of the host country, i.e. the national culture, and the moderating effect of the distance between a focal plant and its headquarters. The informal institutional environment is composed of cultural-cognitive elements, "cultural because they are

socially constructed symbolic representations; […] cognitive in that they provide templates for framing individual perceptions and decisions" (Scott, 2010: 7). This implies different informal institutional environments determine plants' preferences to certain actions and set of outcomes (Newman and Nollen, 1996). In this paper, the central action is the plant's integration. This is compatible with an institution-based view (Peng et al., 2008) that allows to grasp the different "rules of the game" in different nations. We, then, contribute to the research on production networks by further the understanding of its cross-country nature (Demeter, 2017).

National culture and plant's integration

Culture is "the collective programming of the mind that distinguishes the members of one group or category of people from others" (Hofstede et al., 2010). At the national level, people learn a national culture (henceforth, culture) in the form of visible manifestations (practices and its associated symbols, heroes, and rituals) and invisible manifestations (values). According to Hofstede and colleagues, the latter are remarkably stable so they use them to propose the dimensions that define the differences between national cultures (2010): (1) power distance; (2) uncertainty avoidance; (3) individualism versus collectivism; (4) masculinity versus femininity; (5) long-term versus short-term orientation; (6) indulgence versus restraint.

Culture explains a significant amount of the variance in decision-making regarding international operations such as forecasting and purchasing (Pagell et al., 2005). In fact, recent fine-grained analyses have shown that manufacturing practices' impact on performance depends on national culture (Wong et al., 2017, Wiengarten et al., 2011, Wiengarten et al., 2015). Interestingly, Wiengarten et al. (2015) found that although national culture and organizational culture independently affect the impact of lean practices on operational performance, the collectivistic nature of an organization cannot overcome the hindrances of an individualistic national culture. This suggests that national culture plays a dominant role in the pattern of organizational behaviors. Because plant network integration involves opening of boundaries and shared goals, we expect it will be related to culture, which is "hidden" in people's values. To say it differently, employees' predisposition to engage in coordination activities depends on the "unwritten rules" that characterize the social environment (Hofstede et al., 2010), in this case the host country. In that sense, we hypothesize:

> *H1*. National culture dimensions—(a) power distance, (b) uncertainty avoidance, (c) individualism, (d) masculinity, (e) long-term orientation and (f) indulgence— are associated with plant's network integration.

The moderating role of cultural distance

To understand network integration, our paper takes a step further in that it considers the dual embeddedness of a plant in the host environment and the intra-firm network environment (Almeida and Phene, 2004). Our starting argument is that plants are an "extension of organizing principles across borders" (Kogut, 1993: p. 137) since they are linked to the corporate headquarters, which determine the ultimate strategic direction of the firm. The frequent association of a product or brand to its home country irrespective of the place where the product was actually produced illustrates this linkage. Toyota is associated with Japan, Ikea with Sweden, and Intel with the U.S. The home country acts as the institutional field of the firm and, indirectly, influences the entities under its administration, including the plants. In that sense, the headquarters can be seen as the "origin" of the firm, and the home country has unique historical developments and social characteristics that have defined its culture. Japanese, Swedish, or American

companies are not alike for they have developed in different cultures. As stated by Kogut (1993), the institutional field in which the firm has developed sets the organizational structures, policies, and practices.

This means that a discrepancy between the culture at the home country, where the headquarters is located, and the culture at the host country, where a focal plant is located, can influence the plant's operations. Understanding and adjusting organizational practices will be easier in a country culturally similar to its home country than in one culturally distant from the home country (e.g. U.S. firm and a plant in Canada versus one in China) (Kostova and Zaheer, 1999). In line with this idea, cultural distance can be considered as a contingent variable that influences the effects of the national culture in the host country on the plant's operations. Then, we hypothesize:

H2. High cultural distance strengthens the effect of (a) power distance, (b) uncertainty avoidance, and (c) long-term orientation, (d) individualism, (e) masculinity, and (f) indulgence on the plant's network integration.

The moderating role of geographic distance

Another kind of distance that we expect to acts as a contingent variable is geographic distance. The theoretical arguments are similar to those of the moderating role of cultural distance inasmuch as national culture is associated to a particular nation/country. Actually, some authors include differences in cultures as an inherent part of geographic distance–c.f. Wiengarten and Ambrose (2017). Nonetheless, a fundamental argument for the impact of geographic distance is physical separation. Distance, in this case, limits the frequency and intensity of interaction between members in the home country and the host country. In addition, the headquarters-plant communication becomes more costly. These expenses come from: 1) lag time between communication and actual action, especially when the headquarters and the plant are located in different time zones; 2) long managerial travel time and its related opportunity costs; and (3) travel expenses associated with face-to-face encounters (Baaij and Slangen, 2013, Mykhaylenko et al., 2017). In the long term, distance can hinder the development of a strong partnership, damage knowledge exchanges, and undermine trust (Ambos and Ambos, 2009, Hansen and Løvås, 2004).

Lack of contact, shared identity, and informal cooperation, increases the perception of being part of a different group (Hansen et al., 2005, Tajfel, 1982) and less empathetic, supportive responses (Campbell et al., 2011). As a result, plant managers prefer to behave as other organizations in their field, i.e. the host country, because is more legitimate and less risky. This preference dictates the plant's network integration efforts. Accordingly:

H3. High geographic distance strengthens the effect of (a) power distance, (b) uncertainty avoidance, and (c) long-term orientation, (d) individualism, (e) masculinity, and (f) indulgence on the plant's network integration.

Our model is illustrated in Figure 1 in the next page.

Method

We combine both primary and secondary data sources. For primary data, we use data from the sixth edition of the International Manufacturing Survey Strategy (IMSS). The IMSS survey database contains information about plant's and headquarters' country location, integration with other plants in the network and plant's level of autonomy. The initial IMSS dataset consisted of 931 plants in 22 different countries. Our analysis uses a portion of the IMSS database that contains countries with available Hofstede scores and complete data for the variables under study. The final sample is composed by 581

plants in 21 countries. We complemented the survey data with Geert Hofstede's recognized database on national culture.

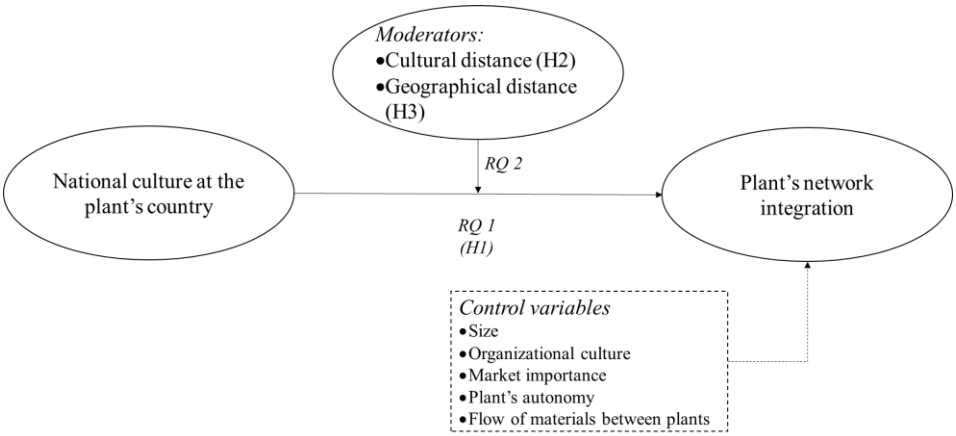

Figure 1 – Research model

The following variables are included in our model: plant's network integration (dependent variable), national culture dimensions (independent variable), cultural distance and geographical distance (moderating variables). Plant's network integration is measured by the plant's current level of implementation of programs to improve information sharing, joint decision-making, innovation sharing, use of technology and the development of a network performance management system. We operationalize our moderating variables as follows. We compute cultural distance by using a Euclidian distance measure (Kogut and Singh, 1988) and geographic distance, which is the distance between the headquarters' and plant's location countries, defined by latitude and longitude coordinates. We included the following control variables: size, market importance, organizational culture, plant's autonomy and flow of materials (SC inputs and outputs). A specific list of items is available from the authors. To assess the validity of our constructs we performed an Exploratory Factor Analysis (EFA) and checked for convergent and discriminant validities as well as reliability. The results show that all items scores are higher or equal than 0.7 and that the average variance extracted (AVE) values are greater than 0.5. These results show that convergent validity is met both at the item and construct levels. In addition, given that the square root value of AVE is higher than the correlation between constructs, discriminant validity is also met. Finally, all Cronbach alpha values are greater than 0.7 thereby reliability is also met.

To test direct and moderating effects, we run a series of multilevel regression models—we used the xtmixed command from Stat, which states for multilevel mixed-effects liner regression. Our data is clustered (i.e., plants are nested in countries) and different levels of analysis exist (i.e., country and plant level) in our dependent and independent variables. Therefore, a multilevel regression qualifies as the appropriate data analysis technique. The results can be found in Table 1 (next page).

Results

The first model (empty model) allows computing the ICC at the country level, which represents a value of 15.11%. This means that 15.11% of the variance of the dependent variable is explained by differences between countries, emphasizing the relevance of including country variables in our model. Model 0, includes the control variables of the study. Other studies present similar results (e.g., Kull and Wacker, 2010; Wong et al., 2017). The results show that organizational culture, market importance and autonomy

influence plant's network integration. Model 1 shows that the national culture does play a role in plant's network integration as Masculinity, Long-Term Orientation and Indulgence dimensions are negatively associated with plant's network integration. These results provide partial support to H1. Model 2a and Model 2b include our moderating variables. In the case of Model 2a, national culture distance positively moderates the relationship between two national culture dimensions (power distance and masculinity) and plant's network integration while negatively moderates the relationship between individualism and plant's network integration. In the case of Model 2b, geographical distance positively moderates the relationship between power distance and plant's network integration, and masculinity and plant's network integration. These results provide partial support for both H2 and H3. Appendix A includes the interaction plots for the moderating significant effects.

Table 1 – Multilevel regression results

Parameters	***Dependent variable: Plant's network integration***				
	Empty Model	***Model 0***	***Model 1***	***Model 2.a.Nat Cult***	***Model 2.b.Geo***
Grand intercept					
cons	3.185***	3.197***	3.216***	3.199***	3.214***
Control variables					
Size		0.029	0.031	0.034	0.031
Org. Cult.		0.381***	0.391***	0.393***	0.392***
Market imp.		0.164***	0.162***	0.162***	0.159***
Autonomy		0.086***	0.096***	0.099***	0.098***
SC input		-0.009	-0.006	-0.014	-0.009
SC output		0.061	0.057	0.548	0.056
Hypotheses					
PD			0.015	0.079	0.056
MAS			-0.118**	-0.237**	-0.244**
IND			0.073	0.047	0.035
UA			0.030	0.033	0.013
LT			-0.103**	-0.124**	-0.122**
INDUL			-0.996**	-0.234**	-0.207**
NatCult				0.013	
PDxNatCult				0.189**	
MASxNatCult				0.194**	
INDxNatCult				-0.147**	
UAxNatCult				-0.029	
LTxNatCult				0.198	
INDULxNatCult				-0.114	
Geo					0.028
PDxGeo					0.137**
MASxGeo					0.162**
INDxGeo					-0.075
UAxGeo					-0.016
LTxGeo					0.023
INDULxGeo					-0.089
σ^2	0.1176	0.0361	3.35e-15	3.24e-15	3.13e-15
τ^2_0	0.6600	0.4880	0.4868	0.4763	0.4652
Deviance (D)					
AIC	1179.25	1036.361	1027.571	1015.582	1017.59
BIC	1191.72	1073.754	1069.894	1045.564	1052.369

*p ≤ 0.10; ** p ≤ 0.05; *** p ≤ 0.00

Discussion

The objective of this paper was to unveil the role played by national culture on the plant's integration network levels. In response to the call of Boscari et al. (2018), we support our results with institutional theoretical underpinnings to explain how the embeddedness of dispersed plants in two different fields affects plants' behavior. To structure our discussion we will follow the two research questions in this study.

What is the role of national culture on the plant's integration level with other plants in its network? Our results suggest that national culture does play a role in the plant's network integration level. In that sense, we contribute to the current literature that has studied the role of national culture in operations management decisions—such as lean implementation, supply chain integration, and CSR standards (e.g., Pagell et al., 2005, Wiengarten et al., 2011, Wong et al., 2017, Orzes et al., 2017)—yet arrived to mixed results (Boscari et al., 2018). Specifically, the national culture dimensions of masculinity, long-term orientation and indulgence negatively affect the plant's network integration level. That is plants located in countries characterized by high masculinity levels, stronger long-term orientation and an indulgent lifestyle tend to integrate less with other plants in their same internal production network. This means that they are reluctant to improve joint information sharing, decision-making and the use of technology to enhance communication.

The negative effects of the masculinity and indulgence can be explained as follows. According to our theoretical arguments, plants in masculine cultures prefer merit-based practices and management by objectives (Newman and Nollen, 1996) over "feminine" practices that demand cooperation and trust. Plants in indulgent societies are prone to focus on friendship and leisure so running the risk of losing focus. Our results are congruent with those of Villena et al. (2011) who pointed out at the perils of excessive social capital because it reduces the ability to be objective and make effective decisions. The negative effects of the long-term orientation national culture dimension are explained as follows. We expected that plants in long-term-oriented cultures would actively try to connect with other plants in an attempt to be adaptive to the future. Our results show a different picture that can be explained by the following argument. Because personal stability is a core value in short-time-oriented cultures, plants may interpret network integration as a means of controlling the past and the present situations. A long-term orientated plant may consider that interplant integration does not allow adaptation and innovation because of the dependence on other plants in the network.

To what extent do cultural and geographic distances moderate the relationship in RQ1? Our results also show that cultural and geographic distances moderate the relationship between certain national culture dimensions and plant's integration level. National culture distance, which is the distance in cultural terms between the country in which the plant is located and headquarters, positively moderates the relationship between power distance as well as masculinity and plant's integration levels. When there is more distance in cultural terms between both countries, the impact of both dimensions in plant's network integration is higher (in the case of masculinity is less negative). In the case of individualism, the moderation effect of cultural distance implies that the negative impact of this cultural dimension on plant's integration is more negative. The results that touch power distance and individualism are expected—we expected that plants would strongly adhere to their national culture values and act accordingly whether facing larger cultural distances. On the other hand, the positive moderating effect of cultural distance on the relationship between the masculinity dimension and a plant's integration is unexpected. Higher cultural distance actually

helps plants to overcome the liabilities of being in a country characterized by high masculinity levels. One possible explanation is that plants in countries whose culture is too different from that of the home country feel the necessity to understand better headquarters' mandates. This, paradoxically, may encourage them to connect with other plants that, after all, are part of the same organization. Because plants in a country with high masculinity levels are ambitious, being culturally distant to the home country, make them more attentive and interested to improve coordination and show their contribution to the company. Although prior researchers have found that the "distance paradox" applies for headquarters (Hutzschenreuter et al., 2016), our findings show that it does for plants too.

Finally, in the case of geographical distance, the relationship between power distance as well as masculinity and plant's network integration is positively moderated in both cases. Once again, the masculinity-distance interaction seems to follow the "distance paradox" argument.

Conclusion

Although prior studies focus on antecedents of plants' network integration at the plant- and firm-level, our study highlights the importance of the plant's embeddedness in its institutional environment. Specifically, our results show that three dimensions of national culture, masculinity, long-term orientation and indulgence do play a role in how a plant integrates in the network, and that the relationship between three dimensions of culture (power distance, masculinity, and individualism) and network integration are moderated by cultural and/or geographic distance.

Concerning theoretical contributions, this study confirms the importance of including institution-related factors (in the form of national culture) to study operations practices and extends this to the context of global production networks. We add to the literature by putting heavier emphasis on the informal institutional contexts in which plants and networks are embedded. By testing the effects of national culture and two types of distances, we further the understanding of context for managing production networks.

Concerning practical contributions, this research provides managers with insights on how to take into account cultural variables when coordinating production networks. As an example, if a plant located in a country that is predominantly masculine, long-term oriented and indulgent—e.g. Switzerland—its efforts to improve its connection with other plants will be negatively affected by the ingrained values of its national culture. The damaging effects of the masculine values, however, may be lessened if the headquarters are cultural distant, e.g. Portugal. However, this may strengthen the negative effects of the Swiss individualist culture. Although a perfect combination is hard to find, our results provide useful information for location decisions.

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Appendices

Appendix A. Interaction plots