**Title:**

Exploring the impact of geographical traits on the occurrence of supply chain failures

**Abstract**

**Purpose** – This research explores the impact of geographical traits on the occurrence of on-time or the risk of late deliveries; one vital category of supply chain failures. Specifically, the regulatory environment framework and national and organizational culture are explored as potential contingency factors affecting these supply chain failures. Furthermore, we assess whether or not potential negative cultural characteristics at the national level can be addressed through specific organisational culture at the organisational level of practice.

**Design/methodology/approach** – This study combines primary survey data from 647 plants in 12 countries collected through the Global Manufacturing Research Group (GMRG) with secondary national data from the World Economic Forum and Hofstede’s national culture dimensions to test our six hypotheses.

**Findings** – Results indicate that firms situated in a regulatory national environment that is conducive to trade experience fewer late deliveries; a national infrastructure that has continuously been neglected leads to more late deliveries. Firms situated in countries with low levels of national uncertainty avoidance experience fewer late deliveries. Supplier communication should be practiced at an organisational level to excel in these countries.

**Originality/value** – This article adds to the ongoing discusses about the importance of contingency factors at the country level (i.e., institutional and cultural factors), which need to be considered when setting up global supply chains. It also contributes important empirical insights to the convergence/divergence discussion.

**Keywords:** supply chain disruptions, surveys, crosscultural management, purchasing, risk management

**Paper type** – Research paper

# 1. Introduction

Over the past decades companies have increasingly disintegrated their supply chain. For example in the automotive industry it used to be a common strategy for OEMs to develop and produce the majority of products and parts in-house (Holweg *et al.*, 2016). Nowadays the continuing trend of focusing on core competencies has resulted in very fragmented and dispersed supply chains (Lorentz *et al.*, 2012). This “core competency strategy”, which has its origins in the resource-based view, has certainly provided companies with multiple advantages such as cost savings, capacity flexibility, innovativeness, etc.; however, these disintegration practices have also made supply chains more fragile and exposed to supply chain failures. For example, as reported by the Business Continuity Institute (2014), about 81% of companies are affected by supply chain failures, of which above 23% experience losses of more than € 1 million per incident. Causes of such failures include issues in outsourcing, transport network disruptions and the passing of new laws and regulations (Business Continuity Institute, 2014). One recent example of a supply chain failure could be witnessed in the dispute between Volkswagen (VW) and two of its German suppliers of seat covers and gearboxes (Taylor and Laurence, 2016). The dispute was triggered by a disagreement over whether changes can be made by VW to an “already agreed upon” supply contract. The two suppliers disagreed with VW and wanted the buyer to stick to the contract. In order to increase pressure on VW, both suppliers decided to provisionally halt their deliveries to VW. As a result of the withheld supply, VW had to temporarily stop production at six of its plants until the disagreement was resolved.

Of the multiple risks a company faces, supply chain failures are probably one of the more difficult events to classify in terms of likelihood and severity. Talluri *et al.* (2013) distinguish between three broad categories of supply chain failures: delays, disruptions and distortion. Delays pertain to individual orders delivered later than expected (Chopra and Sodhi, 2004). It is usually caused by an inflexibility of the supplier to respond to changes in demand, caused by internal (e.g., organizational procedures, production capacities) or external (e.g., transportation infrastructure, inspections) factors. Disruptions can be defined as events that interrupt the flow of material somewhere along the supply chain stages (i.e., from raw material production to the end customer) (Craighead *et al.*, 2007), presenting a serious threat to the normal business operations (Bode and Wagner, 2015). Distortions relate to unforeseen changes in order size (Disney and Towill, 2006). In this paper we analyse the first category of supply chain failures, i.e., supply delays. Supply delays are often used to describe the risk involved in the supply management process (e.g., Schoenherr *et al.*, 2008; Tummala and Schoenherr, 2011), and are a commonly employed measure in the supplier risk management literature (Wu *et al.*, 2006).

Previous research has analysed contextual conditions at the company level that manifest themselves as antecedents of supply chain failures or the successful dealing with such (e.g., Durach *et al.*, 2015; Scholten and Schilder, 2015). Similarly, research has also started to notice that contextual factors at the country level (i.e., geographical traits) can be a cause or antecedent for failures in supply chains. Wiengarten *et al.* (2013), for example, explored the impact of contextual risk factors for the success of outsourcing contracts. Besides others, they identified that a country’s institutional rule of law impacts on cost and quality performance. Other studies have also started to explore the impact of culture at the country and organizational level (e.g., Cadden *et al.*, 2013; Freeman and Browne, 2004). Multiple studies have identified that culture as a contextual factor can have positive and negative implications on the efficacy of manufacturing practices (e.g., quality management, lean) and supply chain practices (e.g., purchasing management) (e.g., Busse *et al.*, 2016; Kull and Wacker, 2010). However, the impact of institutional and cultural factors on delays in supply chains has not yet been explored sufficiently.

This research is set out to fill this void in the literature through exploring the following research questions: *(1) To what extent do geographical traits (i.e., institutional and cultural factors) lead to supply delays? And (2), to what extent can organizational practices counteract potential geographical disadvantageous traits in terms of on-time deliveries?* Providing answers to these questions will enable managers to make more informed conclusions and decisions on location, supplier selection and performance. Furthermore, from a research perspective, this paper contributes to the on-going debate on culture and operations and supply chain management (SCM) and institutional factors in global production networks.

# 2. Literature review: Geographical traits and delivery failures

## *2.1. Institutional factors and delivery performance*

Previous research has identified that geographical and institutional factors not only impact on the adoption of managerial practices such as sustainability practices (Pagell *et al.*, 2013) but also impact on the efficacy of such practices (Wiengarten *et al.*, 2014).

In the risk event of receiving a late delivery an important institutional factor is the regulatory environment under which trade takes place. The regulatory environment can be defined as a variable that conceptualizes the extent to which the country’s environment (the host country of the buyer) is conducive to trade (Kraay *et al.*, 2010). It includes indicators that capture the general quality of governance, and indicators that measure the openness to foreign participation which includes the ease of hiring foreign labour, the extent to which the policy environment encourages foreign direct investment, the availability of trade finance, and an index of multilateral treaties signed by the country pertaining to trade (Lawrence *et al.*, 2012).

Based on recent findings reviewed in international operations and supply chain literature we propose that a favourable regulatory environment that can be characterized to be conducive to trade (i.e., open borders, willingness to engage in cross-border trade, general support to trade) will enable the occurrence of more on-time deliveries. National governance mechanisms that ensure a high degree of rule of law and a general high quality of governance are general supporting mechanisms at the country level for successful trade relationships. Wiengarten *et al.* (2013) tested and confirmed the impact of a country’s rule of law for the success of outsourcing contracts. The authors argued that whenever companies are situated in countries with relatively low levels of rules of law they need to employ additional safeguard mechanisms to support their outsourcing contracts such as monitoring and sanctioning. Furthermore, Wiengarten *et al.* (2015a) confirmed the importance of a country’s regulatory quality for the success of e-business-enabled supply chains.

We thus speculate that a regulatory environment that provides high quality of governance will act as an additional safeguard to receive goods on time from suppliers. Suppliers that might not fulfil their contractual agreements and deliver late might get sanctioned in a high quality regulatory environment. Furthermore, in the case of cross-border activities between the supplier and buyer, a regulatory environment that enables efficient clearance of goods across boarders also enables on-time deliveries. Subsequently, we propose:

 **Hypothesis 1:** *Firms situated in countries with a regulatory national environment that is conducive to trade will experience more upstream on-time deliveries.*

In addition to the regulatory environment that captures the political and general business attitude towards trade at the country level, authors have argued that the infrastructure that enables trade in terms of the logistical movement of goods might also impact on the risk of not receiving the ordered good on time (Ekici *et al.*, 2016). Wiengarten *et al.* (2014) explored the importance of a country’s logistical capabilities for the efficacy of external supply chain integration. The authors argue that supply chain integration comes at a cost and companies need to weight these costs to find the right level of external integration, which by their argument depends on the level of logistical capabilities. They identified that a country’s logistical performance (i.e., logistical capabilities) does affect the efficacy of customer integration in terms of operational performance (i.e., cost, flexibility and delivery performance).

Using a similar line of argument, we propose that firms that are situated in countries with low levels of critical infrastructure (i.e., logistical capabilities), and thus are in need of development or repair, will likely have fewer on-time deliveries as companies situated in countries where the critical infrastructure is continuously developed. Companies that are situated in countries where the development need of critical infrastructure has continuously been neglected face the risk that this ‘country level’ contingency factor impact the likelihood of receiving ordered goods according to schedule, which may in turn disrupt the production process. Subsequently, we propose the following:

**Hypothesis 2:** *Firms situated in countries where the need for critical infrastructure and its development has continuously been neglected will experience significantly fewer upstream on-time deliveries.*

## *2.2. Cultural factors and delivery performance*

In addition to the institutional contextual factors, we now review and analyse the role of culture and its critical importance for the on-time delivery of orders. Culture has been conceptualized and defined at various levels of analysis such as national culture, organizational, and group culture. In this paper we are particularly interested in the conceptualization of culture at the national and organizational level of analysis. National culture can be defined as traits, beliefs, and preferences that members of a society share that shape their behaviour (Hofstede, 1984; Wiengarten *et al.*, 2015b). Organizational culture on the other hand can be defined as the collective programming of the employees’ mind that sets members of one organization apart from the members of others (Hofstede et al., 1990; Hofstede, 1998). Similarly, Daft (2012) defined organizational culture as *“the set of values, guiding beliefs, understandings, and ways of thinking that is shared by members of an organization and is taught to new members as correct”* (p. 576).

### *2.2.1. National culture and delivery performance*

Various models of national and organizational culture have been developed that operationalize culture across multiple dimensions (Hofstede et al., 1990; Hofstede, 1998; House et al., 2002; Schwartz, 1992; Trompenaars et al., 1998). From the different dimensions considered (e.g., power distance, individualism, masculinity, uncertainty avoidance), we focus on the national cultural trait of Hofstede’s (1990) uncertainty avoidance index (UAI). According to Pagell *et al.* (2005), *“UAI measures the extent to which countries deem the pursuit of certainty important”* (p. 376). Nowadays the supply chain environment is widely characterized by shortening product life cycles, changes in consumer preferences, and larger product varieties (Ferdows, 1997; Jordan and Bak, 2016). This requires supply chains to be adaptable to changes and agile in the sense of being responsive, and aligned to every changing corporate strategies (Christopher and Towill, 2001; Lee, 2004). A so-called *Triple-A-Supply Chain* (a supply chain that is agile, adaptable and aligned) would very likely result in more on-time deliveries and general improved operational and financial performance (Lee, 2004). However, this would also require the humans involved in orchestrating and running the supply chain to be adaptable and agile, which requires individuals to be comfortable with uncertain situations (i.e., exhibits low levels of UAI).

Previous literature has extensively explored the role of national culture for the level of adoption (Cagliano *et al.*, 2011) and success of multiple operations and supply chain practices (Kull and Wacker, 2010). There is considerable evidence suggesting that certain characteristics of culture impact on the efficacy of selected operations and supply chain practices (Wiengarten *et al.*, 2015b). For example, recently Bockstedt *et al.* (2015) explored the role of national culture and wealth in the innovation context. Besides others they identified that UAI can have a negative (the effect weakens by an increase in national wealth) impact on problem solving efforts in terms of innovations. At the supply chain level Davis *et al.* (2014) identified that that the e-business value creation process is significantly enhanced in companies operating in national cultures that are characterized by cooperation and interdependence, and promote group-level interests over individual interests. Furthermore, multiple studies have confirmed that national culture impacts on the level of implementation and success of quality management practices and programs such as TQM, ISO 9001 and the likes (e.g., Kull and Wacker, 2010; Power *et al.*, 2010; Wiengarten *et al.*, 2011). For example, Wiengarten *et al.* (2011) explored the impact of various characteristics of national culture on the success of quality management practices (i.e., TQM, ISO 9000, SPC and Six Sigma). In terms of UAI they identify that quality management practices have a stronger positive effect on operational performance when plants are situated in countries characterized by low levels of UAI.

In acknowledging the general findings in the international operations and SCM literature and the particular finding by Wiengarten *et al.* (2011) with regard to quality management practices and UAI, it is reasonable to expect a similar result regarding delivery performance. Countries that exhibit a high tolerance of uncertainty and ambiguity (i.e., low UAI score) are characterised by a culture that does not try to control the future, but rather let things happen (Hofstede, 1984). As opposed to countries with a strong UAI, they maintain less rigid codes of behaviours and are amenable to, sometimes, unorthodox actions or ideas. Weak UAI societies are characterized by a more relaxed attitude in which practice counts more than principles. We therefore assume that low UAI scores characterize societies that are more flexible to adjust established business process to avoid potential inbound delivery failures, while nations with high UAI scores tend to be less flexible to adjust to changes, thus not meeting the agility and adaptability requirement for today’s supply chain environment (Lee, 2004). Subsequently, we propose the following:

**Hypothesis 3a:** *Firms situated in countries with high levels of uncertainty avoidance (UAI) at the national level will experience significantly fewer upstream on-time deliveries.*

### *2.2.2. Organisational culture and delivery performance*

In the previous section we argue on the pivotal role of national culture in terms of UAI for the occurrence of on-time or the risk of late deliveries. However, it is also reasonable to expect that this phenomenon is not solely bound to the national level but may also occur at the organizational level (Naor *et al.*, 2010).

Naor *et al.* (2010) analysed the impact of national and organizational culture on manufacturing performance. They conceptualized national culture using scores from the GLOBE model and compared the performance amongst firms situated in Eastern and Western countries. At the organizational level they identified that some selected traits of organizational culture (i.e., power distance, future orientation and performance orientation) between companies situated in Eastern and Western countries differ significantly. Pagell (2004) explored the role culture as an enabler of internal integration. He identified key cultural traits at the organizational level, which lead to open communication and enable internal integration. Communication is also a key factor in achieving on-time deliveries (Wieland and Wallenburg, 2013). It is important to the creation of flexible supply chains (i.e., adaptable and agile processes) from both an internal and external integration perspective (Cao *et al.*, 2015). It is key to dealing with uncertainties that are present in transnational manufacturing supply chains (Ferdows, 1997), and may give the communicating partners a head start to respond to delivery issues (Yang *et al.*, 2008). Ritchie and Brindley (2007), for example, concluded from case studies that communicating partners commonly manage to resolve disagreements before they turn into a serious issue to supply chain operations. Scholten and Schilder (2015) highlighted from eight case studies that communication between buyer and supplier increases visibility and in turn velocity and flexibility to better deal with supply chain risks, summarizing our before depicted line of argument. Based on these studies, we propose the following:

**Hypothesis 3b:** *Firms practicing high levels of supplier communication at the organizational level will achieve more upstream on-time deliveries.*

### *2.2.3. National, organisational culture and delivery performance*

In the previous two sections we proposed that national as well as organisational culture is related to upstream on-time delivery performance. Whilst this certainly is of great importance from a managerial perspective it might be even more important for managers to know whether they can overcome cultural disadvantages at the national level through organizational culture. Or in other words *to what extent can organizational practices counteract potential geographical disadvantageous traits in terms of on-time delivery failures?* To explore our second research question we explore the interactions between organizational and national culture in terms of UAI in relation to upstream on-time delivery performance.

The interplay between organizational and national culture has frequently been categorized into the convergence hypothesis and national specificity argument (Rungtusanatham *et al.*, 2005) suggesting a superior or inferior role of national versus organisational culture. The convergence hypothesis proposes that companies can influence and mitigate the potentially negative impact of national culture through their own practices and culture (Von Glinow *et al.*, 2002). The divergence hypothesis, on the other hand, proposes that national culture has the upper hand and plays the dominant role and thus organizational culture cannot overcome national cultural differences (Child and Keiser, 1979). According to Ralston *et al.* (1997), *“national culture, not industrialized practice, drives values, and that, even if the country becomes industrialized, the values systems in the work force remain largely unchanged” (p. 183).* Thus, if our findings indicate that organizational supplier communication (UAI at the organizational level) moderates the impact of national UAI on upstream delivery performance we can provide support for the convergence hypothesis. If this is the case, managers will have a lever to alter potential disadvantages from a national culture perspective.

Wiengarten *et al.* (2015b) explored the interplay of national and organizational culture in terms of lean practices through exploring its efficacy levels in the realm of individualism/collectivism. Specifically, they empirically tested whether plants situated in countries with a less favourable individualistic culture for lean practices can overcome these negative influences through practicing high levels of collectivistic organisational culture. Whilst their results showed a tendency that this might be the case, they ultimately did not find support for their hypothesis. Naor *et al.* (2010) specifically explored the interplay between organizational and national culture from a manufacturing performance perspective. Their study provided mixed results and thus support for the convergence and divergence perspective (Ralston *et al.*, 1997; Shenkar and Ronen, 1987).

Whilst previous findings are mixed regarding the interplay of national and organisational culture empirical evidence is still relatively sparse. Therefore, without being biased towards either of the perspectives we propose two alternative hypotheses:

**Hypothesis 4a:** *Firms situated in countries with high levels of UAI can overcome these negative national culture influences through practicing high levels of supplier communication.*

Conversely, we propose:

**Hypothesis 4b:** *Firms situated in countries with high levels of UAI cannot overcome these negative national culture influences through practicing high levels of supplier communication.*

# 3. Methodology

The following Figure 1 illustrates and summarizes our research model, including the control variables.

Figure 1: Research model



## *3.1. Dataset*

We used data collected during the fifth round of the GMRG’s survey to test our hypotheses. The data were collected between 2013 and 2014. The GMRG is a group of scholars that has collected data from manufacturing plants worldwide since 1985 (Whybark, 1997). Various studies have been published that are based on the GMRG data set on topics such as SCM, operations strategy and global operations (e.g., Kull and Wacker, 2010; Schmenner and Vastag, 2006).

The unit of the analysis was the plant, and the target respondents were plant managers. The respondents were encouraged to seek input from other functions if they were deemed useful. As a result, for each plant up to six respondents were involved in filling in the questionnaire. The majority of the data were collected electronically through web surveys and email. Tables 1a and 1b provide an overview of the data set. Our sample comprises 647 responses from manufacturing plants across 12 countries (Table 2).

It is important to note that the fifth iteration of the GMRG survey had 1063 respondents in total. However, in addition to the core module of the survey, researchers were free to select specific sections from the innovation, sustainability, SCM, and facility culture modules. Since we used data collected from the supply chain module our sample size was significantly reduced. We thus tested for significant differences in terms of the number of employees and the percentage of foreign suppliers between the 647 and the 1063 respondents using independent sample t-test. The results indicate that mean scores for the number of employees (p=.236; t=1.186) and the percentage of foreign suppliers (p=.248; t=1,156) are not significantly different between the two samples.

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Insert Tables 1a and 1b about here

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Insert Table 2 about here

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## *3.2. Measures*

To test the hypotheses in the prosed research model we deployed various measures. Regulatory environment of the country is assessed by using a composite index provided by the World Economic Forum and issued in the Global Enabling Trade report 2012 (Lawrence *et al.*, 2012). The index is composed of eight country level composite scores and measures gauging (see Table 3). Scores for the composite index range between 1 (=worst performance) and 7 (=best performance). All sub-indices with the composite index were issued by the World Economic Forum and the International Trade Centre in the period 2011-2012 drawing on data collected in the Global Competitiveness Survey and the Trade Treaties Map. More detailed information regarding data collection in each of the sub-indices and the deployed measures can be obtained from (Lawrence *et al.*, 2012).

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Insert Table 3 about here

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The variable of “Prolonged neglect of critical infrastructure and its development needs” is a single item measure resulting from the Executive Opinion Survey 2012 of the World Economic Forum. 13,000 executives in 144 countries were asked to assess whether they are concerned regarding the neglect of critical infrastructure and its development needs in the particular country. The scale ranged from 1 (=not concerned) to 19 (=highly concerned). The data is published in the Global Competitiveness Report 2014-2015. The interested reader is referred to the (“Executive Opinion Survey 2012”, 2012)

Differences in national culture UAI is measured through (Hofstede, 1984). Hofstede’s model of cultural dimension was last updated in 2010.

The latent construct “supplier communication” is operationalized by three items from the GMRG survey (7-point Likert scale; 1 = not at all; 7 = great extend) tapping into the extent to which the buying firm and its key suppliers (a) exchange proprietary information, (b) inform each other about events affecting the other party and (c) regularly exchange information of supply and demand forecast (Carr and Smeltzer, 1999; Paulraj *et al.*, 2008), with standardized regression weights .421, .648 and item c as the marker.

The dependent variable of “upstream on-time deliveries” also results from the GMRG survey’s fifth round (Table 4). It is a non-perceptual single item variable that measures the percentage of late deliveries (reverse measure) at the respondent’s plant. However, these data are not normally distributed and have an upper limit of 100%. Consistent with previous literature (e.g., Queenan *et al.*, 2016), and in order to meet normality assumptions required in our statistical analysis, we conduct a logit transformation of the data: $logit(p\_{i})=log⁡[p\_{i}/ (1-p\_{i})]$, where *pi*is the logit transformedlate delivery measure.

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Insert Table 4 about here

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Four control variables are added in the hypotheses testing procedure. Industry type was controlled for industry using 20 industry dummies, accounting for the effect of the 21 industry sectors within our sample. The plant’s supply chain position was included by measuring the percentage of sales to end-users. The size of the plant was controlled for, using the number of employees as a proxy measure. Lastly, the share of international supplies was assessed by measuring the percentage of purchases coming from foreign suppliers.

## *3.3. Measure assessment*

During collection of company data by the GMRG group, a common research procedure was used in each country. Following the process suggested by Sperber *et al.* (1994), a double back translation of the original English construct items was conducted to adequately translate the items into the local language of each country. In this process, the questionnaire was translated into the local language by a member of the local research team. It was then back-translated into English by a different team member to assure the integrity of the translation. The questionnaire was then sent out to the plants. After responses had been returned to the local survey administrators, they were tested for non-response bias. Therefore the means of all construct items were compared via t-tests between the first and last third of responses (Armstrong and Overton, 1977). No statistically significant differences between these groups were reported.

 For the purpose of this study, all responses with missing item values were removed. In further screening the data, we also removed unengaged respondents; leaving us with 647 usable responses. We then tested and confirmed unidimensionality of the latent construct measures of supplier communication. Reliability of the latent construct measures was estimated calculating Cronbach’s alpha (α=.757), indicating acceptable construct reliability. Further descriptive statistics for the employed measures and correlations are listed in Table 5.

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Insert Table 5 about here

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Addressing the potential for common method variance (CMV), respondents were ensured complete anonymity in order to address social desirability effects. The constructs used for this study were further mixed with construct items unrelated to this study. In addition, we assessed the extent to which up-stream on-time delivery co-varies with the supplier communication measures. Including up-stream on-time delivery as a scale measure creates a composite scale with extremely poor reliability (e.g., α = 0.042), indicating that supplier communication is an independent measure.

Curve estimation was then conducted for all relationships in the model. All relationships were found to be sufficiently linear to be tested in a covariance-based structural equation model algorithm. Subsequently, multi-collinearity was tested and found to be no issue among the independent variables; suggesting that the findings can be meaningfully interpreted. To assess cross-country level measurement equivalence we followed the confirmatory factor analysis (CFA) method as outlined in Power *et al.* (2015). The CFA method provides a rigorous approach to measurement equivalence assessment when relatively small samples exist within each country. It was used to identify whether a single factor is consistently present in each country (configural invariance) and whether the measurement items load similarly on this factor (metric invariance). Configural invariance was assessed through conducting a multi-group CFA for the plant level data. The resulting model fit indices are acceptable (χ²/df =1.785; CFI=.978; GFI=.970; RMSEA=.035; p-value=.010) suggesting configural invariance of the 12 country groups. Metric invariance was tested for by conducting a χ²-difference test of the model with constraint and unconstraint regression weights. Results suggest that the groups are not different at the model level.

# 4. Analysis and Results

Table 6 presents the results of the covariance-based structural equation model. The relationships between country characteristics and company practises and outcomes were tested following methodological approaches taken in Kaufmann and Carter (2006) and Wiengarten *et al.* (2011, 2015a).

The results, as presented in Table 6, have to be interpreted considering that the dependent variable, i.e. on-time delivery, was logit transformed in order to meet normality assumptions in our model. The transformation does not affect the general direction of the relationship, i.e. whether relationships between the independent variables and the dependent variable are negative or positive; however, the degrees of these relationships are non-linear: $logit (P)=β\_{0}+ β\_{1}$X where X isany of the independent measures and $\hat{ε}=0$, or with the formula transformed as $P=\left[e^{β\_{0}}e^{β\_{1}X}\right]/[1+e^{β\_{0}}e^{β\_{1}X}]$.

Squared multiple correlations are .143 for the logit transformed dependent variable. The model exceeds the recommended threshold for statistical power of .80 (MacCallum *et al.*, 1996). Thus, we conclude that the sample size is adequate and the model has sufficient power to detect global model misspecification.

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Insert Table 6 about here

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In order to explore the impact of institutional factors on delivery failures we proposed two hypotheses. In hypothesis 1 we proposed that firms situated in a regulatory national environment that is conducive to trade, experience more on-time deliveries than firms situated in countries were regulation is less conducive to trade. Similarly, in hypothesis 2 we proposed that firms situated in countries where the need for critical infrastructure and its development needs have continuously been ignored, experience significantly fewer upstream on-time deliveries than firms in countries where the critical infrastructure is continuously developed. The results indicate support for both hypotheses. A regulatory national environment that is conducive to trade helps companies to experience fewer late deliveries; while a national infrastructure that has continuously been neglected leads to more late deliveries.

In order to research the impact of cultural factors on upstream on-time deliveries we proposed two further hypotheses. In hypothesis 3a, we proposed that that firms situated in countries with a national culture that exhibits high levels of UAI will experience more late deliveries. Countries with high levels of UAI are characterized by a rather strong adherence to norms and agreements, as opposed to low UAI countries with a more relaxed attitude. In hypothesis 3b, we proposed that in general, firms practicing high levels of supplier communication at the organizational level will achieve more upstream on-time deliveries. We found support for both hypotheses, suggesting that both, the national culture in the form of national UAI and organizational practices, in the form supplier communication impact on the outcome of supply chain relationships in terms of on-time deliveries. However, for hypothesis 3b we only found marginal support at the .10 level in our results.

In hypotheses 4a and 4b we proposed two contradicting hypotheses. Hypothesis 4a followed the convergence stream of argument and proposed that firms situated in countries with high levels of UAI can overcome these negative national culture influences through practicing high levels of supplier communication. Hypothesis 4b suggested the contrary, proposing that this type of national culture cannot be moderated by supplier communication, thereby drawing on the divergence stream of argument. Surprisingly, we found no support for both hypotheses. The results suggest that that national UAI culture can significantly impact buyer-supplier operations, but the findings are different from our hypotheses (Figure 2).

Figure 2: Significant interaction moderation (H4a and H4b)



Figure 2 suggests for companies situated in high UAI countries a negative impact of supplier communication, while the difference is marginal and may as well suggest indifference. We interpret this finding, as in countries with high levels of UAI (i.e., countries where the society tries to control the future and is less flexible to adjust to changes), high levels of communication with suppliers is a sometimes useless undertaking. Remember the VW example at the beginning of this paper. All three companies involved in the described dispute are from Germany, a country with a relatively high UAI score of 65. Both suppliers demanded VW to stick to the contractual agreements, no matter how often VW tried to communicate the new market situation. While this case arguably describes a disruption rather than a delay, it is still a prime example of how the national UAI culture can impact buyer-supplier operations.

From Figure 2, however, we also derive a significant interaction moderation experienced in low UAI countries. It turns out that firms situated in nations with low levels of UAI can make a significant impact on on-time deliveries through supplier communication. Figure 2 suggests that firms in low UAI countries need to establish higher levels of uncertainty avoidance practices (i.e., supplier communication) at the firm level in order to achieve more upstream on-time deliveries. We interpret these findings as, since countries with low UAI scores have less rigid codes of behaviours, firms in these countries need to practice high levels of supplier communication in order to excel. If buying firms are unable to follow these regional demands for firm practices, they may be better advised to move operations to countries with high levels of UAI. This suggests that, as opposed to what we would have initially expected from reviewing the literature, supplier communication does not provide a remedy for firms situated in high UAI countries but a success factor for firms situated in low UAI countries. We therefore reject hypotheses 4a and 4b.

# 5. Discussion and Implications

## *5.1 Discussion of results*

This study investigates the impact of geographical traits on the occurrence of supplier late deliveries. Specifically, the following two interrelated research questions have been prompted and explored: *(1) To what extent do geographical traits (i.e., institutional and cultural factors) lead to supply delays? And (2), to what extent can organizational practices counteract potential geographical disadvantageous traits in terms of on-time deliveries?* The results of this study lead to the conclusion that, in terms of the first question, geographical traits do matter when it comes to analysing the likelihood of supply chain failures in terms of upstream on-time delivery failures. Specifically, our results indicate that low levels of regulatory environment (H1) and a lack of infrastructure (H2) increases the risk of supply chain failures in terms of receiving late deliveries from suppliers. Furthermore, from a cultural perspective our results indicate that the risk of late upstream deliveries increases when the focal company is located in a country characterized by high scores of UAI (H3a). It seems that a national culture that is more flexible and adapts practices and principles as required (i.e., low UAI scores) are better equipped to deal with delivery issues.

Additionally, through our second research question we explored the interactions between national and organizational culture from an UAI perspective. Answering the second research question will inform us about whether or not implemented uncertainty avoidance practices (i.e., supplier communication – H3b) at the company level can help managers to reduce the negative cultural implications at the national level. Our results reject the proposed hypotheses (H4a and H4b). Contrary to our proposition, it is not the companies in high UAI countries that need to practice high levels of supplier communication to excel in their cultural environment in term of increasing up-stream on-time deliveries, but the companies situated in low UAI countries. We will discuss the theoretical and practical implications of these findings in the following subsections.

## *5.2 Implication for theory*

Our study contributes to the on-going and lively debate on the role of country contingency factors in transnational SCM (e.g., Ferdows, 1997; Sousa and Voss, 2008). Multiple studies have confirmed the role of contingency factors at the country level on operational performance (e.g., Kull and Wacker, 2010; Power *et al.*, 2010) and the efficacy of operational and supply chain practices (e.g., Kaufmann and Carter, 2006; Wiengarten *et al.*, 2015b). This current study further develops this field of research through specifically focusing on supply chain failures in terms of upstream on-time delivery performance. Previous research has discussed and identified multiple reasons that lead to delivery failures in terms of inventory levels, lean practices, or supplier management (Ho *et al.*, 2015). However, country level factors have been largely ignored in that respect. Our results confirm previous research in the sense that cultural and institutional factors matter in terms of operational or supply chain performance. The regulatory environment, infrastructure and national culture in terms of uncertainty avoidance impact on delivery performance and thus on supply chain performance.

Additionally, we empirically tested the validity of the convergence hypothesis and national specificity argument. To do so we tested the impact of UAI practices at the organizational level in terms of supplier communication. Supplier communication was introduced as a moderating variable to potentially dampen the negative impact of UAI at the national level on upstream on-time delivery performance. Our results indicate that companies situated in countries with low levels of UAI can and should rely on uncertainty avoidance practices in terms of supplier communication at the firm level. However, the results also indicate that the firm level culture (i.e., supplier communication) does not help to excel in countries with high UAI levels. Subsequently, we further develop the lively convergence/divergence discussion by providing additional empirical insights (Naor *et al.*, 2010; Wiengarten *et al.*, 2015b).

## *5.3 Implication for practice*

Whilst the findings and results of this study are certainly of importance from a theoretical perspective they might be even more so from a practical perspective. Companies have designed their global supply network taking multiple contingencies into considerations such as the availability of suppliers, skilled workforce, or the proximity to potential customers. Managers have set-up production facilities making location decisions with the goal of cost reduction, differentiation and the confidence of developing a robust supply chain that is resilient towards disruptions. We provide managers with additional factors that need to be considered when designing a global supply chain that keeps it delivery promises in terms of regulatory, infrastructural and cultural factors.

Furthermore, when benchmarking the performance of certain production facilities it is important to take into consideration the potential negative implications of being situated in a country characterized by low levels of regulatory system, infrastructure and high levels of UAI. This is an important consideration since the upstream supplier can at least to some extent not solely be blamed for late deliveries. If a managers sets up a production facility in a country with inferior infrastructure, regulatory systems and high levels of UAI to, for example, gain cost advantages they need to be aware that the on-time delivery performance of their suppliers will drop and thus production disruptions may occur.

However, this current study also tested whether organizational practices can potentially dampen the negative effect of a locational disadvantage in terms of national culture through implementing uncertainty avoidance practices at the organizational level. The results indicate that implementing supplier communication processes presents an important need to be successful in countries with low levels of UAI. It is a potential success factor to excel in low UAI country environments with sometimes unstructured processes and undefined actions or ideas. However, the results also indicate the supplier communication is unfortunately not a remedy to overcome the locational disadvantage posed by countries with high levels of UAI. While this finding is not what we hoped to give managers to take along, it still provides managers with more leeway as well as additional tools when deciding on where to locate their production facilities.

# 6. Conclusion

These results add to the on-going discussion of the importance of contingency factors at the country level when setting up global supply chains. Furthermore, this study has identified a potential lever, in terms of supplier information sharing needed to be successful, in terms of on-time delivery performance, in certain cultural environments. However, as it is the case with the majority of studies, our research suffers from multiple limitations that the reader needs to take into consideration when interpreting our findings. First, the GMRG dataset that we use in this study provides some trade-offs. Whilst we have the opportunity to analyse a truly global dataset it only provides limited information in terms of sampling and response rates, which is a severe limitation. Second, this study solely considers the location of the buying company when assessing the impact of country level contingency factors. However, the location of the supplier might also likely to influence their on-time delivery performance in terms of the country specificities. We tried to partially take account for this limitation through considering the share of foreign supplies in the buyer’s supply portfolio as a control variable in our model.

Nevertheless, despite these limitations this research provides new and important insights into the role of country level contingency factors in terms of institutional and cultural factors on supply chain failures (i.e., delivery performance).

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**Table 1a:**Company sample descriptive – origin, size

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **Sample size** | **Number of employees** | **N** |
| Australia | 24 | ≤ 10 | 34 |
| Croatia | 93 | 11 - 50 | 137 |
| China | 77 | 51 - 250 | 282 |
| Germany | 37 | 251 - 500 | 83 |
| Hungary | 31 | 501 - 2000 | 76 |
| Ireland | 25 | 2001 - 5000 | 20 |
| Korea | 56 | > 5000 | 15 |
| Nigeria | 17 |  |  |
| Poland | 65 |  |  |
| Taiwan | 34 |  |  |
| United States | 93 |  |  |
| Vietnam | 95 |  |  |
| Overall | 647 |  |  |
|  |  |  |  |

**Table 1b:**Company sample descriptive - industry

|  |  |  |  |
| --- | --- | --- | --- |
| **Industry Types** | **US-SIC** | **ISIC** | **n** |
| Food and kindred products | 20 | 15 | 71 |
| Tobacco products | 21 | 16 | - |
| Textile mill products | 22 | 17 | 10 |
| Apparel and other finished products made from fabrics and similar materials | 23 | 18 | 22 |
| Leather and leather products | 31 | 19 | 4 |
| Lumber and wood products, except furniture | 24 | 20 | 23 |
| Paper and allied products, | 26 | 21 | 20 |
| Printing, publishing, and allied industries | 27 | 22 | 9 |
| Petroleum refining and related industries | 29 | 23 | 7 |
| Chemicals and allied products | 28 | 24 | 25 |
| Rubber and miscellaneous plastics products | 30 | 25 | 46 |
| Primary metal industries | 33 | 27 | 33 |
| Fabricated metal products, except machinery and transportation equipment | 34 | 28 | 80 |
| Industrial and commercial machinery and computer equipment | 35 | 30 | 48 |
| Electronic and other electrical equipment and components, except computer equipment | 36 | 32 | 92 |
| Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks | 38 | 33 | 11 |
| Manufacture of motor vehicles, trailers and semi-trailers | 37 | 34 | 22 |
| Manufacture of other transport equipment | - | 35 | 14 |
| Furniture and fixtures | 25 | 36 | 16 |
| Stone, clay, glass, and concrete products | 32 | - | 17 |
| Miscellaneous manufacturing industries | 39 | - | 77 |

Table 2: Country sample descriptive

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | Regulatory national environment (1-7) | Neglect of critical infrastructure (1-19)  | UAI (1-100)  |
| Australia | 4.9 | 14 | 51 |
| Croatia | 3.4 | 8.8 | 80 |
| China | 4.3 | 6 | 30 |
| Germany | 4.8 | 6.2 | 65 |
| Hungary | 3.7 | 3.7 | 82 |
| Ireland | 4.5 | 6.9 | 35 |
| Korea | 3.8 | 2.7 | 85 |
| Nigeria | 3.5 | 15 | 55 |
| Poland | 3.9 | 5.1 | 93 |
| Taiwan | 4.9 | 3.3 | 69 |
| United States | 4.5 | 9.3 | 46 |
| Vietnam | 3.6 | 4.7 | 30 |

Table 3: Scores and measures of the composite index “Regulatory environment” (Lawrence et al., 2012)

|  |  |
| --- | --- |
| **Indicator** | **Description and secondary data source**  |
| 1. Property rights
 | Composite indicator capturing the degree of protection of property rights and intellectual propertySource: World Economic Forum (WEF), The Global Competitiveness Report 2011–2012 |
| 1. Ethics and corruption
 | Composite indicator assessing the level of ethical standards and corruption Source: WEF, The Global Competitiveness Report 2011–2012 |
| 1. Undue influence
 | Composite indicator capturing the degree of undue influence in the judicial system and among government officialsSource: WEF, The Global Competitiveness Report 2011–2012 |
| 1. Government efficiency
 | Composite indicator capturing the efficiency of the government Source: WEF, The Global Competitiveness Report 2011–2012 |
| 1. Domestic competition
 | Composite indicator measuring the intensity of domestic competition and the quality of related policiesSource: WEF, The Global Competitiveness Report 2011–2012 |
| 1. Efficiency of the financial market
 | Composite indicator measuring the efficiency of the domestic financial sectorSource: WEF, The Global Competitiveness Report 2011–2012 |
| 1. Openness to foreign participation
 | Indicator calculated as the average of the following three items and one index: |
| * 1. *Ease of hiring foreign labor*
 | “To what extent does labor regulation in your country limit the ability to hire foreign labor?”Source: WEF, Executive Opinion Survey 2010, 2011 |
| * 1. *Prevalence of foreign ownership*
 | “How prevalent is foreign ownership of companies in your country?” Source: WEF, Executive Opinion Survey 2010, 2011 |
| * 1. *Business impact of rules on FDI*
 | “To what extent do rules governing foreign direct investment (FDI) encourage or discourage it?”Source: WEF, Executive Opinion Survey 2010, 2011 |
| * 1. *Openness to multilateral trade rules*
 | Index: Openness to multilateral trade rules Source: International Trade Centre, Trade Treaties map –LegaCarta database |
| 1. Availability of trade finance
 | In your country, how easy is it to obtain trade finance at affordable cost? Source: WEF, Executive Opinion Survey 2010, 2011 |

Table 4: GMRG survey items

|  |
| --- |
| *Supplier Communication (1=not at all ; 7= great extent; α= .757)* To what extent are the following inter-firm communication practices performed with your plant’s main suppliers? 1. The plant and main suppliers exchange proprietary information.
2. The plant and main suppliers inform each other about events affecting the other party.
3. The plant and main suppliers regularly exchange information of supply and demand forecast.
 |
| Upstream on-time deliveries* What percentage of the plant's purchase orders do suppliers deliver late? (reverse)
 |

Table 5: Correlations

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** | **(7)** |
| Neglect of critical infrastructure (1) | 1 |  |  |  |  |  |  |
| On-time deliveriesa (2) | -.098\* | 1 |  |  |  |  |  |
| Supplier communication (3) | .189 | .065 | .731 |  |  |  |  |
| Uncertainty avoidance (UAI) (4) | -.155\*\* | -.214\*\* | -.036 | 1 |  |  |  |
| Regulatory national environment (5) | .128\*\* | .158 | .051 | -.268\*\* | 1 |  |  |
| Share of international supplies (6) | .165\*\* | -.119\*\* | .063 | -.120\*\* | -.116\*\* | 1 |  |
| Plant size (7) | -.036 | .121\*\* | .084\* | -.114\*\* | .164\*\* | .031 | 1 |
| Supply chain position (8) | .160\*\* | .009 | .025 | .033 | -.031 | -.063 | .002 |
| Note: Value for ‘Supplier communication’ on the diagonal is the square-root of AVE; \* Correlation is sign. at the .05 level; \*\* Correlation is sign. at the .01 level; a Transformed using logit transformation. |

Table 6: Results

|  |  |  |  |
| --- | --- | --- | --- |
|   |   | On-time Deliveries a |  |
|  |  |  |  |
| Controls | Share of international suppliers | -.098\*\* |  |
| Plant size | .087\*\* |  |
| Supply chain position | .011 | Hypothesis test |
|  |
| Independent variables | Regulatory national environment | .076\*  | H1: supported |
| Neglect of critical infrastructure | -.147\*\*\* | H2: supported |
| Uncertainty avoidance (UAI) | -.249\*\*\* | H3a: supported |
| Supplier communication | .067\* | H3b: supported |
| Supplier communication \_X\_UAI b | -.087\*\* | H4a: not supportedH4b: not supported |
| Goodness of Fit Indices | GFI | .999 |  |
| χ²/df | 1.197 |  |
| RMSEA | .017 |  |
| RMR | 74.663 |  |
| CFI | .999 |  |
| p | .292 |  |

Note: \* Correlation is sign. at the .10 level; \*\* Correlation is sign. at the .05 level; \*\*\* Correlation is sign. at the .01 level; a Transformed using logit transformation; b Standardized variables; Controls for industry affiliation are included but not reported