Does Vulnerability or Resilience Matter in Managing International Supply Chains?

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Abstract:
In the context of growing need for offshoring, the managers are always confronted with the dilemma to decide between the competitive advantage and uncertainties. The unique conditions of a country help provide a perception of vulnerability profile that result in placing the countries in least preferred category despite their being abundant in natural resources, human resources, and lower production cost. This article attempts to find the relationship of country vulnerability profile and resilience of supply chain stage carried out in unique conditions of the location. For this purpose, a conceptual framework has been proposed and instrument has been used to measure the model for empirical testing. Data has been collected from international garments supply firms in two countries with unique conditions. Descriptive statistics and regression are used to test the assumption. The findings suggest that only the volatile conditions do not determine the resilience of a supply chain stage but the adaptability of a firm also affects the resilience of a stage, no matter how volatile are the conditions. This is a novel study that significantly contributes to the existing literature besides offering insight to supply chain managers in managing international supply chains.
Keywords: Adaptability, Vulnerability, Resilience, Supply chain, Offshoring decision

Introduction

Supply chain processes are carried out in an environment with uncertainties including natural disasters, men induced adverse events, market instability, and internal disturbances occurring unexpectedly with expected losses. Researchers and practitioners are concerned with the sources of risk, probability and impact of risk, and contingency and mitigation measures (Scheibe & Blackhurst, 2017; Bode & MacDonald 2016). However, uncertainty goes beyond the exposure to risk and vulnerability. It is very relevant, in this context, for the supply chain manager to look beyond the concept of risk and vulnerability and consider resilience while making decisions and managing international supply chains. The research question posed in this study is whether vulnerability or resilience matter in deciding suppliers.

Supply chain resilience (SCRes) is one of a current stream in the literature (Eltantawy, 2016; Lee & Rha, 2016) besides supply chain risk management (Mena, Christopher &

Van Hoek, 2014; O'Connor, 2016), supply chain disruptions (Bode & Macdonald, 2016; Monczka, Handfield, Giunipero, & Patterson, 2015), and supply chain vulnerability (König & Spinler, 2016; Andreoni & Miola, 2015). The term supply chain resilience was first mentioned and formally defined in the literature by Christopher and Peck (Ponis & Koronis, 2012).

Ambidexterity, capability of a firm to efficiently utilize the resources in hand and explore alternate resources to cope with disturbance, is suggested to be linked to resilience (Eltantawy, 2016). The framework suggests that engineering and ecological resilience constructs determine supply chain resilience. Cultural and operational competencies are the sub-dimensions of engineering resilience that is the ability to utilize the resources at hand adjust to changes and attain operational stability. Awareness and approach to handle vulnerabilities result in ecological resilience that is the capacity to forecast opportunities and threats and use this information to sustain the operations. The framework suggests that supply resilience is the product of engineering and ecological resilience that in turn determines the sustainable performance. The study separates supply resilience and firm performance that implies that these constructs will have different measures. The study suggests that the framework is yet to be empirically tested and for the purpose the framework is to be operationalized. Also, the framework is generic and would need to be adapted to different supply chains with respect to industry and geographical networks.

Collaboration including sharing of information, shared communication, joint knowledge pool, and relational efforts effect monitoring, swiftness, and customizability and that results in enhanced SCRes (Scholten & Schilder, 2015). Framework suggests the dimensions of SCRes as flexibility, velocity, and visibility. The study finds that collaboration is the antecedent rather than formative element of resilience. Further, the study finds that collaborative activities enable supply chain firms to monitor, respond quickly and adjust to changes resulting enhanced resilience. The study recommends empirical testing of the proposed model.

Complexities, in upstream and downstream processes as well as in products, affect the responsiveness, adaptability and ultimately the resilience of supply chains (Gunasekaran, Subramanian, & Rahman, 2015). The study also proposed that it is the relationship between complexities and readiness to respond that determines the outcomes of supply chain resilience like risk and innovation, benefits, and challenges. The study suggests that to refine the framework empirical investigation will be required.

Readiness, response, recovery, and growth are four stages rather than viewing supply chain resilience as a single event or result (Hohenstein *et al*., 2015). Readiness is the proactive phase while the later phases are reactive in nature. Formative elements of supply chain resilience are listed including flexibility, visibility, capacity, collaboration, redundancy, and agility.

Visibility, constituting the capability, is considered as at the center of SCRes framework (Brandon- Jones *et al*., 2014). The study adapts resource view based approach to supply chain resilience that ensures connectivity and flow of information. The hypotheses are that connectivity affect sharing of information and both in turn govern the visibility of supply chain. SCRes and robustness are proposed as dimensions of performance construct. The model propounds visibility as determinant of supply chain resilience and robustness. Measurement and scales were adapted and developed for the constructs of connectivity, information sharing, visibility, resilience, and robustness. The measurement and causal models were tested suggested

that the resources of connectivity and information increases the visibility capability that leads to both resilience and robustness of supply chain.

Procurement is thought to be an enabler to attain SCRes (Pereira, Christopher, & Lago Da Silva, 2014). The study is based on systematic review of literature with the objective to examine the part procurement play in gaining SCRes. Among findings of the study, one major contribution is the tabulation of enabler of and barriers to SCRes. In most cases, the presence of a feature is enabler and absence of the same is a barrier for instance flexibility and lack of flexibility; information sharing and lack of information; and collaboration and lack of collaboration. The study concludes that procurement has an impact on supply chain resilience. The limitations of the study suggest that it is concerned with procurement while supply chain is more than that.

Relational competencies are supposed to be having an impact on supply chain resilience (Wieland, 2013). The study is based on theoretical foundation and assumes hypothetical relationship between relational competencies and resilience and between resilience and supply chain customer values. Communication, cooperation, and integration are the dimensions of interpersonal proficiencies. Agility and robustness are considered as the dimensions of resilience. According to the study, there is empirical evidence that relational competencies are the antecedent of resilience. The study has not considered the supply and demand aspects and is therefore limited in its scope.

Capability and vulnerability factors determine supply chain resilience (Pettit, Croxton & Fiksel, 2013; Pettit, Fiksel & Croxton, 2010). Their latest study proposes a tool constructed on the factors explored in earlier study for assessing the supply chain resilience. The factors are operationally defined and detailed into sub factors. The study has 21 vulnerability and capability factors detailed in 111 sub-factors. The tool is useful to suggest balance between vulnerability and capability to attain and maintain resilience. The study is concerned with ranking of the vulnerability and capability using the tool.

Social capital is having an impact on SCRes (Johnson, Elliott, & Drake, 2013). The study investigates the impact of social capital on capability of SCRes. The framework proposes flexibility, velocity, visibility, and collaboration as formative indicators of SCRes. Social capital has sub-dimensions of structural, cognitive, and relational capital. The study finds relationship between concepts of the framework. The study is limited to social competencies and the generic concept of supply chain instead of elemental consideration that may help measure the SCRes and its determinants.

SCRes is formed by the sub-dimensions of flexibility, velocity, visibility, and collaboration (Jüttner & Maklan, 2011). The study aims at exploring the relationship of supply chain resilience with other streams of supply chain i.e. vulnerability and risk management. The proposed model is based on literature review and empirical data suggest that there is positive relationship between supply chain risk management and supply chain resilience while there is negative relationship between supply chain risk management and supply chain vulnerability. The study is limited to investigate the relation of supply chain resilience with supply chain vulnerability and risk management.

Resource based view and system theory have been adapted to determine the enhancers and reducers of supply resilience (Blackhurst, Dunn, & Craighead, 2011). The resources of supply chain firm are human capital, firm and supply chain capital, and physical resources. The system flow activities, units carrying out these activities

and the suppliers of the units. The framework proposes number of generalization and hypothesis. The conceptual model is to be empirically examined and for that purpose operationalization is be done.

Activity based approach has been adapted to identify the disturbances across transportation process of supply chain (Colicchia, Dallari, & Melacini, 2010). The study proposes four contingency solutions and three mitigation measures to handle the disturbances. The contingent plans are use of multiport, hub and spoke, sea-air service mode, and air cargo. The mitigation measures are pre-booking of containers, bonded warehouse, and service level agreements. The article is focused on supply lead time variability that is one of the areas of supply chain management.

Logistic capabilities are proposed as antecedent of supply chain resilience (Ponomarov & Holcomb, 2009). The concept of supply chain resilience is suggested to be comprised of event readiness, efficient response, and recovery. The framework proposes that dynamically integrated logistic capabilities affect supply chain resilience that in turn influence control, coherence, connectedness, and sustainable competitive advantage. Demand, supply, and information management capabilities form logistic capabilities according to the framework in the study. The study is conceptual and concerned with the logistic of aspect of supply chain.

Density, complexity, and number of critical nodes in supply chain are viewed as determinants of supply chain resilience (Falasca, Zobel, & Cook, 2008). A simulation based framework has been proposed to measure supply chain resilience. It considers the reduction of disruptive instances, reduction of the effects of disruption and minimizing the time to recover. The study is limited by not considering the chain from supplier to customer.

As an emerging field borrowed from different disciplines, there is still need for operational definition (Hohenstein, Feisel, Hartmann, & Giunipero, 2015) to measure the resilience of supply chain and help in decision making under uncertainties in international supply chain. The motivation of the article is to address the concerns of supply chain members regarding uncertainties caused by risk events and vulnerability of supply chain activities and processes.

This article stresses the fact that existence of risk, vulnerability of processes to such risks, capability of system to respond, and adapting alternate measures, and restoration of functioning to normality are comprehensive aspects that are to be considered while deciding on the feasibility of carrying out supply chain processes, outsourcing, offshoring, and contracting out the processes. To answer the question, the objective of this study is to measure and analyze the relationship between location with vulnerable profile and resilience of supply chain stage.

Literature Review and Conceptual Framework

To explore the relationship between adaptability, vulnerability and resilience, a conceptual framework begins with a general assumption that supply chain adaptability is negatively related to vunlerability that in turn vulnerability is negatively related to supply chain resilience (Blackhurst, Dunn, & Craighead, 2011 and Pettit, Fiksel, & Croxton, 2010). The supply chain managers percieve that high vulnerability profile would mean low resilience and vice versa. The members of supply chain stage operating in volatile environment will be vulnerable to frequent disruptions and therefore would experience low resilience. This results in negative perception about the location of existing or potential supply chain stage members and are categorized as the least preffered locations irrespective of their competitive

advantages. It is imperative to emprically test the above assumption and this study attempts to fill this gap.

In order to empirically test the assumption, conceptual framework for the study is proposed in Figure 1. where supply chain adaptability, supply chain vulnerability, and supply chain resilience are formed by the adaptability, vulnerability and resilience of the respective supply chain stages.

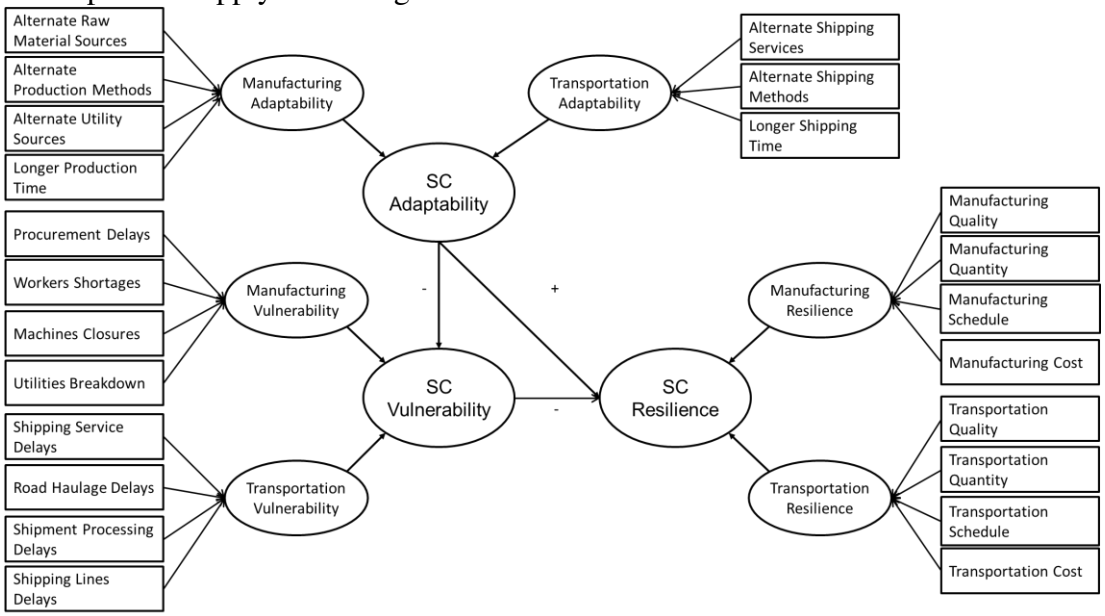

Figure 1 Conceptual Framework of the study

The assumptions are that in a volatile environmnet of a unique location, the supply chain stage operations are hit by disruptive events to which firms will invoke alterntae meaures to recover and continue its functioning. In such situation, firms with high adaptability would be able to recover with the least impact and therefore would exhibit high resilince as compared to firms with low adaptability. The model has six measurment models that form respective second order models and the casual model to carry out the empirical investigations. The framework proposes that supply chain adaptability determines supply chain vulnerability that in turn determines supply chain resilience.

Supply Chain Adaptability

Adaptive measures are invoked when change event hit a system and the operations is adversely fails to continue the service level. Many of the researchers viewed supply chain for resilience through factors of dexterity, responsiveness, visibility, flexibility, redundancy, uncertainty reduction (Ponomarov & Holcomb, 2009), adaptability considers alternative resources and methods available within firm, across the supply chain firms and offered by the location from which the input is received by supply chain stage for example cotton and wool in the case of garments industry.

Items that are used to measure manufacturing adaptability are supplies of substitute raw material, availability of diverse production methods, alternative vendors of utilities, and necessarily longer lead time for production to serve as buffer for discontinuities caused by internal or external change events. Transportation adaptability has indicator variables of availability of multiple shipping services,

options of substitute shipping modes, and necessarily longer lead time for shipping to serve as buffer for the internal and external change events.

Supply Chain Vulnerability

Vulnerability refers to discontinuities of processes related to inbound supplies, operational activities, or the firm running the operations (Pettit, Fiksel, & Croxton, 2010). Vulnerability means how much the system is susceptible to firms and environment related disruptive events which deters the firm from its standard functioning. The susceptibility is displayed in terms of harm caused to performance as the firm lacks strength to react to change event. Vulnerability of supply chain is the collective effect of vulnerability of all the relevant stages e.g. manufacturing vulnerability and transportation vulnerability as is the case in the given framework.

The item to measure manufacturing vulnerability are delays in procuring the raw material, lack of required workers, maintenance and repair of machine and break down of utility services e.g. electricity, gas, and water. Transportation vulnerability is measured through inability of shipping providers to attend requests, discontinuities occurring during road transportation, inability to process shipment in time and the interruptions caused by shipping lines schedules.

Supply Chain Resilience

Supply chain resilience is commonly referred to restoring to level of operations prior to a disruption, getting back to regular functioning or preserving continuousness of operations at required level of structure and function after the disruptive event (Ponomarov & Holcomb, 2009; Falasca, Zobel, & Cook, 2008; and Christopher & Peck, 2004). Supply chain stage aims to deliver the products with required quality, in the right number, at targeted place, in the scheduled time, and within planned cost (Cutting-Decelle, *et al*., 2000). The indicator variables are not single theme and therefore considered as formative measurement models. Methodology is presented in the following section to empirically examine the proposed model.

Methodology

The conceptual model suggested in the preceding section will be applied to an empirical investigation in two countries to test the supposition that vulnerable supply chain processes are not necessarily non-resilient. Before quantitative testing, qualitative approach is applied to understand and interpret social phenomena and human actions in the perspective. The empirical analysis looks at secondary data such as World Trade Organization, Human Development Index, and Cultural Dimensions to compile the vulnerability profile of the countries under study for contextualizing the phenomena.

The instrument to measure the vulnerability, adaptability, and resilience of international garments supply chain is developed by outlining the supply chain processes through interviews and observations by visiting the garments supplying factories and the freight forwarding services. The instrument is used for collection of data with respect to variables in the conceptual framework. The data was collected from international garments supply firms with 114 from Pakistan and 53 from Turkey, managed within financial and logistic constraints and relying on personal and extended contacts.

The data is analyzed to confirm or refute the assumption posed in the research question. For analysis purpose descriptive statistics has been used to empirically

compare the supply chain stages carried out in locations with unique conditions. Statistical software is used to estimate the indicator variables of the constructs for the country-wise data sets. The results are then presented in the form of comparative graphs to highlight the group difference for the supply chain stages operated in Pakistan and Turkey.

Regression analysis is used to assess assumptions hypothesized in the conceptual framework. The conclusion whether vulnerability or resilience matters in managing the international supply chain is made by comparing the evidence from the descriptive and the regression results.

Results and Discussion

The purpose of the study is to find whether supply chain member located in unique environmental condition is vulnerable and non-resilient or otherwise. To answer the research question, objectives of the study are set to measure the adaptability, vulnerability and resilience of the processes of supply chain stages carried out in sites with typical conditions so as to test the comparative difference between the samples collected from garments supply firms located in the two counties. The model assumes that firms with high adaptability will have low vulnerability and will therefore demonstrate high resilience. Before the statistical analysis it is important to have a comparative profile of the locations under study.

Profile of the Countries

The countries rich in natural resources of cotton and wool have developing or developed textile and garment industry and therefore major exporters of garments. Owing to the competitive advantage in terms of low operational costs, the developing countries manifest trend of increasing garments exports like Pakistan and Turkey. The two countries have registered garments export worth of 9 billion and 11 billion US Dollars respectively in 2016 (WTO, 2016). Comparative profiles are presented based on natural and physical resources, communication and industrial infrastructure, human resources, and political, economic, social, and cultural capital. In respect of natural resources related to textile and garments, Pakistan fares better than Turkey. Cotton is a natural resource for both the countries with a production of 7.7 million bales and 3.2 million bales respectively for Pakistan and Turkey (USDA 2017). Of physical resources, Pakistan has been struggling with delivery of utility services such as water, power, and communication supplies in the recent years and even sought support from Turkey for renting power. The two countries are self-sufficient in water resources needed for domestic and industrial use. With respect to communication and connectivity Turkey fares better than Pakistan.

The parameters for supportive mobility infrastructure includes the availability, approachability, patterns, and cost of shipping, on time performance, service, warehouse locations, routing constraints, transportation modes, carrier qualifications and intermodal systems (Prasad & Sounderpandian, 2003). The total paved road network is 185 and 352 thousand kilometers, railways network is 11 and 12 thousand kilometers, waterways 0 and 1 thousand kilometer, and airport transport network with 151 and 98 airports respectively for Pakistan and Turkey (Mundi Index, 2017)

Well-developed associated industry ensures smooth supply chain operations and is considered as must for deciding the facilities and supplier's location (Prasad & Sounderpandian, 2003). Garments industry is the direct customer of fabric suppliers that is dependent on dying and printing vendors, textile mills including weaving, spinning, and ginning mills that thrives on cotton production. Pakistan and Turkey are

among the top cotton producers that contribute considerably to world yarn and clothing production (APTMA, 2015). Pakistan has mostly small and medium sized firms that depends on fabric suppliers whereas Turkey has garment producers with vertically integrated facilities with in-house spinning, weaving and dyeing that serve the demand of garments manufacturing.

Garments sector requires skilled workers that depends on developed human resources. Location with developed and abundant human capital is needed to have labor cost advantage. Pakistan has less developed human capital ranking at 147th as compared to Turkey ranking at 71st among the countries (UNDP, 2017). Political environment is revealed through level of constraints encountered in the implementation of laws, regulations, policies, and procedures that make a merit based and transparent culture and ensure rule of law. According to the index of economic freedom, Pakistan is ranked as 141st and Turkey as 60th freest economy means that the political and legal culture is less supportive in the case of the former (The Heritage Foundation, 2017).

Normally, workers in garments industry demographically hails from collectivist societies with stronger family bonds having responsibilities even to the extended family with social coercion. Societies are unique due to social distance on the basis of power among members, individualistic or collectivistic outlook, gender norms, accepting or avoiding uncertainty, long or short term thinking, and indulgence (The Hofstede Center, 2017). The comparison between the two cultures is presented in the table below:

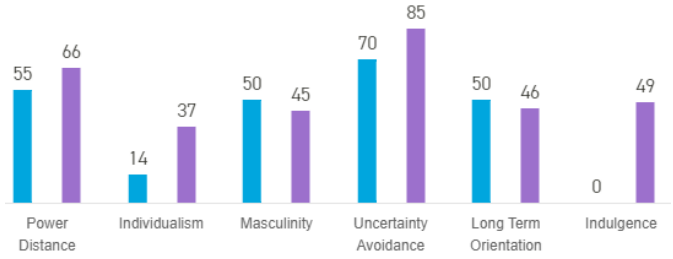

Figure 2 Respective Culture of Pakistan and Turkey

The power distance is lower for Pakistan that is generally low for developed countries while individualism is higher for Turkey that is generally high for developing countries. Masculinity and long-term orientation is higher for Pakistan whereas uncertainty avoidance and indulgence are higher for Turkey. The differences in human resources shape varied business forms, organizational conduct and work behaviors owing to diverse social backgrounds. Country conditions are instrumental in understanding the interplay among vulnerability, adaptability, and resilience of supply chain processes. Country profile provides contextual background to examine the effect of locational conditions on SCRes. Descriptive and regression tests are used for analysis of the proposed model considering the contextual background.

Descriptive Analysis

Descriptive statistics have been used to compare the adaptability, vulnerability and resilience constructs of international supply chain stages i.e. manufacturing of garments and transportation to the customer.

Manufacturing Adaptability

The construct of manufacturing adaptability represents the alternate supplies and production methods to restore the process disrupted by change events. The

options available to the firms or offered by location enable the firm to counter the instabilities. In location with abundant suppliers of material, rich labor market, and multitude of producers, firms are able to move to substitute in case of problem in an option, with lesser efforts, time and cost.

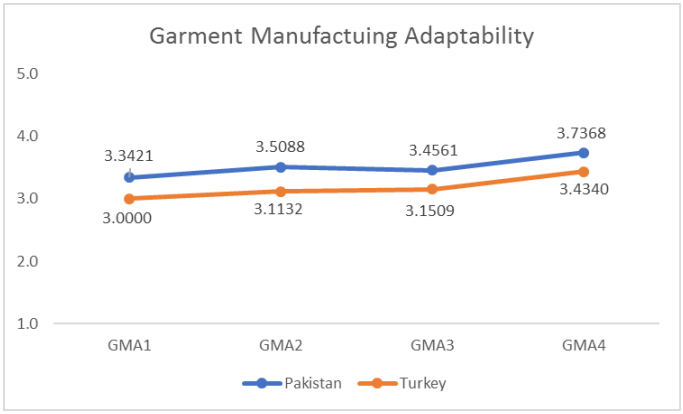

Figure 3 Comparative Manufacturing Adaptability

The results for manufacturing adaptability suggests that the firms of data set 1 resorts more frequently to adaptive measures as compared to the firms of data set 2. This points that the supply chain processes that are more vulnerable require frequent adaptive measures.

Transportation Adaptability

The construct of transportation adaptability is formed by availability of substitute services for shipping, availability of varied modes of shipping, and longer lead time for shipping products.

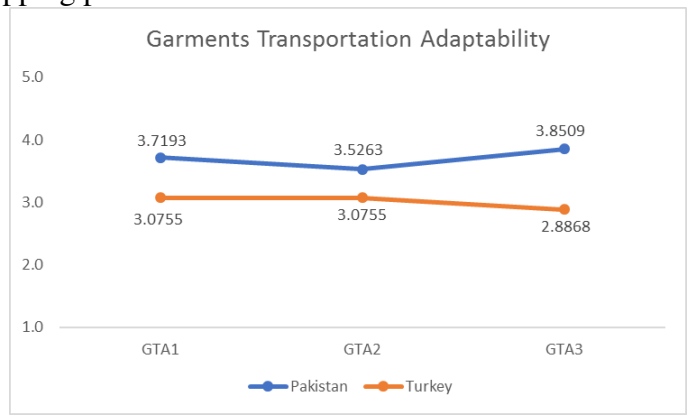

Figure 4 Comparative Transportation Adaptability

The results in Figure 4 suggests that due to high adaptive measures the shipment is delivered to customer in the scheduled time. The alternate means, modes, and methods are affordably available that meets the objectives of right product in right quantity in right time and in planned cost.

Manufacturing Vulnerability

The construct of manufacturing vulnerability measures the frequency of disturbance of manufacturing process caused by change actions such as delays in

procurement of raw material, shortage of workers, machine closures, and utilities breakdown.

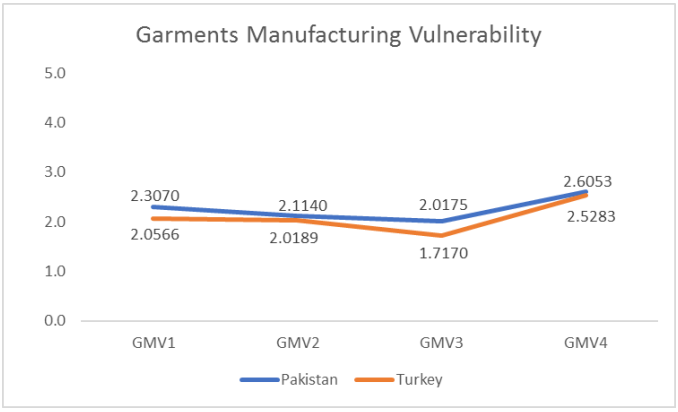

Figure 5 Comparative Manufacturing Vulnerability

The vulnerability of manufacturing processes is high for data set 1 as shown in Figure 5. The result show that manufacturing process in case of data set 1 is comparatively more vulnerable than data set 2. Procurement delays are often observed in the case Pakistan in comparison to Turkey. The disruption owing to shortage of workers and utilities breakdown is slightly different for the two groups of data. The machine closures show significant difference for the two groups, possibly because of reliance on second hand machinery, unstable power supply and inexperienced workers.

According to ND-GAIN Country Index, the infrastructure falls in lower level with high exposure to changes in the environment and more sensitivity to changes for Pakistan compared to Turkey. Similarly, the overall vulnerability of the Pakistan is higher than Turkey. The vulnerability results of both the data sets has a mean range between approximately 1.5 to 2.5 suggesting that the manufacturing process is disrupted less frequently. The profile of a location may be ranked with high exposure given to the internal or external change events, it depends on the proximity and relevance of the disruptive event to hit the process.

Transportation Vulnerability

The construct of transportation process involves the availability of shipping services, delays during haulage to ports, processing of shipment, departure of shipment.

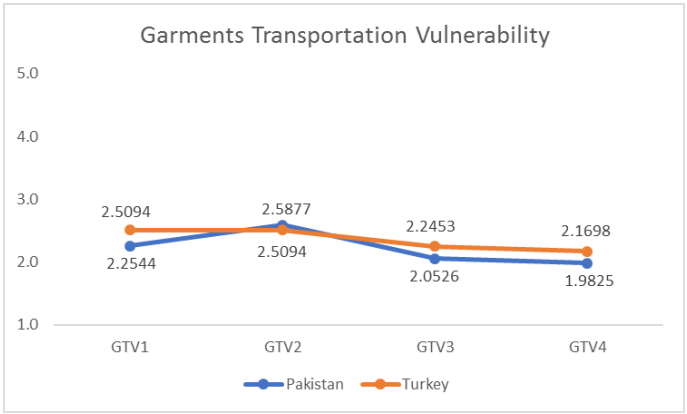

Figure 6 Comparative Transportation Vulnerability

The results show that shipping requests are queued a little, processing of shipment takes longer, and departure delays are a little more for data set 2. The haulage to ports takes almost the same time. Overall the transportation vulnerability average around 2.25 suggesting that the transportation process has low disruptions for both the data sets.

Manufacturing Resilience

The concept of manufacturing resilience is measured by considering how often the target amount is produced with required specifications, within schedule time and planned costs.

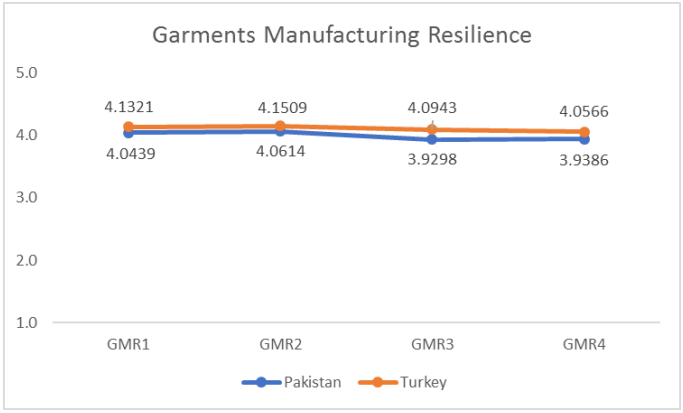

Figure 7 Comparative Manufacturing Resilience

The manufacturing process is reported to meet the quality, quantity, schedule, and cost objective very often as the means are about 4 on 5 points the scale. There is some deviation in meeting the production schedule and cost, both the suppliers demonstrate high resilience in its manufacturing process.

Transportation Resilience

The construct of transportation resilience is measured by considering how often the target amount is shipped with required specifications, within schedule time and planned costs.

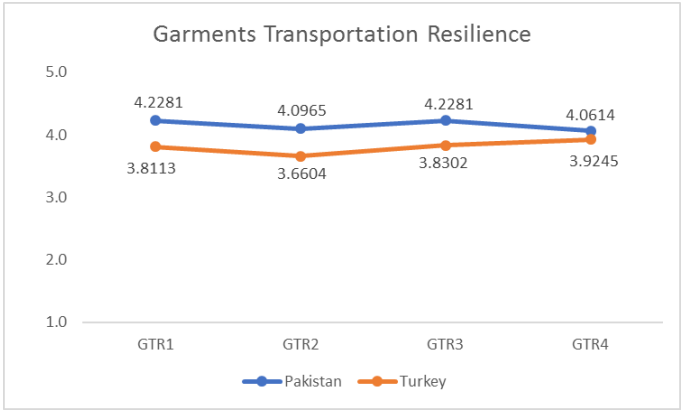

Figure 8 Comparative Transportation Resilience

The result shows that overall the supply chain transportation process meets the objective of delivering products in good conditions. The required amount is shipped to customers within scheduled time and cost. The result shows difference for the data sets where the dataset 1 suggests more resilience than the data set 2. This makes it imperative to analyses the supply chains for having high vulnerability and high resilience against the logical hypothesis that high vulnerability shall result in low

resilience. The supply chain framework suggests resilience as a product of vulnerability and adaptability. It is expected that supply chain process with high vulnerability shall have high adaptability that help the process to restore and there result in high resilience.

Regression Analysis

The measurement models in Figure 1 are tested for validity and reliability through statistical method of partial least square through Smart PLS software. Once the measurement models confirm the validity and reliability, the causal relationship is estimated to accept or refute the assumption.

Outer Model

There are six measurement models namely manufacturing adaptability, transportation adaptability, manufacturing vulnerability, transportation vulnerability, manufacturing resilience and transportation resilience. Each of the model has several indicator variables. The value of factor loadings for the all the indicator variable with respective latent variables is 0.9 on the average demonstrating strong convergent validity. The indicator variables do not show strong cross loadings that means that the measures have discriminant validity. Therefore, none of the indicator variables are candidate for deletion and all of them will be included causal analysis. The value of composite reliability is 0.9 or above means that the indicators are strongly formative of the respective latent variables or factors. Similarly, the Cronbach alpha is well above the benchmark of 0.7 for all the measurement models. This means that the measures of the instrument have reliability. As the measurement models are valid and reliable, the model is qualified causal analysis (Jarvis *et al*., 2003).

Inner Model

The inner model consists of first and second order constructs. The constituents of supply chain stages form the first order model. The hypothesis suggests that vulnerability has negative effect on SCRes and adaptability has negative effect vulnerability of supply chain. This assumes that in case of volatile environment, adaptive measures hedges supply chain stage from vulnerability and thus ensures high resilience. The first level factors form the second level factors of adaptability, vulnerability, and resilience of supply chain. Path coefficient for the second order formative models are having high regression weights and are significant at 1% estimated by bootstrapping in Smart PLS.

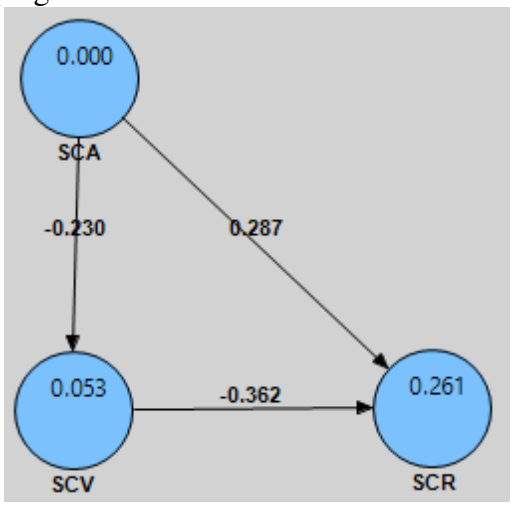

Figure 9 Model Estimation with Smart PLS

The result shows that supply chain adaptability has significant negative effect on vulnerability and thus keeps low vulnerability and ensures high resilience of supply chain stage even in location fraught with change events.

Manufacturing and transportation adaptability is higher for Pakistan as shown in the descriptive analysis. This means that due to volatile conditions of the location, the supply chain firms often invoke adaptive measures. This negatively determine the vulnerability of supply chain process and thus demonstrate low vulnerability almost same as the country with low country profile. The low vulnerability is negatively related to resilience and therefore the supply chain stages show high resilience as discussed in the descriptive analysis. One of the assumptions proposed in the model is that adaptability has positive effect on resilience of supply chain. Regression results show strong weights for the proposed path. The bootstrap results show that the path coefficients are significant at 1% significance level. Based on descriptive and regression results, the conclusion is presented in the following section.

Conclusion

The garments suppliers are in developing countries namely Pakistan and Turkey with varied locational environments. These countries are having different condition given to the attributes of natural and physical resources, communication and supplementary industries, human, political, economic, social, and cultural capital. Indicators for the attributes are better poised in the favor of Turkey and as a result it was assumed that supply chain resilience would be higher for supply chain members located in Turkey as compared to Pakistan. However, the descriptive and regression results are different than the assumption posed in the title of the article. Supply chain vulnerability is almost the same for the manufacturers located in the two countries. One explanation could be that the country specific environment including natural, physical, human, social, and political change events may be frequent in a location, but these may be irrelevant to the supply chain operations. Therefore, the manufacturing vulnerability frequency for the two countries has low occurrence averaging 2.5 on the five-point Likert scale with insignificant difference between the two data sets.

Another explanation could be that the supply chain member with high adaptability are able to restore the operations without significant delays and therefore experience low disruptions and demonstrate high resilience as suggested through the figure below. The same can be inferred from the interaction model that suggests that adaptability of supply chain firms lessen the negative affect of the supply chain vulnerability on supply chain resilience. This suggests that firms with high adaptability will have low vulnerability and high resilience and vice versa. It is therefore found that the profile of country is not the sole indicator for reliability of supply rather it depends on how relevant are change events to the operations and how susceptible and adaptable is the supply chain firm that determine the resilience of supply chain stage.

For manager, countries with high vulnerability profile are the least preferred for location of supply chain facilities or supplier locations. However, the empirical results show that despite volatile locations, firms fare well in terms of competitive advantage. This refers to the fact that the concepts of risk and vulnerability are but partial considerations and there is need to include the ultimate phenomena of resilience to get a realistic assessment of suppliers. This comprehensive approach will help exploiting the suppliers with competitive advantage.

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