The relationship among the resiliency practices in supply chain, financial performance, and competitive advantage in manufacturing firms in Indonesia and Sierra Leone

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Abstract. Current supply chain management (SCM) has become a potentially treasured way of safeguarding competitive advantage and improving organizational performance since competition is no longer between organizations, but among supply chains. This research conceptualizes and develops four resiliency practices (Flexibility, Redundancy, Collaboration and Agility) and tests the relationships between organizations' financial performance and competitive advantage in manufacturing firms. The study involves manufacturing firms in Indonesia and Sierra Leone. The study used stratified random sampling to pick a sample size of 95 manufacturing firms, which represented different industrial sectors. The respondents were mainly managers of different manufacturing companies. The relationships proposed in the conceptual framework were tested using correlation analysis. The results indicate that higher levels of resilience practices in manufacturing firms can lead to enhanced competitive advantage and improved financial performance.

1. Introduction
In today’s competitive business setting, outsourcing and globalisation have made stretched and more difficult supply chains, which exposed business to disruptions in a stormy environment. The amount of supply chain vulnerability is largely determined by the extent of complexity of the supply chain. Over the past years, many supply chains have encounter a wide range of disruptive situations such as transportation delays, port strikes, terrorist attacks, cyber-attacks, economic crises, accidents, natural disasters, poor communication, shortages of parts, quality operational and quality problems. The cost of these supply chain disruptions to a company can be of significance. Disruptions of any nature in the supply chain have the possibility to cause the entire supply chain to be unsuccessful. As noted by Sheffi and Rice, disruptions can result to loss in supply chain organisations and can cause a range of problems such as long lead-times, stock-outs, inability to meet customer demand and increases in costs. When major disruptions occur, many supply chains tend to stop and take a reasonable time to recover. Evidence that demonstrate the importance of even minor disruptions is the example of the automotive manufacturing supply chain in Japan. On July 16, 2007, a magnitude 6.8 earthquake in central Japan severely damaged the facilities of Riken Corp. a supplier of automobile components that is specialized in piston rings. Riken located
all its plants in a single area of Japan to raise efficiency, making the whole production capacity vulnerable to a catastrophic incident. The earthquake damage to Riken facilities and its utilities completely shut down production for one week and required another week of repairs to return to full output. Because of carrying limited inventories, Toyota, one of Riken’s many customers, was highly exposed to production and transportation disruptions. Because Toyota sourcing strategy stressed on close relationships with a limited number of suppliers, but in this case, Toyota has no substitute but to shut down all 12 of its domestic assembly plants, delaying production of approximately 55,000 vehicles [2]. We intend to derive specific supply chain resiliency practices that either contribute to or conversely impact a firm’s disruption mitigation capabilities. Specifically, our objectives are to:

1. Identify resilience factors that affect a firm’s supply chain performance.
2. Propose an empirically tested model that represents the relationships between the supply chain resilience factors, firm’s financial performance and competitive advantage.
3. Offer guidelines for managers to enhance disruption mitigation capabilities through understanding the role of resilience factors in a supply chain.

2. Supply Chain Risk, Disruptions, and Resilience

Mensah et al. [3] Argue that Supply chain risk can be conceptualized as an event that adversely affects supply chain operations and hence its desired performance measures, such as chain-wide service levels and responsiveness, as well as costs. There are wide ranges of events that can affect supply chain operations, from environmental, and intra-organisational to inter-organisational. Their impact is divided from short-term to long-term, as highlighted in various literatures by practical examples. From the logistics point of view, supply chain member’s interaction become very complex, especially in the context of growing uncertainty, where the main drivers of uncertainty are new business models that will applied in order to escalate both the logistics efficiency and competitiveness. Hence, as the main sources of risk in supply chain could be identified in both the relations between members in supply chain and its environment. Risks to supply chain range from short delays to catastrophic disasters and one of the key stages in proactively managing them is to visualize and understand these various types of risks [4].

Supply disruptions stem from a broad range of risk sources and can emerge from within the supply chain or from external events [5]. In recent years, supply chains have become extended and more complex, while this severity and frequency of supply chain disruptions seems to be increasing Error! Reference source not found.[6]. According to the World Economic Forum report launched in close cooperation with supply chain researcher, it indicates that significant supply chain disruptions reduce the share price of affected companies by as much as seven percent on average. Natural disasters and extreme weather conditions are not the only threats to supply chains. There are also Systemic vulnerabilities, such as oil dependence and information fragmentation, that pose serious risks, as do political unrest, cybercrime and the rising cost of insurance and trade finance [6].

From an organisational perspective, resiliency has been termed as a dynamic capacity of adaptability, which grows and develops over time. It reflects an organisations capacity to adjust and maintain required functions under challenging situations. Thus, resiliency studies within an organisation identify both the ability to absorb shocks in the form of extreme events and an adaptive capability to adjust to new conditions. Organisations with better resiliency practices are more likely to deal with everyday problems, as well as those coming from a crisis [7]. Therefore, resiliency is a source of competitive advantage [8].

3. Development of Theoretical Framework

Arani et al. [9] has developed and advance Strategic Choice Theory (SCT). According to this theory the goal of the organizations is to achieve high performance standards and increase the efficiency to the limits of economic constraints. Anew priority has emerged for business planning that is a higher degree of resilience [10]. However, no existing study provides a complete framework that incorporates the scale of issues both internal and external to the supply chain. This research will propose a model in
the form of hypothesis to illustrate the relationship between resilience factors specifically flexibility, redundancy, collaboration and agility to that of a firm’s financial performance and competitive advantage in manufacturing firms as shown in figure 1 below [11].

![Proposed model diagram](image)

**Figure 1. Proposed model.**

Figure 1 above represents a framework developed to show the relationship between resilience factors and a firm’s financial performance and competitive advantage in a manufacturing supply chain. The framework proposes that the four resilience factors flexibility, redundancy, collaboration and agility have a positive impact on manufacturing firms supply chain financial performance and competitive advantage.

4. Methodology
The questions in the questionnaire were designed based on a review of the literature. For constructs, which had not been well documented and tested in the literature, we developed new items based on our understanding of the constructs. The initial survey instrument was revised based on feedback by and experts in supply chain management for content, clarity and understanding. Based on their feedbacks, we modified, added and deleted some questions, making them more understandable and relevant to resiliency practices in Indonesia and Sierra Leone. All the scales used in the study employed a five-point Likert scale. The ends points were labelled ‘Strongly disagree’ (1) to ‘Strongly agree’ (5). The mid-point (3) was labelled ‘Neither agree nor disagree’.

Data was randomly selected from manufacturing companies in Indonesia and Sierra Leone. Questionnaires were distributed electronically via mail, WhatsApp and other social media applications. We sent the questionnaire to key informants, who were CEOs, managers in charge of operations and supply chain, along with a cover letter highlighting the study’s objectives. Follow-up emails or calls were made to improve the response rate. After the follow-up calls or emails, 95 usable questionnaires were received for analysis.

5. Data Analysis
The first common step to consider when examining reliability is factor analysis in order to assess dimensionality [12]. Three measures of reliability or internal consistency were examined in this research: composite reliability, average variance and Cronbach’s alpha. A lower bound of .7 is recommended for composite reliability. It is recommended that the average variance extracted (AVE) be at least .50, as this indicates that the indicators of the latent variable [13] explain 50% or more of the variance. For Cronbach’s alpha, a minimum value of .70 is considered acceptable [12].
provides a summary of Convergent validity for all the constructs. The minimum acceptable values for each construct on each of the measures are met. Therefore, the reliability of the measurement model is adequate. Convergent validity, the ability of items in a scale to converge or load together as a single construct, is measured by examining individual loadings for each indicator. The items with the lowest loadings are generally candidates for removal from the scale. Most of the loadings loads at least 0.60 and above indicating that each measure is accounting for 50% or more of the variance of the underlying latent variable [12]. Table 1 provides a list of standardised loadings for each construct, and it is shown that they are all above the acceptable minimum value [13].

Table 1. Shows convergent validity of the various construct and their loadings

| Construct | Indicator | Mean   | SD    | Loading |
|-----------|-----------|--------|-------|---------|
| Flexibility | Flex2     | 3.58947| 1.18945| 0.81691 |
|           | Flex3     | 3.63158| 1.14903| 0.76481 |
|           | Flex5     | 3.43158| 1.04833| 0.82247 |
|           | Redu3     | 3.47368| 0.92071| 0.85071 |
|           | Redu4     | 3.47368| 0.76967| 0.85636 |
|           | Redu5     | 3.52632| 0.96582| 0.80562 |
| Redundancy | Colla2    | 3.54737| 1.16481| 0.8796  |
|           | Colla3    | 3.34737| 1.11821| 0.84095 |
|           | Colla4    | 3.46316| 0.98726| 0.63382 |
|           | Colla5    | 3.38947| 0.98169| 0.62346 |
|           | Agil4     | 1.09442| 1.07834| 0.85033 |
| Agility   | Agil3     | 1.07834| 1.09442| 0.91572 |
|           | Agil5     | 1.03824| 1.03824| 0.87442 |
| Financial Performance | Finper2 | 0.9936 | 0.9936 | 0.89835 |
|           | Finper4   | 3.56842| 0.84618| 0.88287 |
|           | Finper5   | 3.36842| 0.88789| 0.7522  |
|           | ComAd2    | 3.96842| 0.99416| 0.84844 |
| Competitive Advantage | ComAd3   | 3.70526| 1.09032| 0.79093 |
|           | ComAd4    | 3.82105| 0.93375| 0.90507 |
|           | ComAd5    | 3.57895| 1.05769| 0.79165 |

6. Hypothesis Testing
As shown in ‘Table 2’ below competitive advantage has a significantly positive correlation on a firm’s financial performance (0.01211; p < 0.05). Thus, H1 is supported. The correlation coefficient between flexibility and financial performance is not statistically significant (0.1480; p > 0.05) thus, the null hypothesis H2a is rejected. However, the correlation coefficient from flexibility to competitive advantage is significant, in this case the null hypothesis is accepted (0.0119 p<0.05). Thus, supply chains with high level of flexibility exhibits a lower level of financial performance and a higher level of competitive advantage.

Likewise, for H3a, the correlation coefficient from redundancy to a company financial performance is significant thus, the null hypothesis is accepted (0.0339; p <0.05). However, for H3b the correlation coefficient from redundancy to competitive advantage is not significant, thus the null hypothesis is rejected (0.1167; p > 0.05). Supply chain collaboration has significantly positive correlation to both financial performance (0.3431; p<0.05) and competitive advantage (0.0007; p<0.05) of a firm. Thus, supply chains with high collaboration exhibits high level of financial performance and competitive advantage.
advantage. Hence, both H4a and H4b are supported. Finally, the correlation between supply chain agility to that of financial performance (H5a) is not significant (0.0910; p >0.05), and the correlation coefficient from supply chain agility to competitive advantage is found to be significant H5b (0.0282; p<0.05). Thus, supply chains with high level of agility found to exhibit a low level of financial performance and high level of competitive advantage. Hence, H5a is rejected and H5b is supported.

### Table 2. Correlation matrix of latent variables.

|                  | Flexibility | Redundancy | Collaboration | Agility | Finper | Compadv |
|------------------|-------------|------------|---------------|---------|--------|---------|
| Flexibility      | 1           | 0.41204    | 0.35813       | 0.02179 | 0.14955| 0.25718 |
| Redundancy       | 0.41204     | <.0001     | 0.17984       | 0.24205 | 0.21793| 0.16202 |
| Collaboration    | 0.35813     | 0.17984    | 1             | 0.35284 | 0.34319| 0.2702  |
| Agility          | 0.0004      | 0.0812     | 0.0005        | 0.091   | 0.0282 |        |
| Finper           | 0.14955     | 0.21793    | 0.34319       | 1       | 0.25645|        |
| Compadv          | 0.25718     | 0.16202    | 0.2702        | 0.2252  | 1      |        |

7. **Discussion and Implications**

Supply chain with low capabilities corresponds to moderate or high vulnerabilities that can dramatically degrade the supply chain’s resilience. For example, a supply chain with a high vulnerability to connectivity can face disastrous consequences if it has poor visibility and collaboration. In addition, the framework provides managerial guidance for setting priorities to create a strategy for improving supply chain resilience. The strategy is based on assessment of the firm’s pattern of vulnerabilities and its competitive advantages, weighed against the potential returns on investment. In doing so, corporate strategy will focus on resource investments to fill the gaps which enhances a company’s disruption recovery capability. This study represents an important contribution for managers. It gives insights on the kind of lean, resilient practices with significant impact on supply chain sustainability. In the presence of this information, it is easier for companies to choose the set of practices that should be employed to improve social, economic and environmental sustainability. However it is also important for companies to formulate appropriate strategies for improving resilience. Understanding the source and types of uncertainty and disruptions would be critical for this purpose. As suggested Angkiriwang et al. [2], approaches could be reactive or proactive in nature. Likewise, Pujawan et al. [14] also suggest two different broad strategies in dealing with uncertainty. Obviously, being able to handle uncertainty is also an important characteristic of resilient companies.

8. **Conclusion**

From the study findings, it could be concluded that resiliency factors had a positive significant influence on manufacturing firm’s financial performance and competitive advantage. The study showed that there was a strong relationship between various resiliency factors and firm’s financial performance and competitive advantage. Hence, it could also be concluded that if management of manufacturing firms embraces resilience practices, it could increase supply chain resilience in
manufacturing firms and improve competitive advantage. In addition, based on the results of this study, it could be concluded that manufacturing firms collaborate frequently with their key supply chain partners through the various platforms like sharing of information, synchronizing of decisions, aligning of incentives in a form of co-developing systems, sharing costs, risks and benefits, sharing of resources and constant communication.

Because the concept of supply chain resiliency is a fast emerging topic it is very beneficial to expand the scope of the research. Further research should be undertaken to investigate the concept of resiliency practices in other fields of studies. For example petroleum industry, mining industry, building and construction industry etc. In future investigations, it might be possible to use different resiliency factors such as robustness, leanness etc.

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