



Approaches to Manage Supply-Chain Breakdown and the Operational Performance of Some Selected Manufacturing Enterprises in Katsina State, Nigeria

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Abstract: Several scholarly studies have been conducted to establish relationships between SC breakdown and performance of manufacturing enterprises without any serious attention on the relationship between approaches to manage SC breakdown and operational performance of enterprises. Therefore, this paper provides an empirical analysis of the causal relationships between approaches to manage SC breakdown and operational performance of manufacturing enterprises. The approaches to manage supply chain breakdown are proactive risk management, system flexibility and system wide-disruption awareness while the operational performance metrics include quality, dependability, flexibility, return on investment, lower costs. A Kendall coefficient of concordance is applied to primary data collected through structured questionnaire in five –point Likert Scale format to test the hypotheses via SPSS version 21. Results based on cross-sectional survey data from randomly selected 105 enterprises show evidence of a strong positive statistically significant impact of effective strategies to manage SC breakdown on operational performance of manufacturing enterprises with kendall's tau-c statistical value of .938 and p-value < .05. Subject to appreciable effect on operational performance, this study suggests that enterprises stakeholders (suppliers, manufacturers, distributors/wholesalers and retailers) should consciously embrace SC strategies - proactive risk management approach, system flexibility and system wide-disruption awareness programme and enforce its implementation if SC breakdown must be mitigated and operational efficiency must be enhanced. Therefore, the research concludes that enterprises would become less vulnerable to SC breakdown if they adequately utilize strategies of SCM.

Keywords: Supply-Chain Breakdown, Operational Performance, Proactive Risk Management Approach, Quality, Flexibility.

1. Introduction

Supply – chain management (SCM) encompasses all integrated activities that bring product to market and create satisfied customers. In SCM, everything is involved; it plans-buys-makes-moves-and-sells. It is becoming increasingly difficult to ignore the roles of SCM in virtually every aspect of a company's operations. Strengthening management of supply chain enhances both customer satisfaction and profitability (David L. A. *et al.*, 1997), creates price advantages that help attract and retain customers (Bernard, 1997) and leads to increased market share which in turn brings with it competitive advantages such as lower warehousing and transportation costs, reduced inventory levels, less waste, and lower transaction costs (James and Donald, 1995). The objective being to create the most value for the entire supply chain network, including the end-customer, reduce working capital, accelerate cash-to-cash cycles and increase inventory turns (Keely *et al.*, 2001; Sotiris, 2000).

Despite the significance of SCM, a breakdown in the chain can waste up to 25 percent of a company's operating costs (James and Donald, 1995), threatens production and distribution (Robson and Rosane, 2013; Ruud, 2006) and reduce shareholder value by as much as eight to ten percent, or even worse (Hendricks and Singhal, 2003). A major disruption in the offshore supply chain can shut down a company, and have dire consequences on profitability besides bringing distribution and production to a screeching halt. This was felt most drastically in the past few years, when such events as power grid blackouts, plant shut down, natural disasters, fire and theft, poor communication of customer requirement,

labour disputes, supplier bankruptcy and other causes brought supply chain operation to a standstill (Chopra and Sodhi, 2004; Handfield, 2007).

Research has shown that most organizations are not adequately prepared to manage supply chain breakdown. The implication is that a US \$50 million to US \$100 million cost impact can be incurred for each day a company's supply chain network is disrupted (Handfield and Nichols, 2002; Mitroff and Alpasan, 2003). Besides, empirical evidence which explicitly looked at the impact of effective strategies to manage supply-chain (SC) breakdown on the five fundamental measures of operational performance (product quality and reliability, dependable delivery, flexibility in adjusting to volume change, higher return on investment and low cost) of enterprises is insufficient making it difficult to generalize the findings from previous researches. So, drawing clear-cut conclusion might be complicated. Therefore, this study is an extension of findings of prior research with major emphasis on the cause-effect relationships between the operational performance metrics and effective strategies to manage SCM breakdown. The findings of this research are hoped to add to the existing body of literature, provide a better understanding of the subject matter to suppliers, manufacturers, distributors/wholesalers and retailers, and serve as a frame of future reference to researchers, academics and students.

The remainder of the present paper is organized as follows. Next section provides a review of literature on the approaches to manage supply-chain breakdown and enterprises operational performance. This leads to the development of the hypothesis to be tested in this study. We then provide further details concerning the methodology of the research and analysis of data. The final section discusses the results and concludes the paper.

2. Literature Review

To date existing empirical evidence on the impact of strategies to management SCM breakdown on the operational performance of enterprises is too sparse for satisfactory conclusion. Substantial studies on this subject matter only give considerable attentions to SCM breakdown and its mitigating approaches. For instance, Handfield (2007) surmised that supply chain breakdown is a major disruption in the production or distribution nodes that comprise a supply chain. These may include events such as a fire, machine breakdown, an unexpected surge in capacity that creates a bottleneck, quality problems, natural disasters, customs delays or any number of different problems. These breakdowns can be costly and have in many cases brought distribution and production to a standstill. Further, Chopra and Sodhi (2004) affirmed that supply chain breakdown result from natural disasters, labour disputes, supplier bankruptcy, acts of war and terrorism. They went further and stated that the chain breakdown could damage sales, increase costs or both. Corroborating this view, AON (2013) conducted a survey of global risk management, the findings revealed that economic showdown, financial crisis and fiscal policies are strongly related to chain breakdown. Similarly, Michael J. K. (2004) examined the causes of supply chain breakdown as noted in 1995 earthquake which hit the port town of Kobe Japan, destroying 100,000 buildings and shutting down Japan's largest port for 26 months. This great disaster forced 1000s of firm to alter production, distribution, and inventory strategies just to survive.

The impact of supply chain breakdown on firms performance has been widely studied (Chopra and Sodhi, 2004; Michael R. D., 2005; Monczka and Jim, 1997; Norman and Jansson, 2004; Richard and Donald, 2006; Towill and Peter, 1999). The literature argued that supply chain breakdown threatens the firms' performance. Hence, the need to manage the breakdown leads Handfield (2007) to suggest redesigning supply chain in order to minimize the chance of re-occurrence which involves the development of tools for dynamic management of supply-chain systems. He emphasizes the need to be conversant with the supply-chain problem and readiness to carry out system-wide disruption awareness and capabilities if chain breakdown must be mitigated.

Aligned with the foregoing, Tang (2006) examined robust strategies for mitigating supply-chain disruption based on three cases studied in the U.S.A. He proposed nine strategies believed capable to mitigate supply-chain disruption if companies could minimize their exposure to risk. The studies revealed that supply incentive strategies could increase product flexibility and improve capability to manage; strategic stock capable of increasing product availability; flexible supply base and make and buy could increase supply flexibility; and revenue management, dynamic assortment planning and silent product rollover aid increase control of product. In another study, Ernst and Young (2013) stressed the significance of increased use of insurance to provide coverage for supply-chain breakdown. They believed that better flows of information and improved collaboration with suppliers can help to avert possibility of suppliers' failure. In addition, Ruud (2006) identifies lean, outsourcing and Just-In-Time inventory to stretch supply-chain in order to manage chain breakdown.

To clinch the above suggestions, Norman and Jansson (2004) and Michael J. K. (2004) developed proactive risk adjusted supply-chain strategies which combined risk management and cost minimization into one continuous process to develop optimal result for any organization determined to manage supply-chain breakdown. Similarly, Kleindorfer and Saad (2005) as cited in Silva and Reddy (2011) recommend the use of multiple suppliers as a way to manage supply-chain breakdown and disruption risks. Scott shared the same thought, suggest to put a contingency plan in place to protect supply-chain failure and minimize risk. David S. L. *et al.* (2014) added that system flexibility is the key to rapidly respond to a supply disruption while product-design flexibility would enable company to recover quickly from disruption of its supply.

Consequently, the still unanswered question is the evaluation of the causal relationships between the operational performance metrics and effective strategies to manage SCM breakdown in manufacturing enterprises? This is the basis of this study and the gap the research intends to fill. Hence, the present study aims to establish whether approaches (proactive risk management, system flexibility and system wide-disruption awareness) to manage SCM breakdown have a positive significant effect on operational performance (quality, dependability, flexibility, higher return on investment and low costs) of manufacturing enterprises in Katsina state.

3. Research Methodology

The study adopted a cross-sectional survey research design which is exploratory in nature. The available data to answer the research questions are readily qualitative and subjective in nature, and was obtained mainly through primary source. The independent variables are the approaches to manage supply chain breakdown (proactive risk management, system flexibility and system wide-disruption awareness) while the dependent variable are the enterprises operational performance metrics (quality, dependability, flexibility, return on investment, low costs). The manufacturing industries used were chemical and paint, blacksmith, textile, furniture, food processing, asbestos, foam, rubber product, fabricated metal, shoe and bag.

A sample of 105 respondents (production/operations managers) were randomly selected out of the total population of 143 registered small and medium scale (SMEs) manufacturing enterprises in Katsina state, Nigeria, through Krejcie and Morgan 1970 table of sample size determination. A structured questionnaire with closed-ended questions was used to gather the study data, with five-point Likert scale represents “strong negative impact”, “weak negative impact”, “no impact”, “weak positive impact” and “strong positive impact”. The questionnaire was group into three parts. Part one consists of items relating to proactive risk management and operational performance of firms. Part two focuses on items on system flexibility and operational performance of firms while Part three covers items on system wide-disruption awareness and operational performance of firms. The face and content validity of the questionnaire was ensured by giving the instrument to specialists on the topic in order to determine the appropriateness of the items of the instrument, ascertain relevance and clear ambiguity. The coefficient of the Cronbach’s Alpha was employed to determine internal reliability of the instrument which was 0.87 thus, indicated that the items used for the measurement model are technically free from error. Descriptive statistics, mainly the frequency and percentages, were used to analyse the data while Kendall coefficient of concordance was applied to test the hypotheses via SPSS version 21. All statistical tests were carried out at 95% significant level. The results of the hypothesis are presented in the next section.

4. Descriptive Analysis

The study sought to establish the impact of effective strategies to manage SCM breakdown on the operational performance of manufacturing firms. The study discovered that more than half of the respondents (57%) agreed that proactive risk management approach had a strong positive impact on product quality/reliability and higher return on investment. However, a weak positive impact was found for dependable delivery promises and flexibility in adjusting to volume change by 19% of the respondents while no impact was found for lower costs as asserted by 24% of the respondents. This observation was further buttressed with the result of strong positive relationships between SCM system flexibility and enterprises product quality/reliability, dependable delivery promises and flexibility in adjusting to volume change by 71% of the enterprises. A weak positive impact was observed between system flexibility and return on investment and lower costs from 30 manufacturing enterprises. With regard to system wide-disruption awareness strategies, strong positive impact was observed on product quality/reliability, dependable delivery promises, flexibility in adjusting to volume change and higher return on investment for 90 enterprises in contrast to weak positive impact established for lower costs.

5. Inferential Analysis

Kendall’s tau-c statistic is applied to tests whether approaches (proactive risk management, system flexibility and system wide-disruption awareness) to manage SCM breakdown have a positive significant effect on operational performance (quality, dependability, flexibility, higher return on investment and low costs) of manufacturing enterprises. If the significance value is small enough (conventionally sig.value must be less than .05) then we reject the hypothesis that the variables have negative impact and gain confidence in the hypothesis that they have positive impact. The value of the kendall’s tau-c statistic is .938 with p-value < .05 indicating a strong positive significant relationship between the two variables. This suggests that enterprises stakeholders (suppliers, manufacturers, distributors/wholesalers and retailers) should consciously embrace SC strategies and enforce its implementation if SC breakdown must be mitigated and operational efficiency must be enhanced.

Table 1. Summary of kendall’s tau-c showing the result of the hypothesis

Symmetric Measures		Value	Asymp. Std. Error ^a	Approx. T ^b	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-c	.938	.040	23.238	.000
N of Valid Cases		16			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

6. Discussion and Conclusions

In this paper, empirical analysis of the impact of effective strategies to manage supply-chain breakdown on the operational performance of manufacturing firms was conducted to accomplish the objectives of the study and contribute significant to the body of the literature. It is aimed to establish whether approaches (proactive risk management, system flexibility and system wide-disruption awareness) to manage SCM breakdown have a positive significant effect on operational performance (quality, dependability, flexibility, higher return on investment and low costs) of manufacturing enterprises in Katsina state. The hypothesis was analysed statistically with Kendall coefficient of concordance. The finding revealed a strong positive statistically significant relationship between strategies of SCM breakdown and operational performance of enterprises. This result confirmed the findings of previous studies carried out in this area. Earlier studies established that supply-chain strategies were effective to manage and mitigate supply-chain breakdown and improve operational performance in an enterprise. For example, [David S. L. et al. \(2014\)](#) asserted that system flexibility is the key to rapidly respond to a supply disruption and reduction in the cost of production while product-design flexibility would enable company to recover quickly from disruption of its supply. This view was corroborated by [Tang \(2006\)](#) and [Ernst and Young \(2013\)](#) who affirmed that supply-chain strategies are effective and capable to mitigate supply-chain disruption, increase product flexibility and improve operational efficiency. Hence, this study concludes that enterprises would become less vulnerable to supply-chain breakdown and enhance operational performance if they adequately utilize supply-chain strategies.

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