Quest Journals
Journal of Research in Business and Management
Volume 4 ~ Issue 3 (2016) pp: 01-09
ISSN(Online) : 2347-3002
www.questjournals.org

Research Paper

Influence of Supply Chain Risk Control Strategies on Performance of Food and Beverage Manufacturing Firms in Kenya

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Received 13 April, 2016; **A**ccepted 25 April, 2016 © The author(s) 2015. Published with open access at **www.questjournals.org**

ABSTRACT:-*The food and beverage industry has a special role in expanding economic opportunity yet this growth is threatened by supply chain risks. In this context, adopting proactive strategies is needed for dealing with supply chain risks and vulnerabilities for securing supply chain systems to be responsive and effective. This study focused on finding out the influence of supply chain risk control strategies on supply chain performance of food and beverage manufacturing firms in Kenya. The target population was all food and beverage manufacturing firms in Kenya. The accessible population was 187 food and manufacturing firms drawn from a KAM directory using a census survey method. A five-point Likert scale questionnaire was administered to senior-level managers with the knowledge of supply-chain and logistics functions. Both descriptive and inferential analysis was done using SPSS 17 and structural equation modelling (SEM) R-Lavaan 0.5-20 to find out the influence of supply chain risk control strategies on supply chain performance of food and beverage manufacturing firms in Kenya.*

Keywords:-*control strategy, SC Performance, SC resilience, SC vulnerability*

I. INTRODUCTION

Historically, the growth in manufacturing has been a key element in the successful transformation of most economies that have seen sustained rises in their per capita incomes (World Bank, 2014[1]). In most of Africa, performance in manufacturing has been particularly poor over the last decades. In Kenya, which ranks 17th from the top, manufacturing accounts for 10.6 % of the GDP, which is low compared to most middle income countries, yet it is the most manufacturing-intensive economy in eastern Africa. According to Republic of Kenya (2014[2]), the manufacturing sector in Kenya is a potential major source of growth. The role of the manufacturing sector in Vision 2030 is to create employment and wealth and transform Kenya into a middle-income country. The government's goal is for manufacturing to account for 20% of GDP by 2030, nearly twice today's level, at 10.6% (RoK, 2014[2]).

The Kenyan food-processing sector remains the largest component of the manufacturing industry (Kenya Association Manufacturers KAM, 2015[3]). This sector is the most important and largest comprising of over 187 businesses, encompassing everything from small family organisations to large multinational companies (KAM, 2015). Kenya National Bureau of Statistics (KNBS) report that in 2014, the sector generated over a third (33.4 %) of the total manufacturing production, and provided 33.5 % of jobs in the manufacturing sector. According to KAM (2015[3]) the Kenya Food and Beverage sector encompasses a range of sub-sectors: alcoholic beverages and spirits, cocoa, chocolate and sugar confectionaries, dairy products, juices, water and carbonated soft drinks meat and meat products, vegetable oils.

The food and beverage industry has a special role in expanding economic opportunity because it is universal to human life and health (Roth *et al*., 2008[4]). The food and beverage manufacturing industries account for approximately 50% of manufacturing production turnover which is about 2.8% of GDP (KAM, 2015[3]). Despite this huge influence, the food and beverage supply chain is increasingly in the spotlight for safety concerns, recalls and disruptions. Public interest on these issues has also grown following increasing consumer concerns. Supply chain risks are resulting in increased variations in capacity constraints, increased costs of operations or from breakdowns, quality problems, delays in delivery or even natural disasters at the supplier end (Blackhurst, Scheibe, & Johnson, 2008[5]; Vaaland and Heide 2007[6]).

II. LITERATURE REVIEW

2.1Introduction

Supply chain risk management (SCRM) is becoming an integral part of risk management in most organisations (Tomlin, 2006[7]; Ghagde, Dani, & Kalawsky, 2013[8]). A supply chain consists of all parties involved, directly or indirectly in fulfilling a customer request. The supply chain includes not only the manufacturer and suppliers, but also transporters, warehouses, retailers, and even customers themselves (Chopra, Meiindl & Kalra, 2007[9]).

Supply chain risk management is assumed to either proactively mitigate or reactively respond to risks (Tomlin, 2006[7]; Ghagde, Dani, & Kalawsky, 2013[8]). The conceptualisation of supply chain risk management incorporates supply chain resilience and supply chain vulnerability (Sorensen, 2005[10]). According to Ponomarov & Holcomb (2009[11]) supply chain resilience is an important part of SCRM. Supply chain resilience means the capability of companies to anticipate, identify, react and learn from incidents (Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007[12]; Sheffi, 2006[13]). Christopher (2005[14]) stated that resilient processes are agile and are able to change quickly

2.2 Supply chain performance measurements

Supply chain performance measurement is the process of qualifying the efficiency and effectiveness of the supply chain (Wong & Wong, 2008[15]). Supply chain performance measurement includes multiple dimensions including financial and non-financial metrics describing costs, capacity, lead times and service levels (Bigliardi & Bottani, 2014[16]). SCM could be measured at various management or operation levels. Strategic level measures influence top management decisions and also very often reflects investigation of broad based policies and level of adherence to organisational goals (Chopra *et al*., 2007[8]. The main metrics of a firm's operation performance are based (1) cost; (2) quality; (3) flexibility; and (4) delivery. Recent studies on supply chain management have suggested that these priorities can be categorised into two fundamental dimensions: efficiency and responsiveness (Chopra *et al*., 2007[8]).

2.3 SC Control strategies

According to Deming (1986[17]), the learning of individuals and organisations is a process or loop, which contains separate elements. Deming (1986[17]) presents the following elements: observation emotional reaction-judgment- intervention. According to Koskinen (2012[18]) supply chain management learning can be at the individual, team, node, and supply chain level when its individuals gain new knowledge, behaviour, skills, values, preferences, or understanding.

The ability to learn from past disruptions to develop better preparedness for future events is important to supply chain risk management (Ponomarov & Holcomb, 2009[11]). Therefore, leading companies provide training to employees, suppliers and customers supply network risks to raise awareness and reinforce the importance of supply chain resilience (Blackhurst *et al*., 2011[19]; Schoenherr, Tobias, Griffith, David, Chandra & Aruna, 2014[20]). Besides learning (i.e. knowledge creation) from past experiences and establishing standard practices within the supply chain, knowledge and understanding of supply chain structures – both physical and informational – are important elements of supply chain risk management (Choi *et al.*, 2012[21]). There are other useful and less formal ways in which practitioners share and transfer knowledge: through reflective practice, collaboration, networking, storytelling, coaching, mentoring, and quality circles (Sense, 2008[22]; Samuel, Goury, Gunasekaran & Spalanzani, 2011[23]).

Supply chain risk control is the process of taking proactive steps to reduce the identified risks where possible and putting procedures, rules or policies in place to minimize the residual risk or to reduce the severity of such a loss (Hepenstal & Boon, 2007[24]; Son & Orchard, 2012[25]). Effective supply chain risk management requires supporting infrastructure which is executive led (Flynn, Huo & Zao, 2010[26]; Lockamy, 2014[27]).It has been viewed that companies have been implementing different strategies and philosophies to control inventory, to eliminate waste, bring continuous improvement, to improve forecasting and improved efficiency and responsiveness (Christopher, Peck & Towill 2006[28]; Kleindorfer & Saad, 2005[29]).

The inventory management includes determination of the order quantity, the timing of order, reorder point and the replenishment of inventory. Inventory management and control are crucial to supply chain risk control strategies because mismanagement of inventory threatens a firm's viability (Juttner & Maklan, 2011[30]). Too much inventory consumes physical space, creates a financial burden, and increases the possibility of damage, spoilage and loss. Further, excessive inventory frequently compensates for sloppy and inefficient management, poor forecasting, haphazard scheduling, and inadequate attention to process and procedures. Khan, Christopher and Burnes (2008[31]) concluded that companies with very high inventory ratios have more possibilities to be bad financial performers. Strategic inventory reserves could be used to mitigate against supply chain risks (Vilko, Ritala, and Edelmann, 2014[32]). The effect of supply chain risks is decreased by forecast accuracy, thus it might increase the cost of inventory or stock. In order to mitigate these risks, the firm can use pool or aggregate demand forecasting (Musa & Tang, 2012[33]).

The responsiveness of a supply chain describes how quickly it responds to customer (Li *et al*., 2008 [34]), and being able to reconfigure the supply chain (Bernardes & Hanna, 2009[35]). Responsive supply chain ensures delivery in time, cost reduction and accurate forecasting of data (Mehrjerdi, 2009[36]). One requisite for continuous improvement and responsiveness is employee training and a culture that embraces quality principles (Christopher & Lee, 2004[37]). Techniques such as tactical cycle and operational cycle can detect if processes deviate from the planned. The main objectives for the tactical cycle are to identify, measure and prioritise (IMP) risks inherent in the organisation's supply chain processes. This is also referred to as risk chain analysis (RCA) because the aim is to identify those process risks inherent within the supply chain that are critical to the business and to prioritise them so that ultimately the organization can maximise the reduction in the supply chain process risk (Cranfield, 2011[38]).

The main objectives for the operational cycle are to analyse, reduce and control (ARC) high priority risks through individual risk management projects (Cranfield, 2011[38]). Even after a successful risk management activity, continuous monitoring is necessary to control the risk, analyze the effectiveness of the applied mitigation strategy and adjust measures if necessary at each step of the supply risk management process based on lessons learned (Craighead *et al*., 2007[12]; Giunipero & Eltantawy, 2004[39];Matook *et al*., 2009[40]). Performing companies provide training to employees, suppliers and customers on inventory management, forecasting, responsiveness and continuous improvement to raise awareness and reinforce the importance of supply chain resilience. Drawing on learning theory, the study hypothesized that: Supply chain risk control strategies have positive influence on performance of food and beverage manufacturing firms.

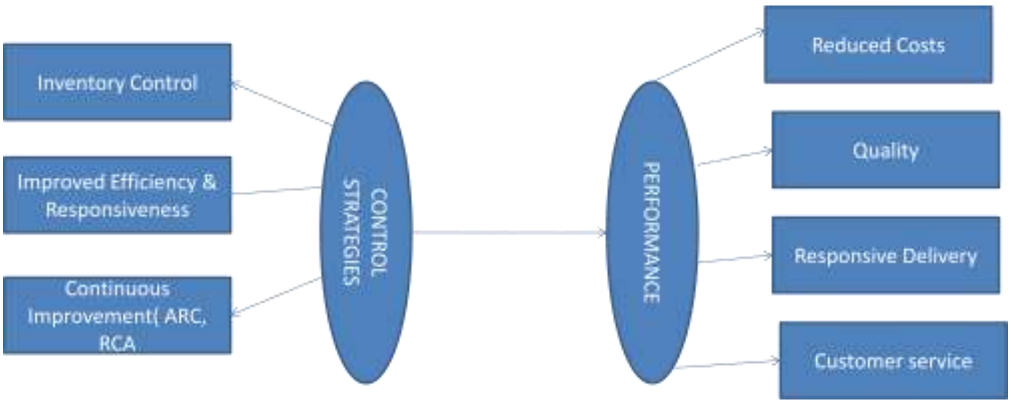

Figure 1: Conceptual Framework

III. RESEARCH METHODOLOGY

3.1. Data Collection Instrument

The study administered a questionnaire to obtain primary data –the unit of analysis was the individual firm and the population was all 187 KAM membership food and beverage manufacturing firms in Kenya. Target respondents were senior-level managers with the knowledge of supply-chain and logistics functions and direct involvement in strategic and operational decision-making. Such respondents were chosen as key organizational informants due to their set of skills, business responsibilities and SC expertise.

3.2 Sample and Sampling technique

This research collected data form I87 firms using the census survey technique. A census survey is the procedure of getting information from each member of the population (Saunders *et al.*, 2009[41]). Census survey is the appropriate data collection design for a small heterogeneous population. Since the sample frame for the study was small and heterogeneous, census survey was adopted. According to Saunders, *et al.*, 2009[41]) the larger the sample size for a small population, the more accurate the results are likely to be and hence the choice of the census technique in this study.

3.3 Data Collection

This study used questionnaire with both closed questions to collect information. The decision to use a questionnaire approach to data collection was consistent with the exploratory aspects of the research question, and the complexity of the issues involved (Wieland & Wallenbug, 2012[42]; Xiao-Feng Shao, 2013[43]). The study sought to find out the influence of supply chain risk avoidance strategies on supply chain performance in food and beverage manufacturing firms. Since the study was concerned mainly with variables that could not be directly observed, questionnaires were used. A five-point Likert scale was used to measure practitioners' perceptions of the extent to which different types of resources and activities achieve supply chain risk management. The end points were labelled 'Strongly disagree' (1) to 'Strongly agree' (5). The mid-point (3) was labelled 'Neutral'. Avoidance strategies include delaying entry to certain markets, avoiding some suppliers and participating in low uncertainty markets. The items were generated by reviewing relevant research literature in supply chain risk management.

IV. DATA ANALYSIS, RESULTS AND DISCUSSIONS

The data was analyzed using both descriptive measures and exploratory factor analysis to identify and validate the items contributing to each component in the model. Structural equation modeling (SEM)-R, Lavaan 20 has been commonly used in recent years as a basis for theory development and testing in supply chain management, and other related disciplines (Wallenburg & Weber, 2005[44]; Kiyun, 2011[45]; Wieland & Wallenbug, 2012[42]; Xiao-Feng Shao, 2013[43]). One of the advantages of structural equation modeling is the possibility to also look at indirect effects between latent constructs. It means that all hypothesized relationships could be tested simultaneously while indirect and direct effects on the endogenous variables could be separated.
The questionnaire was pilot tested on 10% of the members of the sampling frame. A total of 19 firms responded during the pilot survey. After recording all the completed responses, the data was into SPSS 17 software for further analysis. At the preliminary stage the survey responses were examined for errors and missing data. Surveys completed in their entirety accounted for 100% of all collected. Reliability is the extent to which the items are consistently measuring the intended latent construct. To satisfy the reliability criterion, a Cronbach's alpha value of more than or equal to 0.7 is required (Hair *et al.,* 2013[46]). The constructs used in the study have more than 0.7 alpha Cronbach (Table 1).

Table 1: Summary of Constructs

Variables	Mean	SD	Cronbach
CONTROL STRATEGIES	**3.43**	**1.24**	**0.859**
Inventory management			
CS1 Holding of buffer stock to mitigate the risk of stock-out			
CS2 Keeping extra inventory of strategic items (e.g. raw materials parts, and finished goods)			
Capacity			
CS3 Holding of underutilized capacity which serves as a cushion to any disruptions			
Continuous improvement			
CS4 Using improved forecasting techniques to reduce risks associated with supply chain			
CS5 Regular monitoring of supply chain risks (demand, supply process and environmental risks			
SC PERFORMANCE	**3.47**	**1.13**	**0.899**
SCP1 The ability to achieve the lowest possible cost of logistics through efficient operations and/or scale economies			
SCP2 The ability to reduce the time between order receipt and customer delivery to as close to zero as possible			
SCP3 The ability to meet quoted or anticipated quality and quantities on a consistent basis			
SCP4 The extent to which perceived supply chain performance matches customer expectations			

4.2: Descriptive Statistics

4.2.1. Response Rate

Out of the administered 187 questionnaires, 165 were returned fully completed. The response rate is shown in Table 2. This represents a significant 87.3 percent response rate.

Table 2: Case Processing Summary

Valid Active Cases	165
Active Cases of with Missing Values	0
Supplementary Cases	22
Total	187
Cases Used in Analysis	165

4.2.2 Gender of the Respondents

The study sought to establish the gender of respondents in the study. The following information (Table 3) was obtained from the respondents.

Table 3: Gender of the Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	95	57.6	57.6	57.6
	Female	70	42.4	42.4	100.0
	Total	165	100.0	100.0	

The majority of the respondents were male (57.6 per cent) compared to 42.4 percent female. This shows that the gender parity food and beverage manufacturing firms in Kenya is narrow.

4.2.3: Type of Business

The study also sought to establish the types of food and manufacturing firms that the respondents worked for. The information in Table 4 was obtained.

Table 4: Types of Businesses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Alcoholic beverages and spirits	7	4.2	4.2	4.2
	Cocoa, chocolate and sugar confectionaries	35	21.2	21.2	25.4
	Dairy products	39	23.6	23.6	49
	Juices, water and carbonated soft drinks	57	34.5	34.5	83.5
	Meat and meat products	13	7.9	7.9	91.4
	Vegetable oils.	9	8.6	8.6	100
	Total	165	100.0	100.0	

The breakdown of the main test survey respondents by industry is presented in Table 4. Results indicate that the majority of the main test survey participants were from Juices, water and carbonated soft drink (34.5 percent). The dairy sub sector and confectionaries contributed 23.6 percent and 21.2 percent of participants respectively. Participants from the vegetable oil accounted for an additional 8.6 percent. The rest (7.9 percent) were from the meat and meat products.

4.2.4: Influence of Supply Chain Control Strategies on Performance

The study sought to establish whether supply chain control strategies influence performance. The indicator of holding buffer stock had the highest mean score of 3.45 as 23% of the respondents strongly agreed and 29% agreed with the practice. Twenty one percent (21%) of the respondents however disagreed while 4% strongly disagreed with the SC practice. The study revealed that keeping extra strategic inventory does influence performance of F&B manufacturing firms. The indicator had a mean score of 3.43. Fifty five percent (55%) of the respondents agreed with the sentiments as only 26% disagreed with the same. When the respondents were asked to indicate whether holding underutilized capacity to serve a cushion influenced SC performance, 28% of the respondents strongly agreed, and 26% agreed while 21% of the respondents disagreed with 8% strongly disagreed as shown in Table 5.

The study sought to establish whether the firms used improved forecasting techniques to influence SC performance. With mean of 3.45, 28% of the respondents strongly agreed with 22% agreeing. However, 16% of the respondents disagreed with 9% strongly disagreeing with the practice. Monitoring SC systems for risks had the lowest influence (mean=3.38). Twenty percent (20%) strongly agreed as 29% agreed that the practice had influence on performance. Twenty one percent (21%) of the respondents disagreed and 5% strongly disagreed with the practice.

Table 5: Control Strategies Influence SC Performance

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	SD
CS1Holding of buffer stock to mitigate the risk of stock-out	4	21	23	29	23	3.45	1.176
CS2 Keeping extra inventory of strategic items (e.g. raw materials parts, and finished goods)	9	17	19	32	23	3.43	1.265
CS3Holding of underutilized capacity which serves as a cushion to any disruptions	8	21	18	26	28	3.45	1.304
CS4Using improved forecasting techniques to reduce risks associated with supply chain	9	16	26	22	28	3.45	1.280
CS5 Regular monitoring of supply chain risks (demand, supply process and environmental risks	5	21	26	29	20	3.38	1.165

4.3: Structural Equation Modelling (SEM)

This study used structural equation modelling for inferential statistics. Structural equation modelling (SEM) is a statistical technique used to explain the covariance among a set of variables (Hair *et al.*, 2013[46]). SEMs are most appropriately used in a confirmatory to test a theory that explains the relationships among a group of variables. These relationships are specified prior to theory testing and inform data collection (Hair *et al.,* 2013[46]).

4.3.1: Confirmatory Factor Analysis Model Estimation

The weighted least squares mean and variance adjusted (WLSMV) estimator was used to estimate all models (Table 6). WLSMV is robust estimation technique is useful when data are coarsely categorized or follow nonnormal distributions (Sass, Schmitt, & Marsh, 2014[47]). The robust techniques apply rescaling corrections or use alternative calculation procedures to other estimation methods to overcome shortcomings .WLSMV estimator has been found to perform better than with small sample sizes with categorical responses. WLSMV based parameter estimates have show little bias, even when nonnormally distributed ordinal data with few categories are analyzed (Rhemtulla, Brosseau-Liard, & Savalei, 2012[48]).

Table 6: Parameter Estimates

CS =~						
CS1	0.781	0.037	20.998	0.000	0.781	0.781
CS2	0.781	0.038	20.685	0.000	0.781	0.781
CS3	0.783	0.041	18.943	0.000	0.783	0.783
CS4	0.777	0.035	21.915	0.000	0.777	0.777
CS5	0.693	0.047	14.830	0.000	0.693	0.693
SCP =~						
SCP1	0.408	0.084	4.865	0.000	0.804	0.804
SCP2	0.435	0.089	4.877	0.000	0.858	0.858
SCP3	0.452	0.091	4.956	0.000	0.890	0.890
SCP4	0.472	0.094	4.998	0.000	0.930	0.930

Confirmatory factor analysis results for the measurement model provided evidence for convergent validity because all items exceeded the recommended factor loading threshold of 0.5. Unidimensionality is achieved when the items have acceptable factor loadings that are 0.5 or higher (Hair *et al.*, 2013[46]). Reliability is the extent to which the items are consistently measuring the intended latent construct. To satisfy the reliability criterion, a Cronbach's alpha value of more than or equal to 0.7 is required (Nunnally, 1994[49]). The results of the unidimensionality and reliability analysis for all the constructs are shown in Table 6.

4.3.2: Model Evaluation Criteria: Goodness of Fit

The model fitting process in SEM involves determining the goodness-of fit between the hypothesized model and the sample data (Sass, *et al.*, 2014[47]). Goodness of fit shows how well the specified model reproduces the observed covariance matrix among the indicator items. Chi-square and p-value-- the higher the probability level (p value) associated with chi square, the better the fit. SRMR (standardized RMR, root mean square residual). SRMR < = .05 means good fit. The smaller the SRMR, the better the model fit. SRMR = 0 indicates perfect fit. A value less than .08 is considered good fit. The GFI should by equal to or greater than .90 to indicate good fit. A value of 1 indicates a perfect fit. CFI (comparative fix index), close to 1 indicates a very good fit, > 0.9 or close to 0.95 indicates good fit, by convention, CFI should be equal to or greater than .90 to accept the model. CFI is independent of sample size (Rhemtulla, *et al.*, 2012 [48]).

NNFI close to 1 indicates a good fit. TLI greater than or equal to 0.9 indicates acceptable model fit. By convention, NNFI values below .90 indicate a need to re-specify the model. TLI less than 0.9 can usually be improved substantially. RMSEA (root mean square error of approximation), there is good model fit if RMSEA less than or equal to .05. There is adequate fit if RMSEA is less than or equal to .08. The developed model has been proven to meet all the requirements and the results are shown in Table 7.

Table 7: Summary of Goodness of Fit

Name of index	Index value	Comment
CFI (□0.9)	1.000	CFI > 0.95
GFI(□0.90)	0.993	GFI > 0.95
TLI (□0.9)	1.00 2	TLI > 0.95
NNFI(□0.9)	1.002	NNFI > 0.90
RMSEA (□0.08)	0.000	RMSEA < 0.05
WRMR	0.762	
CHISQ/ DF	302.919/ 362.000	
P VALUE (□0.5)	0.989	p-value > 0.05

4.6: Hypothesis Testing Results

Supply chain risk control strategies have positive influence on performance of food and beverage manufacturing firms.

Supply chain risk control strategies have standardized loading of 1.777 and Z value of 7.551 with performance as shown in Table 8. The relation is positive and significant at 1% level as the p-value associated with the critical ratio is less than 0.01. Therefore, Supply chain risk control strategies have positive influence on performance of food and beverage manufacturing firms in Kenya.

Table 8: SC Control Strategies

HISQ	DF	PVALUE	CFI	TLI	RMSEA	NNFI	GFI	WRMR
310.244	366.000	0.984	1.000	1.002	0.000	1.002	0.993	0.771

LHS OP RHS	EST	SE	Z	PVALUE	CI.LOWER	CI.UPPE
SCP ~ CS	1.777	0.235	7.551	0	1.316	2.239

We conclude that supply chain risk control strategies have positive influence on performance of food and beverage manufacturing firms ($\beta = 1.78$, p-value < 0.0001, $R^2 = 0.76$)

IV. CONCLUSION

The objective of this study was to evaluate the influence of supply chain risk control strategies on F&B manufacturing industries in Kenya. From a practical point of view, our results suggest that more attention should be placed on the ability to continuously improve SC systems.The ability to learn from past disruptions to develop better preparedness for future events is important to supply chain risk management. It has been viewed that F& B manufacturing firms have been implementing different strategies and philosophies to control inventory, to eliminate waste, bring continuous improvement, to improve forecasting and improved efficiency and responsiveness. These practices impact on operational costs, quality, delivery and customer service levels. In order to improve SC performance, firms must be learning organizations. Failure to monitor, control and respond to new challenges can pose devastating risks for food and beverage manufacturing supply chains. Control strategies aim at testing capacity, reducing time to accomplish a process, increasing awareness and knowledge among employees about the risk-management plan and incorporating lessons learned from previous tests and actual incidents. Ideally, F&B manufacturing firms should have detailed governance procedures for managing SC risks. This study is, however, subject to some limitations. First, our sample is geographically limited to Kenya and focuses on the food and beverage industry. Second, the study features a relatively small sample size. We, therefore, suggest replicating this study in a different geographical area.

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