

Impact of Covid-19 on the Sierra Leone Brewery Limited Supply Chain

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Abstract

After the outbreak of the novel coronavirus disease (Covid-19) in late December 2019, many supply chains (SCs) and industries around the world have been greatly affected by the impacts of the virus. Measures such as closure of international airports, seaports, land borders, nationwide lockdown, social distancing, quarantine measures, and work-from-home have impacted many production firms and consumers around the globe. The overall objective of the research is aimed at assessing the impact of the covid-19 lockdowns and social distancing measures on the SC of the Sierra Leone Brewery Limited (SLBL) located in Sierra Leone, West Africa. The study gives insights into the understanding of SC in relation to the covid-19 pandemic by uncovering key issues of the covid-19 measures to the normal operations of the company that provides a baseline for the company in decision making should there be such an unforeseen disruption to its SC. The research adopted a case study qualitative research method, administering open-ended questionnaires to identify the key problems caused by the covid-19 measures. The research identified six (6) key problems from the responses of participants and proposes improvement initiatives by the use of the quality function deployment (QFD) framework.

Keywords

Supply Chain (SC), Pandemic, quality function deployment (QFD), Covid-19, SLBL.

1. Introduction

COVID-19 pandemic has brought a disruption that has impacted every corner of the globe since the outbreak in Wuhan, China in late 2019. Disruptions are costly to a firm's supply chain and hence affects the performance of the entity. Pujawan and Bah (2021) described SC disruptions as significant breakdowns in the production process that affect end-user activity. This corroborate the ideas of Vanpoucke and Ellis (2019) who suggested that supply chain disruptions, and their mitigation, represent a pressing concern for today's purchasing, supply managers, and the supply chain as a whole. The beverage industry is an essential component of Sierra Leone's economy.

Global SCs have been disrupted due to the interconnectivity of their activities. Kamara and Pujawan (2020) emphasized that the management of SCs has become a significant aspect of global business performance and sustainability. The practice of social distancing has become a lifestyle as individuals, governments, communities, and industrial firms come to stick with it (Sarkis et al. 2020). A global fall in economic activities by the major production countries in the world has resulted in several firms reducing staff capacity and taking other necessary measures to suppress increased costs. Therefore, this research has been conducted at a time where companies are faced with various challenges in their SC processes during the covid-19 pandemic. The improvement initiatives provided in this paper will serve as a baseline for the company's SC continuous resilience and performance during disruptions.

1.1 Background of the Sierra Leone Brewery Limited

The Sierra Leone Brewery Limited came into existence on 19th November 1962 with its production and manufacturing headquarters located at the Wellington Industrial Estate in the eastern part of Freetown, Sierra Leone. The company started producing Heineken lager beer after obtaining permission from Messrs. Heineken Technique and Beer of Holland. This product was brief due to increases in production related costs. A major supplier of stocks is IBECOR in Holland, approved by Heineken International to supply Kronos (Heineken Technical Experts) materials, raw materials like malt, sugar, yeast, etc. and spare parts for the new bottling line which is used for producing the products

of the Sierra Leone Brewery Limited. With the efficiency of the new bottling line and enough stock, production is rapid without any delay to cause shortages in the market.

As at today, the company is owned by both foreign (97.76%) and local investors (2.24%), and since have ensured the company engaged in the production of Star Beer, Trenk beer, Salone beer and Maltina. Brewing and marketing of these products are the primary functions of the company. As a secondary objective, the company is the sole importer and marketer of Heineken, Heineken Keg, Shandi, Climax, Mutzig, etc. For the primary products (i.e., Star, Mutzig, Trenk, Salone beer and Maltina) raw materials are needed for the production including bottling half for storing empty crates and bottles, in providing an industrial and manufacturing base for the economy, employment opportunity is also part of the company's objective. Currently, the company is rated as having the largest market in the country for its products, and one of the highest employers in the country.

1.2 Research Questions

In the study by Bodenstern et al. (2020) stated that the covid-19 measures can reduce the number of infections amongst people but at the same time create serious social and economic costs to businesses, workers and society. Therefore, two questions that needed to be investigated in this paper are:

- I. What are the key problems encountered by the company's SC during the lockdown and social distancing measures?
- II. What are the improvement initiatives that can be implemented to achieve a sustainable and resilient SC during disruptions (in this case covid-19)?

1.3 Objectives

It is important for SCs to be robust during disruptions to normal operations. It is of great importance to assess the SC problems during the covid-19 to the Sierra Leone Brewery Limited (SLBL). However, other specific objectives include:

- I. To unearth key problems brought by the covid-19 lockdown and social distancing measures to the SLBL's SC through a structured online open-ended questionnaire.
- II. To propose improvement initiatives to these problems identified by the use of quality function deployment (QFD) framework.

2. Literature Review

As of July 9, 2021 over 186 million covid-19 cases and over 4 million deaths with over 170 million recoveries (Worldometer 2021) have being reported. In the study conducted by Beatriz et al. (2020) noted that Covid-19 is a significant source of external risk to the smooth operation of SCs, this source of risk had destabilized SCs, leaving them unable to meet demand and satisfy customers' requirements and needs. In the absence of an immediate effective treatment or vaccine in its early days, governments around the world urged people to comply with non-medical measures through strict lockdowns and social distancing (Nilsen et al. 2020, Sardar et al. 2020). Lau et al. (2020) highlighted that heavily affected regions had been able to buy time and enable medical facilities to cope with increasing intense care cases by implementing strict lockdown and social distancing measures.

Guan et al. (2020) argued that SC losses are more responsive to the duration of the lockdown measures rather than its strictness. In the study conducted by Wieteska (2020) found that the facets of managing SC disruptions and sustainability development are now critical for ensuring the continuity of business processes.

2.1 Supply Chain Disruptions (SCDs)

A disruption has been described as any event that occurs suddenly and whose impact may increase in intensity to operational and economic losses (Kaur and Singh 2019). Several events in the past had disrupted SC activities in different regions of the world. Natural disasters, epidemic and pandemic outbreaks have been the most common disruptions to global SCs. But in the study by Oke and Gopalakrishnan (2009) highlighted import, climate, man-made and natural disasters, socio- economic, and loss of key suppliers as key potential supply risks that could disrupt SCs. Hence the issue of SCD have become crucial problems for SC managers to resolve due to its negative consequences and the rising frequency over which they happen (Albertzeth et al. 2020). SC issues are difficult to consider and address because of the interplay of various elements inside and between levels of the SC. As a result, when a significant event happens in today's integrated environment, many organizations will be either affected by or engaged in managing the risk (Ahlqvist et al. 2020, Pope 2020). As a result, a disruption in one country could have an impact on production industries in other nations along global SCs. To maintain resilience during and after disruptions (whether

pandemics, man-made calamities, or natural disasters), global SCs must collaborate (Pujawan and Bah 2021). Hence, Albertzeth et al. (2020) argued that if such a disruption occur along a SC, a key important sector that might be seriously affected is the transportation sector due to the interconnectedness of global sourcing of SCs.

Due to robust SC mechanisms and investments, some firms do withstand the negative consequences caused by disruptions. In their research, Ambulkar et al. (2015) discovered that a company can be resilient during SC disruptions by keeping an understanding of the environment such that potential disruptions can be managed. Tang (2006) emphasized that having a proper SC policy will help an organization become more robust during and after disruptions. Covid-19 responses has introduced a bullwhip effect in the manufacturing sector on a scale never-before-seen to global SCs (Handfield et al. 2020). Hence, Yu and Aviso (2020) stated that due to the interconnectedness of global SCs, has made industries and economies vulnerable to the outbreak of the covid-19 pandemic due to the unpreparedness to handle such a pandemic.

2.3 Impact of Lockdowns and Social Distancing on SCs

Several studies have identified various effects the covid-19 lockdown and social distancing measures has had on SCs across the globe. The covid-19 pandemic has further disrupted domestic value chains and increased West Africa's reliance on imports as a result of global lockdowns that have severely limited farm labor, transportation, and security (Arouna et al. 2020, Inegbedion 2020). Beatriz et al. (2020) noted that Covid-19 is a significant source of external risk to the smooth operation of SCs which has destabilized SCs, leaving them unable to meet demand and satisfy customers' requirements and needs. However, during the covid-19 pandemic, several research conducted showed that lockdowns and social distancing measures had a negative effect on the functions of national and international SCs, and that these measures had greatly increased inequality among societies, especially in developing countries (Arndt et al. 2020, Arora et al. 2020, Chirisa et al. 2020, Giammetti et al. 2020, Mandel & Veetil 2020, Singh et al. 2020).

2.4 SC Challenge of Vaccine Production and Distribution

Countries like the U.S, Canada, Australia, UK, China, Nigeria, Singapore, etc. have all been pushing towards the accomplishment of successful vaccines. However, the supply of these vaccines will underline the next challenge SCs will face in the optimal distribution of this scarce resource related to covid-19. Shin et al. (2020) recommends that the complexities of vaccine supply and distribution for a global pandemic could drive vaccine platform selection that should have easy integration into devices designed to be widely distributed, produced at low cost, and administered with minimal supervision. Graham (2020) strongly argued that vaccine production typically takes years or decades to be approved, having an authorized vaccine available for large-scale distribution within a year may increase the severity of subsequent SARS-CoV-2 infection. As a consequence, the efficacy of vaccines given to people during this period must be a top priority.

2.5 Effect on Global SCs During Covid-19 pandemic

The coronavirus pandemic has unleashed many challenges that the world and global SC is still fighting to gain control over. The year 2020 and the start of 2021 have been very difficult years for SCs and global economies as every business now is more concerned about what will be the aftermath to their normal operations post covid-19. Various studies are have tried to explicitly investigate and analyze the impact of covid-19 on the global economy, local economies, businesses, and social lives of people. The findings from studies conducted by Arndt et al. (2020); Arora et al. (2020); Chirisa et al. (2020); Giammetti et al. (2020); Inegbedion (2020); Jribi et al. (2020); Kanitkar (2020); Kumaran et al. (2020); Mandel & Veetil (2020) have contributed in several ways to the understanding of covid-19 on the globe by investigating the effect lockdowns have brought on both national & international SCs, economies, global production, employment, and education. The World Economic Forum (2020b) reported that the impacts of covid-19 on the global financial system will have a long-term negative effect on the global economy's recovery post covid-19. Finally, a very important issue to note is the emergence of vaccines for the covid-19 virus. As the race to create and develop vaccines for the virus intensifies, countries are investing heavily in the research and development of the project. But there are emerging challenges that SCs are facing, such is the distribution of vaccines to places highly needed as emphasized by Deo et al. (2020); Graham (2020); Kaur & Gupta (2020); Koirala et al. (2020); Shin et al. (2020) that SCs will encounter significant challenges in implementing a viable distribution system.

3. Methodology

This research adopted a qualitative case study method as it seeks to assess the impact of the covid-19 lockdown and social distancing measures on the SC of the SLBL. Case study research has gained a reputation as a valuable tool for researching and comprehending complex problems in real-world contexts (Harrison et al. 2017). The use of qualitative

case studies is a well-established tool for investigating and identifying individuals or groups that are associated with a specific issue that affects humans or society (Creswell 2009 p. 4). Online open-ended questionnaires were administered to collect information from the targeted sample size.

3.1 Sampling Technique and Sample Size

A sampling technique is the method used in selecting appropriate sample of participants from the population (Cooper and Schindler 2014 p. 84). As explained by Cooper and Schindler (2014 p. 351), Kothari (2004 p. 62) that it is a process in which the population is divided into strata, from which items are selected in each stratum to constitute a sample.

Table 1. Sample size distribution

Total Staff Number	Percentage	Sample Size
115	35%	40

Table 1 above show the total number of staff and the sample size for the study. After the distribution of questionnaires, 40 employees were able to respond within the time frame established in gathering data for the study. The sample size as a percentage of the total gives a percentage of 35%, which is considered adequate for the study. Hence, this is supported by Cooper and Schindler (2014 p. 354) that 10% to 75% of the total population is justifiable figure to use when the total population of a study is large.

3.2 Data Collection

Questionnaires were developed as the main source of collecting data for the research, in which the research objectives and demographic information were provided for the participants in the introductory part. Green and Salkind (2014 pp. 51–55) asserts that the collection of information and analyzing them are the founding pillars to the success of a research. In line to this, Kothari (2004 p. 95) divided the data a researcher needs to consider into both primary and secondary. Hence, this study uses both by developing and administering an online open-ended questionnaire (through google forms) for the collection of primary data and using secondary data such as articles, publication journals, books, etc. Table 2 below show the response rates from the participants.

Table 2. Data collected from participants

Participants	Response	Percentage (%)
Directors	1	2.5
Supervisors	4	10
Managers	8	20
General Staff	25	62.5
Secretaries	2	5
Total	40	100

From Table 2 above, it shows that only 1 representing 2.5% participant was a director, while 10% represented supervisors across the entire respondents. 20% of the responses represented managers, 62.5% of the participants were general staff members, being the highest group. Meanwhile, 5% represented secretaries.

3.3 Data Analysis Method

Using the quality function deployment (QFD) framework, the study proposes improvement initiatives to these problems based on responses from respondents and rigorous literatures on how to mitigate these problems. This framework presents important improvement initiatives and what actions need to be done that can help the company during disruptions. Furthermore, it gives weight to these items in the framework in order to determine their level of importance. The QFD framework provided an analysis of competitive strength between the SLBL and two other top competitors in the beverage industry. The competitive strength was rated from 1 to 5 (1 being the lowest strength, and 5 being the highest strength).

4. Results and Discussions

4.1 Key Problems Identified

From the questionnaires sent to participants aiming to identify the problems created by the covid-19 lockdown and social distancing measures to the company's SC, six key issues to the company's operations and sustainability were

identified as stated shown in Figure 1 which show a fishbone analysis of the key problems identified from the study. These problems have created a disruption across the SC of the company's processes.

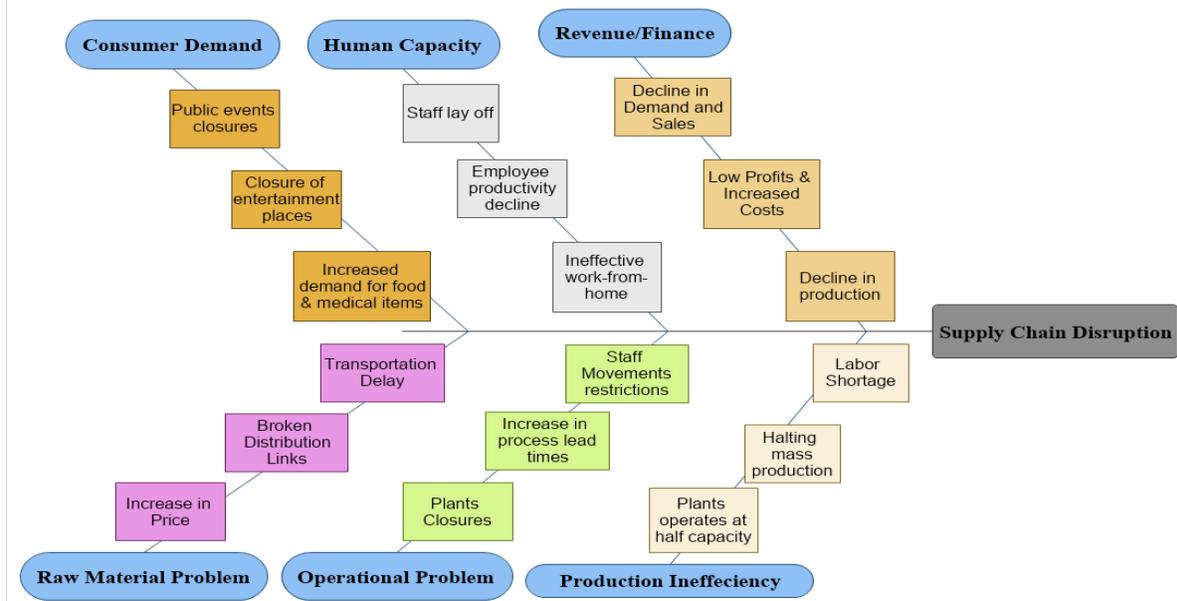


Figure 1. Fishbone analysis of key problems identified

4.1.1 Lockdown in the fishbone Analysis

It can be seen that these six factors have had a negative effect on the SC of the SLBL. Firstly, as a result of the lockdown, consumer demand has fallen for their products due to the closures of public events, entertainment places, and a significant rise in the demand for food stuff, medical and non-medical items like, face masks and hand sanitizers for the protection against the virus. Next to this issue is the effect it had on the staff capacity of the company. It can be seen that staff were temporarily or permanently laid off and some were asked to work from home which do not prove to be too effective considering the infrastructure that are in place. Another key problem created is the shortage of raw materials from suppliers. For the SLBL, the key transportation of raw materials is by trucks from various suppliers to the company site. Due to the lockdown of certain regions across the city and countrywide, transportation of raw materials was affected causing an increase in lead time, increase in raw material prices, broken distribution links between parties involved. This has resulted in shortage of raw materials available for mass production even though, the production capacity was reduced due to demand forecasts. Revenue generation significantly declined as a result of the closures of entertainment places, events and tourism. Sales declined during this period, making the company prone to breakeven point.

4.1.2 Social Distancing in the fishbone Analysis

In Figure 1 above, it can be seen that this measure resulted in production inefficiency and operational deficiencies. This measure ensure people are not clustered in an enclosed location; they must be separated by a specific distance to avoid direct contact. According to the results of the study, when employees are separated in production plants, this on the other hand causes operational disruptions. The physical distancing of employees resulted in plant closures due to the unavailability of operators, increases process lead times, and staff restrictions to-and-from certain areas, all which culminated to disrupted operational processes. The other important problem that can be seen is that of the result of production inefficiency which has been a critical backlash to the company during the implementation of social distancing among its staff. It occurred as a result of the massive reduction in labor supply, reduction in production capacity, and plants operating at half of their capacity.

4.2 The Quality Function Deployment (QFD) framework

Due to the uncertainties that have been created by the outbreak of the covid-19 pandemic, manufacturing companies would need robust SCs and operational sustainability to bounce back from the troubles brought by the virus. QFD is

a system used by an entity to establish a connection between customer needs and their corresponding organizational/operational requirements (Rahmawan and Kholis 2017). QFD has been known to be a very important instrument that ensure companies move towards a more proactive production process and customer satisfaction (Chan and Wu 2002). Meanwhile, Shrivastava (2013) describes HoQ as one of the matrices of an iterative process called QFD which acts as the nerve center that drives the QFD process. This tool consists of a matrix that facilitates the identification of customer requirements (in rows) that affects design variables (in columns), a roof that determines if there are trade-offs among pairs of design variables. Chen et al. (2017) illustrated that additional column which benchmarks how competitors satisfy each customer needs are also established on the right side of the matrix. This framework has been used in this study to further help the company address these problems already caused by the measures of the covid-19 pandemic to their SC.

As stated in the objective of this study, QFD is used to present improvement initiatives to the problems identified caused by the covid-19 lockdown and social distancing measures to the SC of the SLBL. These mechanisms will further strengthen their SC resilient during disruptions, ensure smooth continuity of their operations and, above all, achieve higher competitive advantage. The QFD entails various branches in analysing these initiatives ranging from the correlation between the action plans needed (how) and the direction needed to be taken, importance score given to the improvement initiatives with corresponding relative weights, and competitive assessment done between the case company and two other top competitors in the industry. Figure 3 below illustrates these analyses. Finally, in the framework, weights are calculated for the control variables (how's) in order to determine their level of significant importance.

4.2.1 Why QFD?

Due to the greater challenges that keep evolving every day in meeting customers and production quality expectations, companies continuously find themselves in a situation where they invest a lot to achieve such expectations and surpass them. In that vein, the QFD is a very useful tool that assist companies achieve those set targets more proactively. Successful applications of QFD as a proactive planning methodology tool have yielded numerous benefits, including cheaper start-up costs, faster design cycles, increased teamwork, and the availability of proper documentation. The QFD framework has been around for a very long time and have helped companies who have implemented it to achieve their objectives in a more unique, cheap and reliable form. Due to these benefits, the study found it very unique in helping the SLBL provide improvement initiatives during these difficult times. The benefits of using the QFD framework is summarized in Figure 2 below.

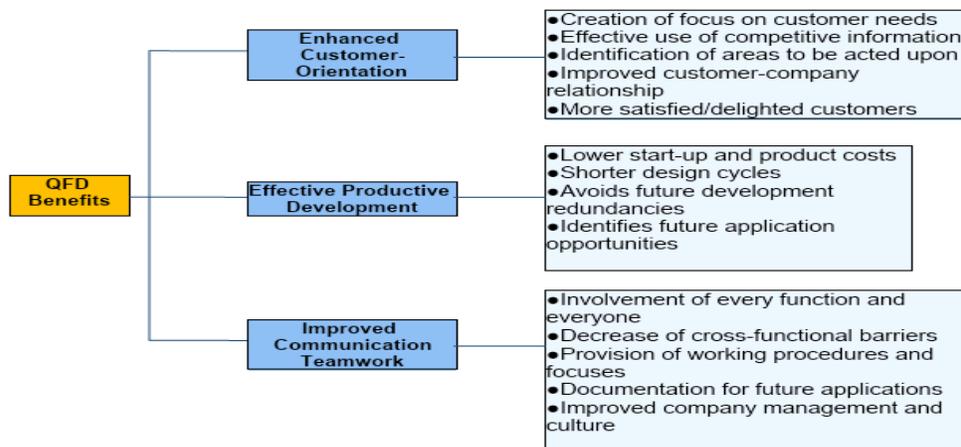


Figure 2. benefits of using the QFD framework

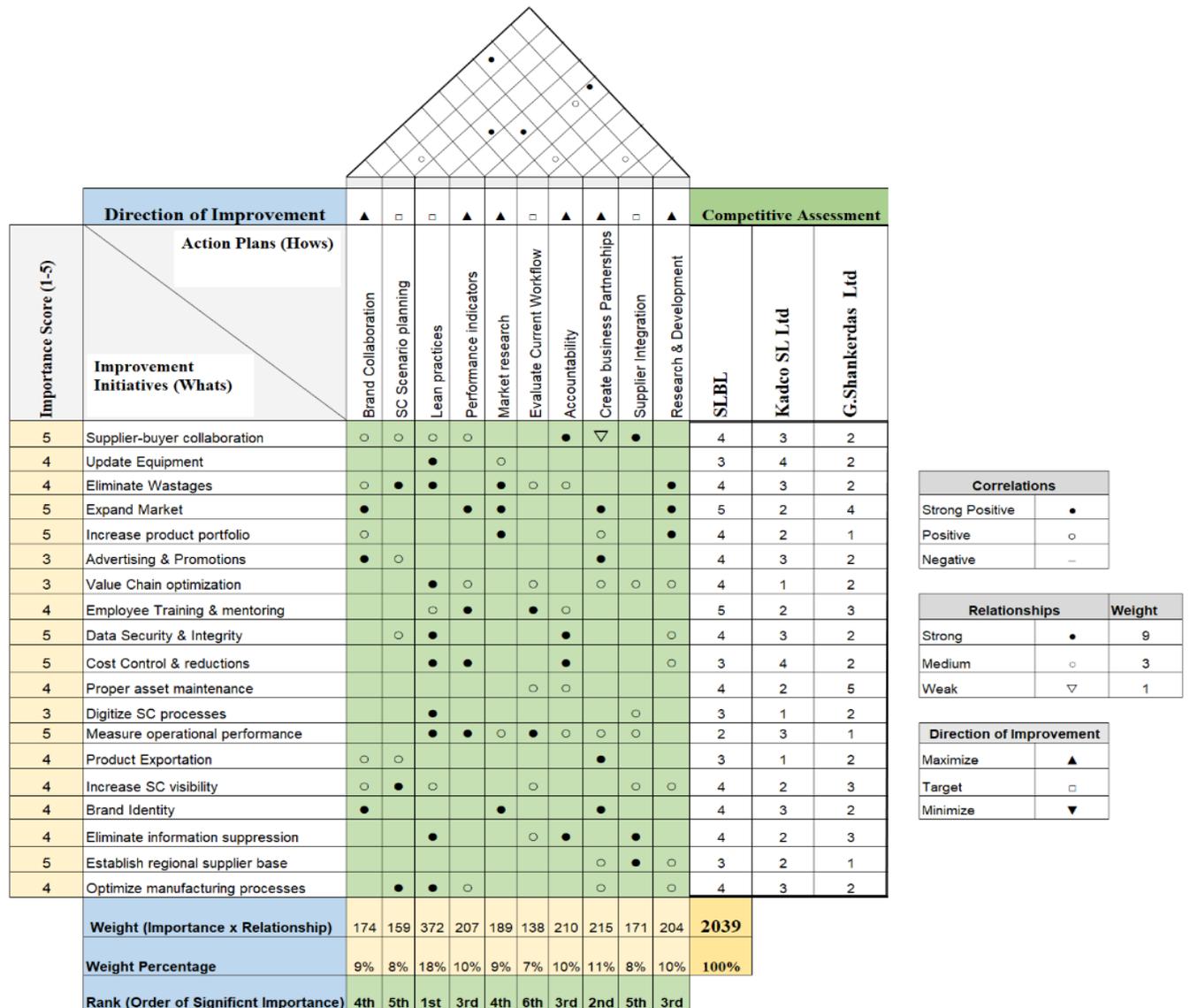


Figure 3. analysis of the improvement initiatives

4.3 Technical Correlation Matrix (TCM)

From Figure 3 above, the TCM is at the peak of the diagram, looking like a roof. From the analysis, there are some correlations between the different action plans needed to be implemented in the company's SC. This means that if one action is implemented, it might have either a strong positive or positive correlation. The framework shows that implementing lean practices and SC scenario planning have a positive correlation. Creating business partnerships has a very strong impact on the company's brand collaboration. Lean practices give a significant boost in evaluating the company's current workflow, which can help the SLBL to figure out their current stance in the market and meet customers' requirements. Establishing performance indicators has a very good impact on employee accountability. That will further make employees more robust in executing and reporting of their various functions. Market research needs to be conducted in order to identify suitable and highly demanding products needed in the market.

4.4 Improvement Initiatives and Action Plans in the QFD

The study recommends improvement initiatives and action plans through a rigorous literature reviews relating to such study and interviews conducted between key respondents to help identify certain measures needed to address these problems encountered by the company. Respondents indicated that updating production equipment, eliminating wastages, training employees on new technologies, proper asset maintenance, motivating employees for operational performance are key to strengthen the company's processes and competitiveness. Meanwhile, based on reviewed literatures, other critical initiatives were found to be very important like supplier-buyer collaboration, expansion of its current market, cost control and reductions, invest in SC digitalization to help during the time of such disruption when human intervention is reduced in their processes, increase their SC visibility, and establish supplier-base from other African countries.

On the other hand, key actions were highlighted which are embarking on creating performance indicators for key processes, implement lean manufacturing practices, establish brand collaboration with reputable companies, conduct market research to determine consumers' needs, and try to integrate with key suppliers.

4.5 Importance scores and weights

As can be seen in the framework, importance scores of 1 to 5 are given to the initiatives in order to class them according to their level of action needed. From the study, weights are also given to the action plans in order to rank them according to their level of significant importance. These weights are calculated by multiplying the importance score of each initiative by the relationship matrix score. According to the findings, the application of lean practices to the company's operations is the most important factor, with a weight of 372 representing 18%. Second to lean practices is creating business partnerships with a weight of 215 representing 11%. The third most significant factors are creating performance indicators, employee accountability and conducting product research and development all with 10% respectively. In fourth, are brand collaboration and market research with 9% each. Finally, in fifth are supplier integration and SC scenario planning with 8% each.

4.6 Competitive Assessment/benchmarking

This part of the matrix assessed the SLBL with two main rival companies in Sierra Leone; Kadco SL Ltd and G. Shankerdas & Sons Ltd. These two companies are in the same industry as the SLBL and are considered major competitors in the market. Therefore, the study assessed the strength of these two companies in relation to the improvement initiatives proposed in the study.

Table 3. Competitive strength assessment

No.	Improvement Initiatives	Importance Score (1-5)	Competitive Rating		
			SLBL	Kadco Ltd	G.Shankerdas
1	Supplier-buyer collaboration	5	20	15	10
2	Update Equipment	4	12	16	8
3	Eliminate Wastages	4	16	12	8
4	Expand Market	5	25	10	20
5	Increase product portfolio	5	20	10	5
6	Advertising & Promotions	3	12	9	6
7	Value Chain optimization	3	12	3	6
8	Employee Training & mentoring	4	20	8	12
9	Data Security & Integrity	5	20	15	10
10	Cost Control & reductions	5	15	20	10
11	Proper asset maintenance	4	16	8	20
12	Digitize SC processes	3	9	3	6
13	Measure operational performance	5	10	15	5
14	Product Exportation	4	12	4	8
15	Increase SC visibility	4	16	8	12
16	Brand Identity	4	16	12	8
17	Eliminate information suppression	4	16	8	12
18	Establish regional supplier base	5	15	10	5
19	Optimize manufacturing processes	4	16	12	8
Total			298	198	179

Going to the total scores of each company at the bottom of Table 3 above, it shows that the SLBL has the highest competitive strength with 298, Kadco Ltd with 198, and G. Shankerdas with 179. This further illustrates the SLBL is

competitively better than its strongest competitors. This assessment was carried out to determine the company's competitiveness in relation to its two main competitors, which will be useful for management decision making. This competitive rating was determined by multiplying each individual initiative importance score (1-5) by the corresponding score for each company. In short, it is the important score multiplied by the competitive assessment score.

5. Conclusion

The study's goal was to determine the difficulties that the SLBL's supply chain faced during the covid-19 outbreak. Using a quality function deployment (QFD) framework, the research also identifies important issues that have caused major business interruptions and proposes improvement strategies. Based on the study's findings, it is clear that the company's management has to focus on improving their supply chain network resilience to disruptions. Future research into this subject may be beneficial in determining the extent to which the covid-19 pandemic has affected industrial processes either locally or internationally.

6. Recommendations

Implementing the proposed initiatives from the study will not only help the company to battle through the hard lines of the covid-19 pandemic but will put their SC in a resilient position for such future disruption. The following recommendations are critical to the company's success during disruptions such as the covid-19:

- Management must ensure that there is strong collaboration between raw material suppliers and the company, that production equipment is updated to suit the current trend of manufacturing processes, that wastage is minimized or eliminated, and that new products are developed that are highly needed even in the time of the covid-19.
- In order to ensure the company sustains a resilient SC during disruptions, management should try and invest in digitalizing their SC operations due to the lessons already learnt from this current pandemic. The motive is that even if employees are reduced to observing social distancing, operations can still be executed without any disturbance.
- Another key area the company needs to pay attention to is the area of sourcing. The study found out that their raw materials are sourced from local farmers across the country. This is good, but a situation like the covid-19 lockdown might tend to halt the supply of raw materials to the factory. Therefore, it is recommended to consider outsourcing raw materials from other countries situated closer to Sierra Leone in order to avoid raw material shortages.
- Finally, management should try and invest in research & development of new products that consumers are willing to buy at any point in time. This is because the study also found that demand declined because of the closures of public places and events which account for about 80% of the company's sales revenue.

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