

Non-Financial Matrices for Supply Chain Performance Measurement

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Abstract:- Purpose: The main aim of the study was to understand non-financial matrices for supply chain performance measurement. Particular objectives were to identify key non-financial matrices used to measure supply chain performance and the disadvantages of non-financial matrices used to measure supply chain performance.

Methodology: The research applied quantitative descriptive research design. The purposive sampling method was used to select procurement professionals from Airtel Zambia, MTN and Zamtel mobile telecommunication companies. The data was analyzed using Statistical Package for Social Science (SPSS) version 26.

Results/Conclusion: The research found that 35% of the respondents stated that nonfinancial matrices brings in closer link to long-term organizational strategies, the research showed that 22% of the participants were of the view that non-financial data can provide indirect, quantitative indicators of a firm's intangible assets. The study showed that 25% of the participants stated that nonfinancial matrices are better indicators of future financial performance. Similarly, it was found that 18% of the responded were of the view that nonfinancial matrices provides information about managerial actions which is vital for the performance of an organization. Non-financial performance measurements provide a lot of benefits, but they also have some negatives. According to the study, 56% of respondents said that time and cost have been issues for certain businesses, non-financial variables are assessed in a variety of methods; as seen by 12% of the replies, there is no common denominator. Lack of causal connections was identified as a third problem by 10% of the replies, according to the study, Lack of statistical reliability. Further, these metrics typically have low statistical dependability, which hinders their capacity to identify better performance or forecast financial outcomes. Additionally, implementing an assessment system with too many indicators might result in "measurement disintegration," according to 8% of the responses.

Keywords:- Non-Financial Matrices, Performance Measurement

I. INTRODUCTION

In every supply chain, performance measurement is a crucial subject that should be taken into consideration (Correa, 2015). Given that there is no longer a competitive

environment between enterprises, supply chain performance monitoring is crucial (Keebler, 2015). In other respects, supply chains are competing for consumers' business and consuming a bigger portion of the available demand as market competition rises. Consequently, it is crucial to maximize the efficiency of the entire supply chain rather than concentrating on specific components (Behrouzi and Wong, 2013). The performance measurement idea states that appropriate measures must be used to assess performance (Galankashiet al., 2018a, b). Further study must be done in this regard to devise, identify, quantify, and use the most appropriate techniques for evaluating the efficiency of supply chains from a financial standpoint (Lapide, 2018). Prior study has mostly focused on cost, despite the fact that there are a number of financial performance factors in supply chains that need to be examined (Lee, 2015). The need of transitioning from financial to non-financial performance assessment of supply networks has been highlighted in past studies on supply chain performance measurement (Neely et al., 2005).

A. This Study will be Guided by the Following Research Questions.

- *What are the Advantages Non-Financial Matrices Used to Measure Supply Chain Performance?*
- *What are the Disadvantages Non-Financial Matrices Used to Measure Supply Chain Performance?*

II. LITERATURE REVIEW

This Part of the Research Explores Literature in Order to have a Deep Understanding of the Topic.

A. An Overview of Supply Chain Performance Measures (Scpm)

Performance measurement is "the process of analyzing the efficacy and efficiency of activity," according to Neely et al. (2005). Efficiency assesses how effectively a business uses its resources to attain a predefined level of customer satisfaction, whereas effectiveness shows how successfully a corporation uses its resources to reach that level. Neely et al. (Neely, 1998; Neely, 2005) claim that being able to measure and convey anything in numbers is the only way to have a solid grounding and comprehension of it. Otherwise, your comprehension of it is limited and insufficient. As per Bhagwat and Sharma (2017), performance assessment relates to the assessment on activities that are centered on client happiness, strategic choices, and goals. They continue by stating that performance metrics indicate the functional

activities that need the most attention and are referred to as blockages.

Supply Chain Management (SCM) is recognized as a crucial tenet of a positioning game that will increase the company's efficiency and profitability. Most firms have prioritized a variety of metrics for gauging the effectiveness of their operations and human resources, frequently ignoring the performance of the distribution networks and logistics that support those activities. The first universal performance measures used in supply chain performance monitoring were created by Pittiglio, Rabin, Todd, and McGrath (PRTM) (Wong and Wong, 2018). The involvement in performance management and evaluation has increased significantly during the past 20 years (Taticchi et al., 2010). Businesses and individuals are changing their lives, places of employment, and recreational activities as a result of globalization, technology, and the rising demand for environment protection and sustainability (Bititci et al., 2018). Therefore, creating an efficient strategy is essential for a Supply chain performance assessment system (efficiency is a measure of how efficiently a firm's resources are utilised while giving a specific level of customer satisfaction) (Neely et al., 2005). On the other hand, due to complex SCM procedures and interconnects both inside and outside of the organization, tracking and improving the effectiveness of a supply chain is now a more challenging process (Cohen et al., 2017).

What else should professionals understand about the appropriate measures? When ought one to use it? How can I evaluate the performance of the supply chain using the proper metrics? This complexity results from the fact that performance evaluations depend on the situation. It's hard to apply a single definition to the idea of "excellent supply chain strategy." Both the product features (functional vs. innovative) and supply chain strategy (risk hedging, efficiency, responsiveness, and agility) must be coordinated. The issue gets considerably more difficult when trying to analyze supply chain strategy for various supply chain topologies (such as liner, network, and amorphous). An industry-specific supply chain performance evaluation system has to be rigorously analyzed before it can be generalized. Additionally, the composition (suitable mix) of the supply chain performance assessment system will change based on the objectives of the supply chain (agility-adaptability-alignment). This highlights the importance of continually improving supply chain procedures. The selection of supply chain metrics is essential since managers must examine supply networks as a whole rather than on an individual basis.

B. Non-Financial Performance Measurement Systems

A very small number of prior attempts ((Neely et al., 2005). were made with the same goal, but they were more limited in scope, only used a few methods, and didn't offer a clear comparison that highlighted the main distinctions across groups. In the next nine subcategories, the identified groupings are described:

➤ *Supply Chain Operations Reference Model (SCOR)*

Developed by the Supply Chain Council, the SCOR model (Stephens, 2001; Huang et al., 2014; Lockamy and McCormack, 2014). In 1996, the initial version was created. It is a framework for closely studying the supply chain by classifying and specifying the processes that go into it, giving them measurements, and looking at similar benchmarks. In Huang et al., the SCOR model framework is presented (2014). It is the only comprehensive, cross-functional framework that connects software requirements, best practices, and performance metrics to an in-depth business process model. According to the SCOR model, a supply chain is made up of five key interconnected processes: Plan, assemble, deliver, and then return. The five views of reliability, responsiveness, flexibility, cost, and asset are typically used to evaluate process performance. Since the model spans the supply chain from the supplier to the customer's customer while aligned with operational strategy, material, work, and information flows, it is regarded as an exhaustive system that necessitates a well-defined infrastructure, managerial resources that are fully dedicated, and ongoing business process re-engineering to align the company with best practices.

➤ *Supply Chain Balanced Scorecard (SCBS)*

The Balanced Scorecard (BSC) was first proposed by Kaplan and Norton in 1992 as a crucial performance management tool. Since that time, it has been acknowledged as the top instrument for gauging success in both research and business. It makes it possible for managers to quickly have a balanced perspective of both operational and financial data. The authors suggested that managers should keep an eye on four key perspectives: financial, customer, internal business processes, and innovation and learning. Kaplan and Norton (1992) provide a visual representation. Managers may transform strategies into precise measurements that can track the total effect of a strategy on the organization by keeping these four views in mind. All perspective's objectives and metrics are taken from the strategic initiatives.

Parker (2017) provides an example of how the balanced scorecard and a supply chain management framework are related. BSC is effective in giving managers a complete view of the business performance (Abu-Suleiman et al., 2014; Kaplan and Norton, 1992). However, as stated in the literature, it has two fundamental flaws. It is a top-down strategy, to start. As a result, it lacks participation and may overlook connections between other process metrics that already exist. Lohman et al. (2014) contend that BSC is a static technique that, when used in a business environment, does not offer a chance to develop, discuss, and put into practice strategy. Second, BSC simply offers a conceptual framework while being strong and popular in industry. In other words, it lacks a method of execution and strays from the virtue of the notion itself.

➤ *Interface-based Measurement Systems (IBMS)*

IBMS was primarily proposed by Lambert and Pohlen in 2001. They suggested a structure in which the supply chain's performance at each level is connected. The structure

moves outward one connection at a time, starting with the links at the focal firm. With the overarching goal of increasing shareholder value for both each firm and the whole supply chain, this link-by-link strategy offers a way to coordinate performance from the point of origin to the point of consumption. The IBMS technique appears fine on paper, but in practice it is challenging to adopt since it demands openness and complete information exchange at every level (Parker, 2017).

➤ Hierarchical-based Measurement Systems (HBMS)

Gunasekaran et al. (2004) created the HBMS in 2004, which categorizes actions as strategic, tactical, or operational. The key goal was to place measurements where they could be handled most effectively by the proper management level, permitting speedy and informed choices (Ramaa et al., 2009). The measures are also separated into financial and non-financial categories. Such solutions link the performance metrics particular to organization goals with the maps and the hierarchical perspective of supply chain performance monitoring. However, in such systems, it is impossible to provide a clear guide to classify the actions into different categories that might lower conflict levels among the various supply chain parties.

➤ Efficiency-based Measurement Systems (EBMS)

EBMS are systems that assess the effectiveness of the supply chain. Chan, 2003, Charan et al., 2017, Sharma and Bhagwa, 2017, Chen and Paulraj, 2014, and Ramaa et al., 2019, among others, all developed ways in this area. By creating a Data Envelopment Analysis (DEA) model for the internal supply chain performance efficiency with the use of case study applications, Wong and Wong (2007) developed a framework for studying supply chain performance. Chen et al. (2016) looked at the effectiveness of two supply chain participants. They developed two efficiency functions and many DEA-based supply chain efficiency functions with the goal of finding inefficiencies among chain participants. They proved that there were many Nash equilibrium conditions in the supplier-manufacturer game. When intermediate indicators are incorporated into the assessment scheme, a novel DEA-based method for measuring supply chain efficiency was created by Liang et al. (2016). It was designed to address the shortcomings of the traditional DEA approach for directly assessing multi-member supply chain

activities. A methodology created by Berrah and Cliville (2017) connected the fundamental performance expression to the supply chain's total performance. Utilizing the Choquet integral Operator, aggregation was performed. Their strategy made it possible to compare circumstances that were previously thought to be incomparable. The majority of EBMS are DEA-based. Despite being extremely helpful, they have the same general drawbacks as traditional DEA techniques in any other situation. Efficiency is only judged in a relative sense. It assesses the effectiveness of several supply chain units in relation to one another rather than against a predetermined goal value or best practice. This might occasionally mislead management and stakeholders.

➤ Function-based Measurement Systems (FBMS)

A FBMS is one in which measures are incorporated to address the various supply chain processes (Bititci et al., 20018). It was initially created by Christopher in 2005 to encompass the specific performance indicators applicable at various supply chain links. Despite being simple to deploy and allowing for departmental objectives, it does not offer top-level measurements to span the whole supply chain. The main criticism leveled against FBMS is that it views the various supply chain functions apart from the overall strategy, which might lead to localized advantages that could be detrimental to the entire supply chain.

C. Non-Financial Performance Measurement Metrics

➤ This part presents the most common non-financial performance measurement metrics as follows.

➤ Quality

Since the late 1970s, quality, according to Ramaa et al., (2019), has taken center stage. Several businesses, though, have fallen short in this market. According to Ramaa et al., (2019), the term "quality" has been defined broadly to include a number of qualities, which has led to a lack of comprehension and a consequent lack of direction. Companies' incapacity to identify the quality dimension(s) that would produce the greatest results in certain markets is one reason why they are unable to compete in the quality domain. Garwin (1988) is a well acknowledged researcher who offered eight characteristics of excellence.

Table 1 Function-Based Measurement Systems (FBMS)

	Dimension of quality	Function(s) typically responsible for their provision
Performance	A product's primary operating characteristics	Design
Features	Secondary characteristics the "bells and whistles"	Design
Reliability	The probability of a product malfunctioning within a given period	Design
Conformance	The degree to which a product is manufactured to the agreed specification	Manufacturing
Durability	A measure of a product's life in terms of both its technical and economic dimensions	Design
Serviceability	The ease of servicing (planned or breakdown) including the speed and provision of after-sales services	Design and After-sales
Aesthetics	The appearance of the final product	Design
Perceived quality	How a customer views the product	Marketing and Design

Source: Garwin (1988)

The aforementioned quality criteria are general criteria that may be used with all kinds of goods and services in all kinds of markets. These excellent attributes are well-known and frequently mentioned. Product quality, which was not previously addressed, can be categorized based on perceived quality, or how a buyer sees the product. The consumer of the product is the emphasis of product quality (or service, service quality). The user may be a business or an individual; they are not necessarily the end user or the supply chain's internal customer. Numerous submeasures, such as conformance quality, quality reliability, and final product quality, are included in the supply chain performance metric "quality." Quality and delivery are referred to as crucial metrics in the literature.

➤ *Delivery*

On-time delivery, delivery dependability, quicker turnaround times, delivery service, delivery frequency, delivery synchronization, delivery speed, etc. are only a few of the performance sub-measures related to delivery. Delivery dependability refers to the capacity to provide the requested goods by the scheduled time. Therefore, on-time delivery (OTD) is a top priority for both the production and distribution functions. According to Ramaa et al., (2019), this characteristic frequently serves as a qualification in commercial settings. According to research of the Indian car industry (Saad and Patel, 2016), the majority of respondents listed supply delivery lead time, historical rejection rate, geographic closeness, and dependability as the most important criteria when choosing a supplier. Organizations that routinely miss the OTD deadline generally run into trouble and need to fix the issue fast to keep consumers from switching suppliers. Customers frequently assess OTD as a competitive aspect and performance metric. According to Lapide (2018), a corporation gains business by being able to supply orders faster than rivals or by meeting deadlines when few or no competitors can. According to him, there are two views on the subject of delivery speed. One is when the forward order load, or the order backlog on the manufacturing capacity, makes it difficult to meet the process lead time, even though it is less than the delivery time required by customers. In this case, the process led time to complete the order is longer than the required delivery time. When the process lead time exceeds the customer delivery requirement, the second viewpoint is used. Organizations choose which sub metrics, such as delivery from suppliers, delivery inside their own organization, or delivery to consumers, are most relevant to measure when it comes to delivery.

➤ *Flexibility*

Flexibility is "the degree to which a corporation intends to adjust to market changes, e.g., material increases in demand," according to one definition (Ramaa et al., 2019). Alternatively, flexibility is the management of responding to changes in demand by holding onto resources like as time, money, materials, people, plants, and suppliers until they are expressly needed, as stated by Ramaa et al., (2019). Both definitions define flexibility as the capacity to adapt to the specific needs of each customer. This is a comprehensive performance metric that takes into account

things like product mix, order size, order handling time, order volume, and demand growth. According to Lapide (2018), in some markets, a company's capacity to adapt to surges in demand plays a significant role in securing orders. Japanese automakers serve as a good case study for flexibility since they have developed and are still developing a manufacturing system that can adapt to the specific needs of each client. Wang et al., (2007) identified four categories of system flexibility, with each category having a range and response that can be measured. These categories are volume flexibility (the capacity to alter the output level of produced products), delivery flexibility (the capacity to alter scheduled delivery dates), mix flexibility (the capacity to alter the variety of products produced), and new product flexibility (the ability to introduce and produce new products).

D. Methodology

This study was conducted in Lusaka Zambia. The study was centered on the mobile telecommunication industry which comprised of Airtel Zambia, MTN Zambia and Zamtel. Descriptive research design was applied. The target respondents were procurement departments from the three mobile service providers. A total sample of size of 36 procurement professional made up the recommended sample size as per Kothari (2014). The sample size was purposively selected to participate in this study. The data from the research field was analyzed by Statistical Package for Social Sciences (SPSS) version 20.0.

III. RESULTS

A. The Advantages of Non-Financial Metrics Used to Measure Supply Chain Performance.

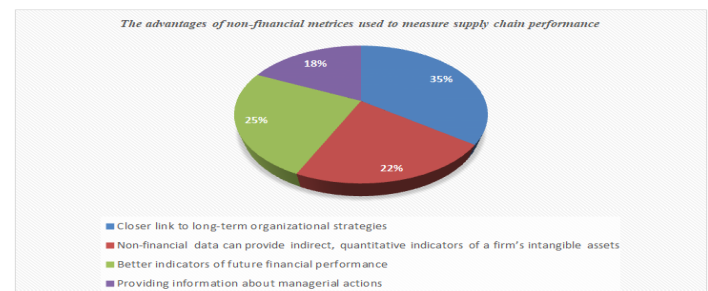


Fig 1: The advantages of non-financial metrics used to measure supply chain performance
Source: Field Data (2022)

According to the results shown in figure 3.1, 35% of the respondents stated that nonfinancial metrics brings in closer link to long-term organizational strategies. Typically, yearly or short-term success versus accounting benchmarks is the main emphasis of financial assessment systems. They do not address developments in relation to consumer demands or rivals, nor do they address other non-financial goals that could be crucial for attaining profitability, competitive strength, and longer-term strategic objectives. For instance, while developing new products or enhancing organizational capacities may be crucial strategic objectives, they may have a negative impact on short-term accounting performance. Further, the research showed that 22% of the

participants were of the view that non-financial data can provide indirect, quantitative indicators of a firm's intangible assets. Additionally, the study showed that 25% of the participants stated that nonfinancial metrics are better indicators of future financial performance. Similarly, 18% of the responded were of the view that nonfinancial metrics provides information about managerial actions which is vital for the performance of an organization.

B. The Disadvantages of Non-Financial Metrics Used to Measure Supply Chain Performance

Non-financial performance measurements provide a lot of benefits, but they also have some negatives. According to research, there are five main constraints. According to the study, 56% of respondents said that time and cost have been issues for certain businesses. They have discovered that a system that keeps track of a lot of financial and non-financial metrics sometimes has more costs than advantages. Selling the system to employees who have become accustomed to following the rules as they might take a lot of time and money during development. It is usually necessary to make considerable investments in information systems in order to gather data from different (and frequently incompatible) databases for a wider range of diverse performance measurements. It can take time to evaluate performance using many metrics that can clash in the short term. The time needed for area directors to evaluate branch managers increased from less than one day every quarter to six days when one bank implemented a performance review system incorporating several accounting and non-financial indicators. The measuring process may become reduced to mechanical exercises that do nothing to advance strategic objectives because of bureaucracies.

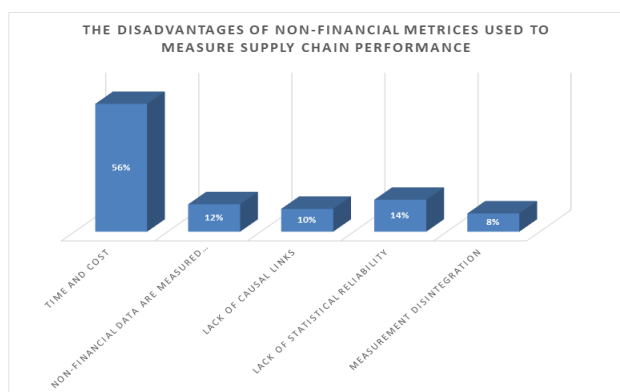


Fig 2: The Disadvantages of Non-Financial Metrics Used to Measure Supply Chain Performance
Source: Field Data (2022)

Additional disadvantage is that, in contrast to accounting measurements, non-financial variables are assessed in a variety of methods; as seen by 12% of the replies, there is no common denominator. When certain traits are measured in terms of time, others in terms of amounts or percentages, and some in arbitrary ways, it can be challenging to evaluate performance or make trade-offs between them. Many businesses make an effort to get around this by assigning a strategic priority grade to each performance metric (from, example, not important to highly essential), and then evaluating overall performance using a

weighted average of the measurements. Others give the different objectives arbitrary weights. Lack of causal connections was identified as a third problem by 10% of the replies, according to the study. Many businesses employ non-financial measurements without clearly explaining how they relate to one another or confirming their impact on accounting and stock price performance. When assessing performance, causal relationships that are unknown or unproven present two issues: Inaccurate measurements focus emphasis on the wrong goals, and advancements cannot be connected to future results.

Respondents accounting for 14% stated that Lack of statistical reliability, or if a measure genuinely reflects what it claims to represent as opposed to random "measurement error," comes in at number four on the list of issues with non-financial measurements. Numerous non-financial statistics, such as satisfaction ratings, are derived from surveys with a small sample size and few questions. These metrics typically have low statistical dependability, which hinders their capacity to identify better performance or forecast financial outcomes. Implementing an assessment system with too many indicators might result in "measurement disintegration," according to 8% of the responses even while financial measurements are unlikely to adequately reflect the myriad facets of organizational success. This happens when the impact of the measuring procedure is diluted by an excess of measurements. While pursuing many metrics at once, managers make little progress in the key success factors.

IV. CONCLUSION

The research found that 35% of the respondents stated that nonfinancial metrics brings in closer link to long-term organizational strategies, the research showed that 22% of the participants were of the view that non-financial data can provide indirect, quantitative indicators of a firm's intangible assets. The study showed that 25% of the participants stated that nonfinancial metrics are better indicators of future financial performance. Similarly, it was found that 18% of the responded were of the view that nonfinancial metrics provides information about managerial actions which is vital for the performance of an organization. Non-financial performance measurements provide a lot of benefits, but they also have some negatives. According to research, there are five main constraints. According to the study, 56% of respondents said that time and cost have been issues for certain businesses, non-financial variables are assessed in a variety of methods; as seen by 12% of the replies, there is no common denominator. Lack of causal connections was identified as a third problem by 10% of the replies, according to the study, Lack of statistical reliability. Further, these metrics typically have low statistical dependability, which hinders their capacity to identify better performance or forecast financial outcomes. Additionally, implementing an assessment system with too many indicators might result in "measurement disintegration," according to 8% of the responses.

RECOMMENDATIONS

Even though non-financial metrics are becoming more crucial for decision-making and performance assessment, businesses shouldn't simply adopt these metrics. Several elements, including company strategy, value drivers, organizational goals, and the competitive environment, must be taken into consideration while selecting metrics. Companies should also keep in mind that selecting the right performance measurement is a dynamic process. While certain measurements may be acceptable today, the system must be updated when plans and competitive conditions change.

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