

## Performance Indicators in Internal Logistic systems

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**Abstract.** In today's competitive world, organizations need the performance measurement systems not only to perform better but also to develop new competencies either as a firm or as a part of connected supply chain organizations in relation to others. This leads them to performance measurement of their logistic systems. Present paper tries to find answers to some questions about the nature of Internal Logistic Performance Indicators, their importance and contribution to goal achievement within firms. This study has been conducted with theoretical method and has made use of different existing literature in the field including both theoretical and case studies. As a result, some conclusions have been made regarding the link between internal logistic and supply chain performance indicators, the categorization of internal logistic performance indicators, their definition, use and role towards achievement of objectives within entities. There is no unique categorization of logistic performance indicators that could be applicable to different systems. However, the definition and type of these indicators (either qualitative or quantitative) highly depends on the objectives of the system itself.

**Keywords:** Performance Measurement, Internal Logistic, Supply Chain, Indicator

### 1. Introduction

In today's competitive world, organizations need the performance measurement systems not only to perform better but also to develop new competencies either as a firm or as a part of connected supply chain organizations in relation to others. Generally speaking, performance measurement is a wide topic and a lot of work has been done in this area. Most of them such as [1] discussed the standards for setting a performance measurement system and defining measures for them. There also have been some attempts to describe logistic and supply chain performance measurement systems as well [2,3,4 &5]. However, there are very few studies that either directly or indirectly discussed the Internal logistic and hence its indicators and their contribution. This paper aims to go through the works and researches conducted on supply chain and logistics and then discuss internal logistic performance indicators, their diversity, categorization as well as their significance in goal achievement. By performing a theoretical study the aim of this paper is to discuss internal logistic indicators and some of their characteristics, for this purpose this study has made use of works by various authors in the field, including both theoretical researches and case studies.

By performing a theoretical study the aim of this paper is to discuss internal logistic indicators and some of their characteristics, for this purpose this study has made use of works by various authors in the field, including both theoretical researches and case studies. There have been several attempts to describe performance measurement in general, [1] reviewed and discussed performance measurement system design. In describing performance measurement of supply chain also several approaches have been offered; [6] performed a survey study in supply chain entities to examine what they measure and how they perceive performance measurement from four perspectives of balanced scorecard. [7] reviewed logistic performance measurement in the supply chain by benchmarking number of companies in the US. [8] presented a review on bench marking for supply chain measures by looking into previous studies. [3] pointed out the lack of

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research into performance measurement systems and metrics of supply chains by critically reviewing the contemporary literature and suggesting possible avenues for future research. [9] suggested set of reliable and valid measurements to extend conceptualization in supply chain by identifying and consolidating various supply chain initiatives and factors. [2] Introduced a new frame work for performance measurement in a supply chain including both quantitative and qualitative measures. [10] reviewed problems with existing supply chain metrics in general and proposed a framework that aligns performance at each link (Supplier-Customer pair) within the supply chain. [5] discussed supply chain performance measuring and introduced a new framework for it. [4] examined the definition and measurement of performance in logistics research.

## **2. Theoretical Background**

### **2.1. Logistic and Supply Chain Performance Measurement**

The comprehensive nature of the extended literature for the *Performance Measurement* has led to the emergence of various definitions for the topic. [2] Defined performance measurement as the feedback on activities considering customer expectations and strategic objectives which reflects improvement needs in areas with unsatisfactory performance and can enhance efficiency and quality. Although based on the characteristics of each system, a specific approach for performance measurement is required [5], yet [1,4 &5] all discussed that due to the variety of the literature and different aspects of each system, it is difficult if not impossible to adopt an applicable and systematic approach to performance measurement that is agreed upon by all.

Logistics performance, as a subset of the larger notion of firm or organizational performance, may be defined as the extent to which goals such as Cost-efficiency, Profitability, Social responsibility, On-time delivery, Sales growth, Job security and working conditions, Customer satisfaction, Keeping promises, Flexibility, "Fair" prices for inputs, Low loss and damage and Product availability are achieved [4]. According to [9] measuring supply chain performance can facilitate a greater understanding of the supply chain, positively influence actors' behavior, and improve its overall performance. [3] Emphasized on the importance of adopting a systematic and balanced approach towards designing performance measurement systems for supply chains. However [8] believed as the previous literatures on performance measurements had not viewed supply chain as a whole entity so it is difficult to evaluate performance with multiple inputs and outputs to the system. [4] Discussed supply chain performance measurement is multi-dimensional, so no one measure will suffice for its performance. A single performance measure is generally inadequate since it is not inclusive, ignores the interactions among important supply chain characteristics, and ignores critical aspects of organizational strategic goals [5].

As for the performance measures of logistic or supply chain, there are various definitions and indicators, hence the main focus of this study is on the internal logistic indicators, a brief overview of both supply chain and logistic is needed to narrow the stream of literatures in this regard. The supply chain consists of different levels, e.g. supplier, manufacturing, distributing, and consumer, and it is a network of companies which influence each other [2]. As [10] quoted from the Council of Logistic Management 1998; Supply chain management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customer and other stockholders while logistic is that part of the supply chain process that plans, implements and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customer requirements. As a matter of fact, the existing literature faces some difficulties in defining and collating both logistic and supply chain performance indicators:

- Firms' focus on traditional financial measures (gross revenue, profit before tax, and cost reduction) despite the need to provide a balanced approach to performance measurement [6].
- The complexity of supply chain metrics and disagreement over an appropriate categorization [3].
- Lack of a balanced approach to integrate financial and non-financial measures, lack of a system thinking; viewing supply chain as a whole entity and the loss of the supply chain context [2].
- Absence of an approach for developing and designing supply chain performance measures [10].

## **2.2. Categorization of Logistic Performance Measures**

As far as the literature is concerned there is a consensus among some authors that; a systematic grouping of logistic performance measures doesn't exist in a particular form [2,3 &6] rendered a performance measurement research in supply chain entities based on four perspectives of balanced score card (Financial perspective, Customers' perspective, Internal business processes perspective, Learning and growth perspective). [3] collected supply chain performance measures from different previous literatures and presented them based on the processes identified in the SCOR model: plan, source, make, deliver or return, whether they measure cost, time, quality, flexibility or innovativeness; and, whether they are quantitative or qualitative. [2] categorized measures for supply chain according to them being Qualitative (quality, visibility, flexibility, trust, innovativeness) or Quantitative (Cost, Resource utilization). [5] introduced Resource, output, flexibility as main types of supply chain measures.

[2] discussed that the quantitative measures are the ones that can be observed easily and be represented numerically and qualitative measures are those that have an influence on the performance and are more conceptual. According to [3] the quantitative and qualitative distinction highlights whether measures are objective or rely on the subjective interpretations of individual actors. Meanwhile, [2] noted that there is no recognized definition of qualitative criteria and when it can be appropriately applied to the supply chain. [5] argued that qualitative nature of some measures makes them vague and difficult to incorporate into quantitative models, hence they are not used as often as quantitative measures. [6] incorporated 15 generic performance measures in the survey study: Financial perspective (Return on investment, Gross revenue, Profit before tax, Cost reduction), Learning and Growth perspective (Investment in employee training, Number of suggestions implemented per employee, Employee turnover, Employee satisfaction), Internal business processes (Waste reduction, On time delivery, New services, Quality of services), Customer perspective (Customer satisfaction, Number of customers retained, Market share). According to [2] quantitative measures include: different Costs (Distribution, manufacturing, inventory, warehouse, incentive, intangible, overhead, sensitivity to long term cost) and Resource Utilization (labor, machine, capacity, energy). Qualitative measures are; Quality: (Customer dissatisfaction, Customer response time, Lead time, On-time delivery, Fill rate, Stock-out probability, accuracy), Flexibility: (labor, machine, Material handling, routing operation, volume, mix, delivery, modification, new product, expansion), Visibility: (time, accuracy), Trust: (consistency), Innovativeness: (new launch of product, use of technology) [2]. [5] in addition introduced some measures for each suggested category; Resource measures such as (Total cost, Distribution costs, Manufacturing cost, Inventory, Return on investment (ROI)), Output measures (Sale, Profit, Fill rate, On-time deliveries, Backorder/stock-out, Customer response time, Manufacturing lead time, Shipping errors, Customer complaints) and Flexibility.

## **2.3. Internal Logistic Performance Indicators and Supply Chain Performance Indicators**

The existing measures and whether they belong to supply chain or internal logistic have also been debated. According to [10] most articles about supply chain metrics are in actuality about internal logistics performance measures that have an internal focus and do not capture how the firms drive value or profitability in supply chain. Many of the measurements used within firms are developed in isolation and are linked to local rewards rather than strategy, which results in performance measures and activities not in line with supply chain strategy [10] discussed. Moreover [9] argued that rising international cooperation, vertical disintegration, along with a focus on core activities have led to the notion that firms are links in a networked supply chain, hence this perspective has created the challenge of designing and managing a network of interdependent relationships developed and fostered through strategic collaboration. All the presented logistic and supply chain performance indicators in the literature, regardless of their qualitative or quantitative nature have been suggested to be measured in the form of input-output ratios [5,2,6 &7].

When measuring internal logistic and supply chain performance, some metrics seem to be measured more often in comparison to the others. [2] explained that the profit of an enterprise is directly affected by the cost of its operations and it is the most significant direct kind of measurement. [7] discussed that effectiveness and cost measures are captured more often measured while productivity and utilization indicators are measured much less often in the companies. According to [6] the top three indicators most commonly measured are financial in nature (profit before tax, gross revenue, cost reduction) and for non-

financial indicators; on-time delivery, customer satisfaction, service quality, and employee turnover are measured more. [6] also noted that the least measured indicators seem to be the number of suggestions implemented per employee, market share and new services implemented. Obviously, there are some enablers and barriers for internal logistics performance measurement within companies that makes this process easier or more difficult. According to [7] the biggest enablers for internal logistics measurement are upper management support and resource availability in the department, on the other hand the major barriers are resource availability in (IT) function, availability of information in general and the perception of the accuracy of the information.

#### **2.4. Pivotal Internal Logistic Performance Indicators and goal achievement**

According to [4], Input/output measures or *performance indicators* in this form they can be used to evaluate goal attainment in many areas, particularly efficiency and effectiveness. [5] explained that three defined supply chain performance indicators categories are devoted to different goals in the system; Resource measures: relate to high level of efficiency and therefore system profitability; Output measures: aim for the high level of customer service and Flexibility measures: contribute to responsiveness ability in an uncertain changing environment. According to [2] the importance of each performance measure is different in various industries. However [6] claimed that among studied firms, on-time delivery and customer satisfaction were the two most highly rated performance indicators by importance and the three least important logistic indicators were; investment in employee training, new services implemented per year and the number of suggestions implemented. [2] suggested the application of Analytic Hierarchy Process (AHP) to choose the optimum supply chain and discussed that the use of AHP as a common tool for solving multi-criteria decision-making problems helps to rank supply chain measures, considering that the weighting of them can differ according to different industries. The question of how often measures of supply chain performance should be re-evaluated and when measurement should take place has not yet been given adequate consideration [3].

### **3. Concluding Discussion**

A dearth of related references on the issue of internal logistic performance measurement has made research in the field difficult. Most of the researches have been carried out with a focus on supply chain performance measurement. Meanwhile, most of the existing literatures maintain that a systematic grouping or definition of logistic (including internal logistic) and supply chain performance measures in a particular form, either is difficult or has not been provided yet. According to [7] a comprehensive study is needed to define exactly what is meant by logistics performance. Moreover, the diversity of available metrics and lack of appropriate categorization makes it difficult for one to distinguish between supply chain measures and internal logistic measures.

Internal logistic is a part of supply chain so its performance can't be measured apart from the supply chain, rather it should be looked at as a part of it, thus the measures should be defined with this in mind to contribute to the improvement of logistic and supply chain performance as a whole. In fact, viewing internal logistic performance without paying attention to the supply chain, may not prove a resounding success and as [10] argued, it results in performance measures and activities that are not in line with the supply chain strategy. In addition, there is not a complete discussion on each measurement and its suitability for application to each industry [2]. It is clear that this discussion highly depends on the various goals and objectives of each industry; therefore the importance of diverse logistics performance measurement indicators varies from one entity to another. Obviously, one single indicator cannot be viewed as the most important metric of all internal logistic systems in general. However, the use of tools such as either benchmarking of performance indicators within different industries and different supply chain systems or application of AHP could be helpful in recognizing the measures and their level of contribution to the system. Moreover, there is a general agreement on the literatures supporting that using single performance measure has shortcomings and is not efficient enough to address the issue of logistic and supply chain performance measurement. In light of the recent literature, generally, most logistic and supply chain indicators are either quantitative or if not, for the ease of use and more clarity efforts have been made to convert them into

measurable indicators. This has developed to the extent that some intangible concepts such as flexibility, quality, customer satisfaction and even innovativeness have been defined numerically just as in the case of measurable indicators. In measuring logistic performance, there is a consensus among the literatures that firms are highly focused on financial and cost related indicators; however some other metrics such as customer satisfaction are being monitored vastly as well. Given the works and studies carried out in the field, a need is felt for further research on the definition of both supply chain and logistic performance measurement and their categorization.

The conclusion of this paper can be summarized as follows; Although there have been efforts to define and categorize logistics and supply chain performance indicators, due to some difficulties dealing with supply chain systems metrics, a systematic definition or collation for them has not been offered yet. However it should be mentioned that different industries needs different Logistic measurement indicators based on their goals and objectives. Internal logistics is a part of supply chain links, therefore its performance indicators should be defined and measured in compliance with supply chain system and be seen as one piece. A single indicator cannot be adequate for measuring logistic performance, instead; for this purpose a set of measures should be defined that comply with the strategy of supply chain as well as entity's goals. Given the importance of finance in entities, companies seem to favor measuring financial or cost related indicators more often. For the ease of use and more clarity, efforts have been made to turn almost all qualitative indicators to measurable indicators. The importance of internal logistics or supply chain indicators as a whole, highly depends on the significance of objectives of firm and supply chain links. Application of some methodes such as bench marking and AHP could be helpful in determining the level of importance and contribution of indicators in goal achievement. Given the works and studies carried out in the field, a need is felt for further research on the definition of supply chain and internal logistic performance measurement, performance indicators and their categorization.

#### 4. References

- [1] A. Neely, K. Platts and M. Gregory: Performance Measurement System Design: A literature review and research agenda. *International Journal of Operations & Production Management*, v. 15, n. 4, p. 80-116, 1995.
- [2] F. T. S. Chan: Performance Measurement in a Supply Chain. *The International Journal of Advanced Manufacturing Technology*, v. 21, p. 534-548, 2003.
- [3] C. Shepherd and H. Günter, Measuring supply chain performance: current research and future directions. *International Journal of Productivity and Performance Management*, v. 55, n. 3/4, p. 242-258, 2006.
- [4] G. Chow, T. D. Heaver and L. E. Henriksson: Logistics Performance: Definition and Measurement. *International Journal of Physical Distribution & Logistics Management*, v. 24, n. 1, p. 17-28, 1994.
- [5] B. M. Beamon: Measuring supply chain performance. *International Journal of Operations & Production Management*, v. 19, n. 3, p. 275-292, 1999.
- [6] A. Chia, M. Goh and S. H. Hum: Performance measurement in supply chain entities: balanced scorecard perspective. *Benchmarking: An International Journal*, v.16, n. 5, p. 605-620., 2009.
- [7] J. S Keebler and R. E. Plank: Logistics performance measurement in the supply chain. *Benchmarking: An International Journal*, v. 16, n. 9, p. 785-798, 2009.
- [8] W. P. Wong and K.Y. Wong: A review on benchmarking of supply chain performance measures. *Benchmarking: An International Journal*, v. 15, n. 1, p. 25-51, 2008.
- [9] I. J. Chen and A. Paulraj: Towards a theory of supply chain management: the constructs and measurements. *Journal of operations Management*, v. 22, p. 119-150, 2004.
- [10] D. M. Lambert and T. L. Pohlen: Supply Chain Metrics. *The international journal of Logistic Management*, v. 12, n. 1, p. 1-19, 2001.