

Supply Chain Performance Measurement Tools: Case of Moroccan Companies

Imad Ait Lhassan¹, Rachid Daanoun²

^{1,2}Laboratory of Research and Studies in Finance, Audit and Management, National School of Business and Management of Tangier, Abdelmalek Essaadi University, Tangier, Morocco

Abstract: *In recent decades, management control practices have greatly evolved in companies around the world. Also for logistics, it becomes one of the important activities in national and international companies; it has become a vital focus of development of competitiveness and business performance. The role of the supply chain is to manage physical flows and information flows, from the supplier to the customer, and its goal is to optimize the Quality-Cost-Delay triangle. The supply chain performance measurement is a strategic way and necessary element in companies, its role is to identify opportunities to improve profitability and align the objectives of all actors in the chain. Companies adopt the supply chain performance measurement tools based on functional or process approaches, also those tools can be used on three levels, strategic, tactical and operational (Balanced Scorecard, ABC / ABM, SCOR, ASLOG, EVALOG, etc....). The purpose of this article is, firstly, to present the concept of supply chain management control, secondly, to identify and present the research work on tools to measure the performance of the supply chain, and finally, to present the results of an exploratory study conducted in Moroccan companies.*

Keywords: Supply Chain, Performance, Measurement, Tools, Practices

1. Introduction

The evolution of Supply Chain Management (SCM), over the last twenty years, has led to many changes in measurement and control systems, especially management control systems.

Today, logistics has become the most competitive field in the world, especially in Morocco. Moroccan companies are still in the process of improvement, and their objective is to achieve its objectives of efficacy, efficiency and effectiveness.

The supply chain is a vast element, it is the management of physical, financial and information flows. The supply chain performance of the companies is combined in the organization and the value of the logistics activities of the supplier until the customer, thus, looking for the reliable tools that make it possible to measure this performance.

Currently, Moroccan companies are using conventional tools like the classic dashboard, and they are looking for effective tools to measure the supply chain performance.

This study aims to answer the following question: What is the degree of use of the supply chain performance measurement tools in the Moroccan companies?

To answer our issue, we will, firstly, present clearly the definition of the supply chain concept and its importance in the companies, secondly, we will present the supply chain performance measurement tools, its functions as well as the research works on these tools, and at the end, we will finish with an analysis of our case study to study the level of use of supply chain performance tools in Moroccan companies.

2. Literature Review

This section present clearly the concept of supply chain, and the meaning of supply chain performance measurement and their tools.

2.1 Concept of the supply chain

We cannot present the definitions of the supply chain without defining the concept of « logistics ».

Logistics is the setting up of products or raw materials to customers in the best conditions, and when we talk about the conditions, it's mean a minimum cost, a better time, quality and a good delivery.

There is three types of logistics in the literary: the logistics exploded, the logistics integrated and the logistics extended.

The first type is the exploded logistics, this type of logistics function is managed by separate services, and each service works independently and makes decisions without having a global control of logistics flows.

The second type is the integrated logistics, it's mean when the company's departments must collaborate and exchange information to achieve logistical objectives and optimize « cost, time, quality ».

The third type is the extended logistics, this type is a new global vision of the supply chain. In this type of logistics, the company has become part of a larger network, each component having a particular mission but with the same objectives.

Some definitions of the concept of the supply chain has been identified in the literature. In the old vision, the supply chain encompasses all activities associated with both physical flows through the transformation of goods from the raw material stage to the final customer, and information flows

[10]. Today, the supply chain has become a global network [7].

A supply chain is a network of organizations or functions that are geographically dispersed across multiple sites that work together to reduce costs and increase the speed of processes and activities between suppliers and customers.

Another definition of the supply chain proposed by [14], « a supply chain is a network of organizations (suppliers, factories, distributors, customers, logistics providers ...) involved in the manufacture, delivery and sale the product to a customer ».

The supply chain is the set of physical, information and financial flows managed by a manager to succeed the chain of a supplier to the customer.

The supply chain performance based on functional or process approaches, this diagram explains the two approaches:

The functional approach is linked to the company's chain value (see Figure 1), each department of the company works independently of the others, with individual performance objectives, sometimes contradictory.

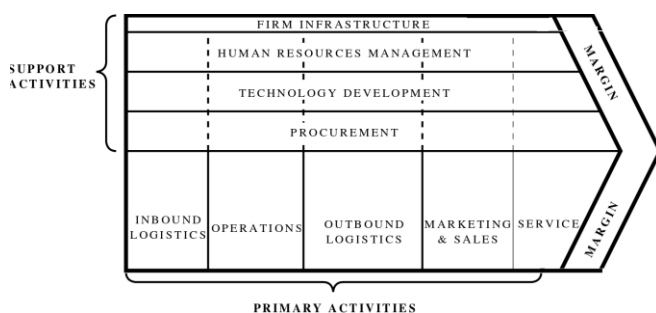


Figure 1: Vision of Operations by Function (M.E.Porter Value Chain)

The process approach allows company departments to work together on common goals. The SCOR model is based on five distinct management processes: Plan, Source, Make, Deliver and Return.

The other supply chain approaches are organizational approach, complex approach, and structural approach.

In reality, supply chains have only their name. They consist of a complex network of organizations whose remains a simplified illustration.

2.2 Supply Chain Management Control

[2] defined management control as « a process by which managers gain the assurance that resources are obtained and used efficiently to achieve organizational goals »¹.

Management control can also be defined as a decision support process in an organization, allowing intervention before, during and after the action.

The challenge of the management control system is to coordinate all of these actors with the common goal, oriented towards the performance of the supply chain. To this end, the control system, associated with the logistics system, is based on the company's information systems, which provide it with the information necessary to manage these relationships.²

The mission of management control is to ensure the implementation of the strategy of the company using the resources allocated on the ground, to achieve this end. First, we have to analyze the performance of activities to optimize their management; and to use of the dashboards, as well as the appropriate indicators for the targeted activity and objectives.

Among the most well known performance measurement tools, we have the dashboards, which are considered as central tools of management control, and which make it possible to transform the strategic objectives of an organization into actions variables and into monitoring indicators.

To better understand the management control practices of the supply chain, we will first present the definitions of the supply chain, then the supply chain performance measurement, and finally, the supply chain performance measurement tools.

2.3 Supply chain performance measurement

The concept of performance is a multidimensional concept; it has been the subject of several definitions. [8] defined performance as the achievement of organizational objectives, regardless of the nature and variety of these objectives.

Authors defined performance by focusing on the concepts of efficacy, efficiency, effectiveness and relevance.

Efficiency is measured by the difference between the company's objectives and the results obtained (Neely et al 1995). An author identifies efficiency with the ability to achieve the goals set by the company [4].

Efficacy is measured by the ratio between the resources implemented by the actors and the results obtained (Bireau 2013).

The concept of effectiveness is related to purpose. Moigne defines effectiveness by « the evaluation of triptych (objectives - means - results), that is to say going back to the

¹ Anthony R. N., Planning and Control Systems, A Framework for Analysis, Division of Research, Boston, Harvard University, 1965, p. 17.

² Simon Alcouffe and al. « Contrôle de gestion interactif : Commercial. Supply chain. RH. Environnement », Edition 2013 DUNOD.

ends which are at the very origin of the system whose performance one seeks to evaluate » (The 1973 Moigne).

Relevance makes it possible to know if the company has the necessary means to achieve its objectives (Barabel and Meier 2015).

Measuring performance is a very important step in the business. [17] defined performance measurement as a tool for achieving the company's financial and non-financial goals.

Measures or types of indicators are also classified as typically financial / quantitative (investment, profit, cost, balance sheet, etc.) or non-financial / qualitative (delivery performance, customer satisfaction, quality of products and services, etc.).

Bititci et al. (2002) reported that performance measurement is a tool that helps managers achieve financial and non-financial goals through control and improvement.

The frequency of measurement is important, the measurement can be annually, semi-annually, etc. Depending on the choice of managers or other managers who measure the supply chain performance of the company. And each frequency can impact the result, either positively or negatively.

[1] found that the quality, reliability and cost of delivery of the final product were highly rated and were the most important indicators for supply chain performance. According to [1], the study measures firms' performance in terms of quality, cost and time rather than other criteria such as flexibility, technology, efficiency and effectiveness.

As a result, [21] found that supply chain performance was more closely linked to marketing performance, but that it had a positive impact on financial performance.

The supply chain performance measurement has become important in the company today, it plays a very important role in the optimization of logistics flows and in the improvement of the supply chain efficiency, as well as in the achieved their goals such as customer satisfaction, revenue growth and optimization of Quality-Cost-Delay triangle.

The supply chain performance is measured by tools, models and benchmarks, firstly the measure of performance will be made for reasons of organization and improvement, and several factors explain why leaders need the specific measure to manage the supply chain, including:

- The lack of measures that express the supply chain performance;
- The need to determine the interaction between the performance of each actor in the supply chain;
- The complexity of supply chain management;
- The need to align activities and share performance information to implement a strategy that achieves the goals of the supply chain;

- The desire to widen the angle of vision within the supply chain;
- The willingness to spread the positive and negative effects of functional changes within the supply chain;

2.4 Supply Chain performance measurement tools

Companies use tools, models to measure the supply chain performance by strategic, tactical and operational indicators, and improve its performance.

We will then present the tools and models for measuring the supply chain performance as well as the research work studied on these tools.

Classic dashboard

The dashboard is a set of indicators of measurement and control, built periodically, for the manager, to guide his decisions and actions to achieve performance objectives.

Balanced scorecard

The prospective scorecard was developed by the two major authors, Kaplan and Norton in 1992, it's a central tool for management control and steering, transforming an organization's strategic objectives into action variables, and indicators of followed.

[5] examine how traditional balanced scorecard perspectives can be used to develop a framework for assessing supply chain performance, by providing a process for selecting indicators that can be adapted to the context of the supply chain. They conclude by saying that the main processes and interactions of the supply chain should be addressed.

[16] constructed a dashboard of the supply chain and followed the methodology of [5], also associated the objectives pursued within the supply chain with axes of the balanced scorecard.

The scoreboard proposed [16] deals with a set of indicators that are defined in the SCOR model and this dashboard is a representative table of the indicators to be put in place to pilot efficiently the supply chain.

[3] develop a balanced scorecard for supply chain management taking into account the indicators of the four traditional perspectives. They argue that the proposed framework may be the basis for a strategic supply chain management system, but more in-depth research should be addressed to analyze the set of performance indicators.

Activity Based Costing

The method was created in 1980 and involves breaking up the business in the activities, putting the strategic objectives at stake to evaluate the results obtained.

The ABC approach was developed in 1987 by [12] to try to link financial measures to operational performance. The analysis performed as part of this method allows the company to obtain accurate information on costs and

margins. It is a variation of the total cost method that goes beyond a simple calculation of the cost of production.

The method establishes monitoring indicators that are consistent with the company's strategies and suggests a benchmarking procedure to improve performance.

Using the ABC method, we can eliminate non-value-added activities, improve the efficiency of logistics management and control logistic costs through the analysis and evaluation of logistics activities (Zhou and Jiang, 2010).

The ABC method is not only a costing method, but also an effective measure of cost control (Zhou and Jiang, 2010). [13] pointed out that after its initial application in manufacturing, ABC can also be a useful tool in logistics management. It can measure how products or customers consume logistics resources so that the allocation of logistics overheads can be made more accurately.

In 1996, [13] considered that the ABC method can be used to determine the overall efficiency of the supply chain, evaluate alternative supply chain structures or select chain partners.

[19] defined ABC as a method of measuring the cost and performance of activities and objects of costs. It allocates costs to activities based on their resource consumption, and then costs to cost objects based on the required activities.

[18] showed how ABC can be used as a tool to determine the actual costs of logistics activities and how this information can be integrated into the marketing strategy.

Supply Chain Operations Reference

The Supply Chain Operations Reference (SCOR) model was created in 1996 by Supply Chain Council, and it's a standardized methodology for describing and evaluating flows within its Supply Chain. This model aims to integrate a new step of supply chain process.

[15] published an article on the adaptation of the SCOR model for the specificity of Moroccan SMEs, these authors worked on a case study, aiming to modelize the supply chain of an SME and to realize Benchmarking, to improve its performance by the SCOR model, and they chose the SCOR model as a diagnostic tool.

[20] adopted the SCOR model as the basis for developing a supply chain management and measurement system for a manufacturing company.

We also add other authors like Paul J., Laville J. (2007), Moutaokil H., Jamouli H. (2014), [11], who spoke about the SCOR model as a tool for measuring and improving the supply chain performance.

World Class Logistics

The WCL model, proposed by the Council of Logistics Management in 1990, suggests grouping the key success factors of logistics policy around four main skill areas: positioning, integration, agility, and measurement.

This model makes it possible to analyze several companies in the same chain (from the supplier supplier to the final customer), also it compare the practices of several actors in the same chain.

The World Class Logistics model was developed by Michigan State University in the 1990's. This model is used to evaluate the supply chain performance of the company's. This model gathers 68 questions [The survey is based on the results of a pilot survey completed by almost 3,700 respondents in North America, Europe] that allow on the one hand to analyze the competences of the supply chain (positioning, integration, agility, measurement) in several companies and on the other hand, to compare these variables of several companies in the same chain.

Research on supply chain skills (World Class Logistics model) has been developed for almost two decades. [6] published an article in 2000, this author used the World Class Logistics model to evaluate the supply chain performance and determine the level of skills of multi-sector companies in France.

In an article of [9], these researchers studied the impact of supply chain skills on environmental practices, also referring to the WCL model.

In the next step, we will present some tools of supply chain performance measurement used in Moroccan companies.

3. Material and Methods

Based on the presentation of the theoretical and conceptual part of our article on the supply chain concept, performance measurement and measurement tools, and right now, we will pass directly to the exploratory study conducted with Moroccan companies for the purpose of our study a set of elements related to the supply chain performance measurement tools.

In the first step of our exploratory study, we prepared a survey, which is divided into four axes, namely:

Axis 1: General data of the company

Axis 2: General data of the respondent

Axis 3: Supply chain practices

Axis 4: Supply chain management control practice

In the second step, we sent the survey to 110 Moroccan companies, only 30 surveys were returned with a response rate of 27,27%.

The survey were sent to logistics managers, financial managers and other managers who are concerned. In the third step, we analyzed the 30 responses to study the supply chain performance measurement tools practiced in Moroccan companies.

4. Results and Discussion

After receiving the responses to the survey, we collected the information and analyzed it in order to study a set of elements relating to the supply chain management control practices.

Axis 1: General data of the company**According to geographical distribution**

The table below shows that 40% of the companies surveyed are located in Tangier, 24% in Casablanca, 14% in Kenitra, 10% in Rabat and 3% in Fes, Meknes, Nouasser and Oujda.

Table 1: Geographical Distribution of Surveyed Firms

City	Respondents	% Responding
Tangier	12	40%
Kenitra	4	14%
Fez	1	3%
Meknes	1	3%
Rabat	3	10%
Casablanca	7	24%
Nouasser	1	3%
Oujda	1	3%
Total	30	100%

According to the sector of activity

The following table shows that 50% of the companies surveyed are the automotive sector, 20% of transport and logistics sector, 10% of agribusiness sector, 7% of construction and services sector and 3% of the aeronautical and textile sector.

We note that the automotive sector is one of the emerging sectors, it has seen a great evolution in Morocco, and plays a very important role in the Moroccan economy.

Table 2: Business Breakdown by Business Line

Activity area	Respondents	% Responding
Automobile	15	50%
Aerospace	1	3%
Agribusiness	3	10%
Transport and logistics	6	20%
Textile	1	3%
BTP	2	7%
Services	2	7%
Total	30	100%

According to the legal form

The following table shows that 57% of the companies surveyed were created under the legal form Limited Liability Company and 40% are Anonymous society.

Table 3: Distribution of companies by legal form

Legal Form	Respondents	% Responding
Anonymous Society	12	40%
Limited Liability Company	17	57%
Others	1	3%
Total	30	100%

According to the workforce

The table below shows that 50% of the companies surveyed have a workforce of 500 or more, 26% have a workforce between [100-500], 17% have a workforce between [0-50], and 7% have a workforce of effective [50-100].

Table 4: Distribution of companies by Workforce

Effectif	Respondents	% Responding
[0 - 50]	5	17%
[50 - 100]	2	7%
[100 - 500]	8	26%
500 et over	15	50%
Total	30	100%

Axis 2: General data of the respondent**According to the respondent positions**

People use tools and methods of measuring performance are managers, and among the people and executives who answer the survey are managers, logistics managers, management controllers, financial managers, managers of quality and others.

The table below shows that 67% of the respondents are logistics managers, 10% are management controllers, 7% are financial managers, 3% are quality managers, and 13% are other respondents that also concerned.

Table 5: Distribution of business respondents by position

Position	Respondents	% Responding
Logistics Manager	20	67%
Financial Manager	2	7%
Quality Manager	1	3%
Management Controller	3	10%
Others	4	13%
Total	30	100%

According to respondent's level of education:

The table reading below shows that, 74% of respondents have a higher level of education (Master degree level), 13% have a level of (degree level / fourth-year university level) and 10% of respondents with a level of study superior to higher than Master degree level.

Table 6: Distribution of business respondents by Level of Study

Level of studies	Respondents	% Responding
First-year /second-year university degree level / fourth-year university level	1	3%
Master degree level	4	13%
Higher than Master degree level	22	74%
Total	3	10%
	30	100%

According to years of experience

We found that 36% of respondents with experience between 3-5 years and 27% with experience between 1-3 years and between 5-10 years and 10% of respondents who were responsible more than 10 years.

Table 7: Distribution of Respondents by Years of Experience

Year of experience	Respondents	% Responding
Between 1 - 3 years	8	27%
Between 3 - 5 years	11	36%
Between 5 - 10 years	8	27%
More than 10 ans	3	10%
Total	30	100%

Axis 3: Supply Chain Practices

We start with the types of logistics practiced in the companies, and as we mentioned before that there are three types of logistics: Exploded Logistics, Integrated Logistics and Extended Logistics.

Table 8: The type of logistics practiced in companies surveyed

Logistics Practices	Respondents	% Responding
Exploded logistics	5	17%
Integrated Logistics	17	57%
Extended Logistics	8	27%
Total	30	100%

We note that 57% of the Moroccan companies surveyed practiced integrated logistics, those companies are integrated in their logistical functions, against 27% of the Moroccan companies surveyed practiced the extended logistics and 5% who practice the logistics exploded.

We will move on to the second table, which presents the types of supply chain approaches practiced in the Moroccan companies surveyed, and as we mentioned before there are five types of approaches: by process, structural, functional, organizational and complex .

Table 9: The supply chain approach practiced in the companies surveyed

Supply chain approach	Respondents	% Responding
Process approach	15	50%
Structural approach	4	13%
Functional approach	3	10%
Organizational approach	4	13%
Complex approach	4	13%
Total	30	100%

According to this table above, we find that 50% of the Moroccan companies surveyed use the process approach, which shows that these companies manage their supply chain by each process and each logistics function, and we find that 13% of companies use the process approach, structural approach, organizational approach and complex approach, and 10% use a functional approach.

Axis 4: Supply Chain Management Control Practice

We asked several questions to the Moroccan companies surveyed about supply chain management control practices, performance measurement tools, the types of indicators used and the frequency of performance measurement, etc.

Table 10: The Performance Measurement Function in the companies surveyed

	Respondents	% Responding
Yes	21	70%
No	9	30%
Total	30	100%

We find that 70% of the Moroccan companies surveyed used a performance measurement function, however, a percentage of 30% of the Moroccan companies surveyed do not have it,

which shows that these companies won't have the ability to track the evolution of the logistics process efficiency.

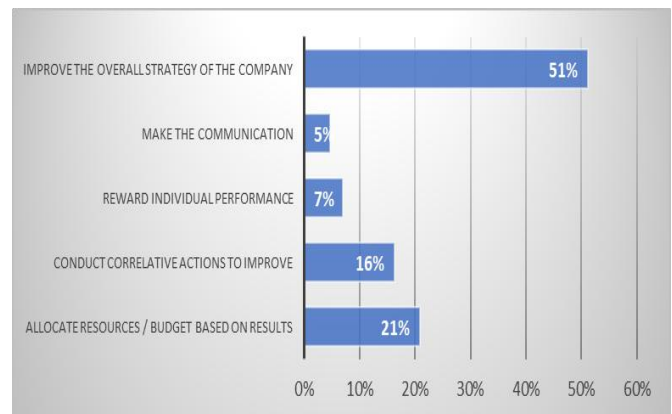


Figure 2: The vision of the companies surveyed on the concept of performance measurement

Regarding the definition of the concept of performance measurement, this graph (figure 2) shows that 51% of respondents consider that the measure of performance aims to improve the overall strategy of the company, 21% who considered a process that allows to allocate results-based resources / budget, while 16% defined the measure of performance through the stage of taking corrective actions in order to improve.

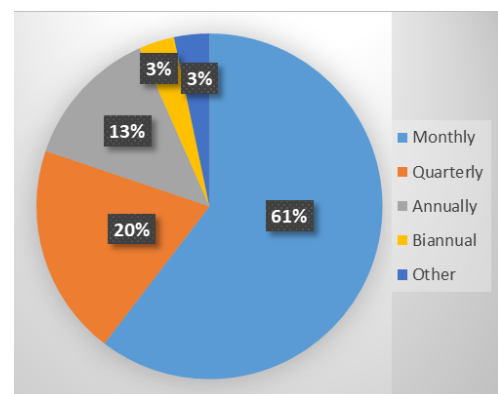


Figure 3: Frequency of performance measurement in companies surveyed

The frequency is an important factor for measuring the supply chain performance. In this graph (figure 3) above shows that 61% of the companies surveyed measure their performance monthly, which shows that they aim to improve their performance, and we note that 20% measure their performance quarterly.

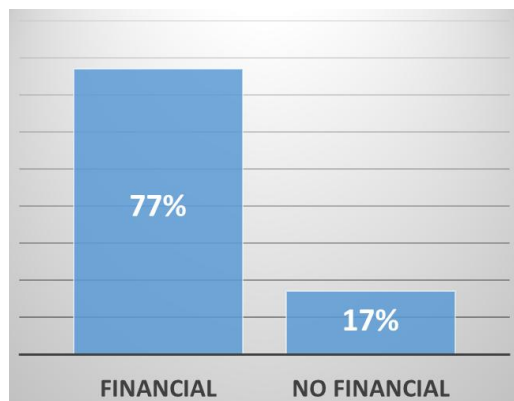


Figure 4: Types of Supply Chain Indicators used in companies surveyed

This graph (figure 4) shows that 77% of companies use financial indicators, and 13% use non-financial indicators. We find that Moroccan companies use financial indicators more than non-financial, only 8% of the companies surveyed use non-financial indicators.

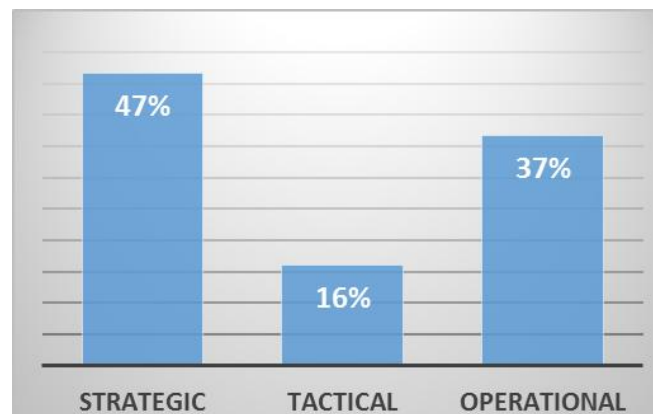


Figure 5: Supply chain indicator levels used in companies surveyed

This graph (figure 5) above shows that 47% of the companies surveyed use strategic indicators to measure their performance, 37% of operational indicators, and 16% of tactical level indicators.

Table 11: Training on performance measurement tools

	Respondents	% Responding
Yes	22	73%
No	8	27%
Total	30	100%

The table 11 shows that 73% of respondents participated in the training on performance measurement tools, and 27% did not have the opportunity to have training on management control. Management control training and performance measurement tools are very important for managers.

Table 12: Tools for measuring supply chain performance known by respondents

Classic Dashboard				
	Yes	Maybe	No	Total
Respondents	26	2	2	30
% Responding	86%	7%	7%	100%
Balanced Scorecard				
	Yes	Maybe	No	Total
Respondents	15	8	7	30
% Responding	50%	27%	23%	100%
ABC				
	Yes	Maybe	No	Total
Respondents	20	4	6	30
% Responding	67%	13%	20%	100%
ABM				
	Yes	Maybe	No	Total
Respondents	11	5	14	30
% Responding	37%	17%	46%	100%
SCOR				
	Yes	Maybe	No	Total
Respondents	16	4	10	30
% Responding	54%	13%	33%	100%
ASLOG				
	Yes	Maybe	No	Total
Respondents	11	6	13	30
% Responding	37%	20%	43%	100%
EVALOG				
	Yes	Maybe	No	Total
Respondents	11	4	15	30
% Responding	37%	13%	50%	100%
WCL				
	Yes	Maybe	No	Total
Respondents	6	6	18	30
% Responding	20%	20%	60%	100%

We notice that 86% of the companies surveyed are familiar with the dashboard tool because it is the first tool created to measure and evaluate the performance of the company and 67% know the ABC method of the cost analysis of the company.

We consider that some of respondents do not know the modern tools like ASLOG, EVALOG, WCL and ABM. It is will be good if the manager know all management measurement tools. Cause any tool has an important value

that's can be used on strategic level, tactical level and operational level.

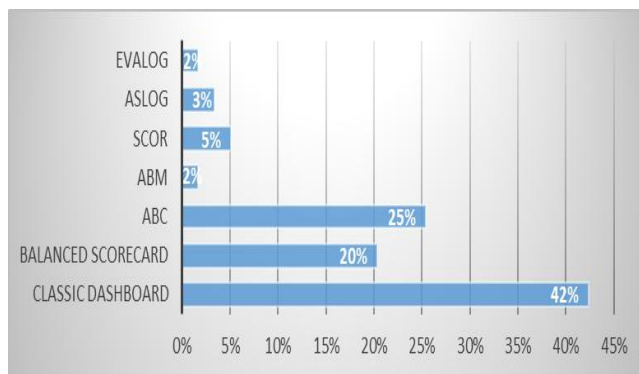


Figure 6: Tools and methods used in companies surveyed

From this graph (figure 6), we note that surveyed companies use only two conventional tools, the classic dashboard and the ABC method. Moreover, we have some companies that use modern tools like Balanced Scorecard and SCOR.

In this case, we summarize that, on the one hand, managers of Moroccan companies have already had training on new tools for measuring performance, and they know some tools like SCOR, ASLOG, EVALOG, and Balanced Scorecard ...etc. In addition, on the other hand, the rate of use of these tools in Moroccan companies is low.

Table 13: The opinion of the companies surveyed on the tools mentioned before

	Respondents	% Responding
Yes	18	60%
No	12	40%
Total	30	100%

We note that 60% of the companies surveyed answered that, these tools and models make it possible to measure and evaluate the performance of their supply chains and 40% of the companies do not agree.

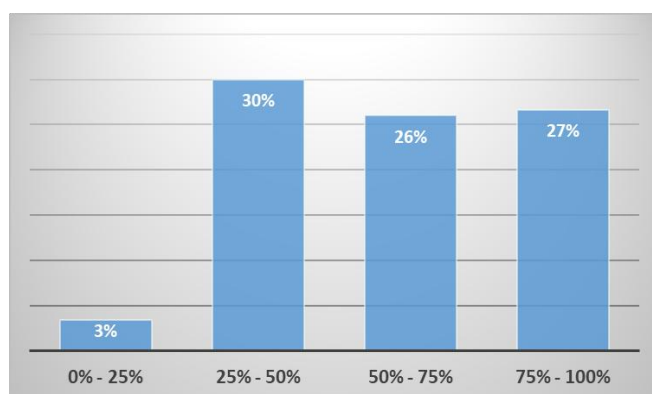


Figure 7: Supply chain performance level of surveyed companies

According to this graph, we find that 30% of the companies surveyed have reached a level of supply chain performance between 25% and 50%, and 27% of companies have confirmed that their performance is level between 75% and 100%. These results show that the performance of these companies is at a medium level and that they must improve their performance with more efficient tools and manage the logistics flows and the entire supply chain.

5. Conclusion

The performance measurement is necessary in companies; it allows analyzing and controlling the flow of the company. The goal of the supply chain performance measurement is to treat logistics flows in order to optimize them and reduce risks. Its function is to present the related indicators with the supply chain actors.

Even though most of manufacturing companies use, traditional measurement tools such as financial performance measurement systems. However, these traditional performance measurement tools did not properly assess the performance and competitiveness of all supply chain systems in manufacturing sectors.

However, optimal performance measurement systems must measure the supply chain at different levels, usually at the strategic, tactical and operational levels.

Therefore, in order to meet the challenges and try to meet the current limitations in performance measurement, further study and development of optimal performance measurement systems at different levels, usually strategic, tactics and operations of the supply chain.

The aim of this research is to give a general overview of the logistics and supply chain and its approaches, the performance management function and the presentation of a set of supply chain performance measurement tools and methods. On the other hand, to carry out a field study to know the idea of the logistic and financial frameworks on the performance measurement and to determine the level of use of effective tools which make it possible to measure the performance of the supply chain.

We have seen that the supply chain management can be based on the organization of its processes and that its performance depends on the relevance of the strategic, tactical or operational decisions taken in each of the identified processes. This performance is measured using interconnected indicators that reflect the impact of different actions along the supply chain. Each of these actions has an effect on some of an organization's performance indicators, and one of the fundamental concepts of a performance evaluation system is to specifically identify the cause-and-effect principles that bind inducers of performance to the measurement elements.

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