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How do you evaluate logistics and supply chain performance? A review of the main methods and indicators

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Abstract

Despite of its origins, logistics concept is today strictly related to commercial activities. In particular, transport and logistics activities are more and more responsible for the success of a company, because their performance strongly influence customer loyalty. An efficient and updated supply chain performance assessment system is so essential for the financial wellness of a business. However, no many studies have been made on SC performance assessment and they have been all carried out lately. Starting from the definitions of logistics and supply chain, this paper presents a review of the main methods and tools used to evaluate supply chain performance. In particular, it focuses on the analysis of the main indicators used to assess logistics performance.

Keywords: Supply Chain Management; Supply Chain Performance; Performance Assessment; Review.

1. Introduction

In the last years, the need to define a tool to support businesses within Supply Chain Management (SCM) and distribution arose. Logistics, transport and distribution of goods, in fact, represent the essential components of SCM; they strongly influence supply chain costs and their poor management could undermine the success of a company. For this reason, it was born the SCM, which has recently gained high attention from academics, consultants, professionals and business leaders. The SCM, in fact, aims at assisting managers in the management of the supply chain (SC) and therefore help companies to survive under the constant pressure to achieve the common goal of customer satisfaction. Over the past decade, there has been a continuous research in the field of SCM which leads, among others, to the definition of tools to supply chain performance measurement (SCPM), essential for an effective strategic management which aims at achieving the business success. Supply chain management should consider an holistic approach to evaluate SC processes performance. In fact,

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activities, functions and systems should be integrated for a success management of the SC (Vickery et al., 2003). Stevens (1989) and Tan et al. (1998) showed that integrated business processes create value for the firm's customers. For these reasons, the SC should be considered as the whole within the performance assessment process. Based on an in-depth study of the literature published in the field of SCM (in particular on SCPM), with this paper the author aims to review the main methods and tools developed, in order to provide a framework which allows choosing the best tool to measure and monitor the performance of the logistics and transport processes, thus to help managers in the decision process.

2. Logistics versus Supply Chain Management

Nowadays logistics can be considered a branch of engineering which creates "people systems" rather than "machine systems" (Islam et al., 2013) and it is strictly related to the evaluation and optimization of times and costs related to processes and services of commercial activities. In fact, logistics can be considered the science that studies the management of the supply chain as the whole, which includes supply of raw materials, production processes, warehousing and goods transport from one point to another one. Despite of this modern concept of logistics, it is worth noting that the term "logistics" finds its origins in the ancient Greece, exactly in the military discipline. There were a specific department of the army that was responsible for providing the necessary weapons, ammunition and rations when they were needed (Islam et al., 2013). On the other hand, the term "Supply Chain Management" was introduced at the beginning of the '80s (Cooper et al., 1997) and it started drawing the attention of the researchers at the beginning of the '90s. Actually, SCM interested not only the marketing and business world, but also the world of scientific literature (Lambert et al., 2000). But, what is the difference between logistics and SCM? It is very thin. In fact, till few time ago, SCM was considered as the logistics related to the external stakeholders: suppliers and customers. For this reason, in 1998, the Council of Logistics Management (CLM) provided a new definition for logistics: ''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 customers' requirements '' (Cooper et al., 1997). On the other hand, the Global Supply Chain Forum (GSCF), a group of non-competing firms and a team of academic researchers, provided a definition for SCM, which was defined as: "the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders". With the latter definition, therefore, not only products' flows, but also information flows, stakeholders integration and management are considered. The GDCF also defined the 8 key supply chain processes (Figure 1):

1.Customer relationship management;
2.Customer service management;
3.Demand management;
4.Order fulfilment;
5.Manufacturing flow management;
6.Procurement;

7.Product development and commercialization;
8.Returns.

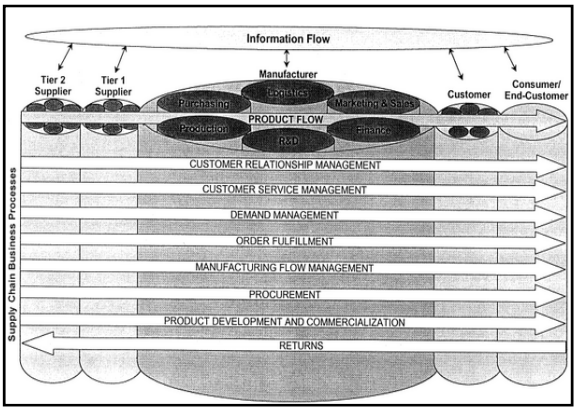

Figure 1: Supply chain management: integrating and managing business processes across the supply chain.
Source: Cooper et al., 1997.

3. The concept of measure and the performance measurement in the Supply Chain

An effective system of performance measurement allows making decisions and undertaking actions in order to make the evaluator able to quantify the efficiency and effectiveness of past actions through the collection, selection, analysis, interpretation and dissemination of suitable data (Neely et al., 2001). The performance measurement is defined as the process that quantifies the efficiency and effectiveness of the action (Neely et al., 1995). Effectiveness is the measure to which customer needs are met, while the cost-efficiency measures as the company's resources are used to achieve a predetermined level of customer satisfaction (Agami et al., 2012). In the last years, researchers have deeply studied supply chain performance measurement - SCPM (Agami et al., 2012). Performance assessment is an important and essential tool to successfully manage the supply chain (Gunasekaran et al., 2001) and the lack of a suitable assessment represents the main obstacle to an efficient supply chain management (Lai et al., 2002). The design and development of a SCPM system implies various difficulties because it represents a tool that generally leads to a company organizational change. As said by Agami et al. (2012), in their review of the main methods used to measuring SC performance, according to leading researchers in this field (Beamon, 1999; Keebler, 2001; Gunasekaran et al, 2004; Tangen, 2004; Ramaa et al, 2009; Akyuz and Erkan, 2010; Kurien and Qureshi, 2011), an effective SCPM should be characterized by:

1.“Wholeness”: it must cover all supply chain aspects and processes;
2.“Universality”: should allow comparison of performance over time and under different operating conditions;
3.“Measurability”: the output should be a quantitative measure;
4.“Consistency”: the measures must be compatible with the objectives of the supply chain.

The choice of the right measurement system represents an important problem. In fact, the most appropriate measure should not only provide an indication of the actual distance of the company from its objectives, but should also provide a means to define its strategy and encourage its implementation (Agami et al., 2012). In the literature there are several works related to the definition of the more appropriate measurement system. According to Gunasekaran et al. (2004), a measurement system shall be used along the SC and have to be "balanced", i.e. it must consider both financial and non-financial indicators that can be classified at strategic, tactical and operational levels. The SC performance measurement (SCPM), thus allows evaluating in both qualitative and quantitative terms if a supply chain is working well or not. The performances of a company have always been assessed through different measurement systems, which evolved over the centuries. Before the nineteenth century, performance measurements were expressed in terms of financial indicators related with the amount of product sold or purchased (for example: cost per ton, cost per kilo, and so on). In the twentieth century, the company DuPont (1903) defined the "Rate of Return on Investment" (ROI - Return on Investment) to evaluate the performance of different units and so they developed the "DuPont System Scale", which has been widely adopted later. Since then, the financial indicators have become the most widely used method for measuring performance (Parker, 2000). After World War II, the climate of uncertainty has meant the birth of the need to balance marketing relationships, research and development, human resources and finance (Kurien and Qureshi, 2011). For these reasons, companies started using both financial and non-financial indicators. However, before the '80s, there was a tendency to still use traditional accounting systems with pure financial guidance. They relied only on quantitative generic financial parameters, ignoring any other important not financial indicator: such as the quality of service or customer loyalty. In the first following decade, these accounting systems have been strengthened and their application has been extended to the evaluation of specific processes and tasks within the supply chain. In the early 90's, Kaplan and Norton (1992) developed the Balanced Scorecard model (BSC), which represents the introduction of the concept of mixed systems for the first time. As widely pointed out by the literature (Kurien and Qureshi, 2011; Lapide, 2000), despite the financial measures are important to evaluate the financial health of a company, they are insufficient to measure the performance of the supply chain. Indeed, they tend to give short-term measures, which focus on the inner vision of the company and are focused on historical data. They also do not make reference to important strategic non-financial performance indicators such as customer satisfaction and the quality of the product and are not directly related to the measure of operational effectiveness and efficiency.

4. Performance measurement models

Performance measurement is critical to improve the effectiveness and efficiency of a company (Beamon, 1999) and of the supply chain (Shepherd and Günter, 2006). The literature review showed the most used models for the measurement of logistics performance are the following:

1.Key Performance Indicators (KPIs);
2.Balanced Scorecard (BSC) model;
3.Business Excellence Model (EFQM) model;

4.Performance Prism model;
5.Supply Chain Operations Reference (SCOR) model.

4.2 Key Performance Indicators (KPIs)

KPIs can be defined as a set of indicators used to measure the success of a company through the measurement of the performance of a particular activity or process. They are not predetermined, but may change depending on the evaluation criteria or priorities that the company associates with each area. The KPIs are used to understand the extent to which an area or process is working against the objectives that the company is responsible to achieve. Based on the values of the indicators, the manager can decide which action has to be taken to improve the performance of a specific area. They can therefore be considered as a real decision support tool. The supply chain decision makers are focused on the development of indicators for assessing SC performance (Beamon, 1999; Gunasekaran et al., 2004) and, when these indicators are properly developed and used, managers need to identify the critical measures related to the areas that need to be improved. Even thought KPIs are useful to quickly identify critical areas, understand what priority give to each area, on the basis of the KPIs values, is not so easy. In fact, the determination of priorities of a given set of KPIs is a critical element in improving the management of the supply chain (SCM) for many companies (Cai et al., 2009). KPIs can be applied to different areas such as sales, marketing, finance, insurance, retail, health care, social media and, of course, supply chain and logistics. Garcia et al. (2012) proposed four performance attributes within which they defined specific KPIs related to each level of the whole logistics process. In particular, following the approach proposed by Frazelle (2002), which provided for the introduction of financial indicators, productivity, quality and cycle time processes, Garcia et al. (2009) proposed four new attributes related to logistics processes: quality, timeliness, logistics costs, productivity and capacity. The quality attribute is related to both the quality of the processes and that of the product along the supply chain; it is indispensable to measure the level of customer satisfaction. The timeliness attribute is related to the response time of the supply chain, required to meet the needs of customers. The logistics costs attribute is related to the financial logistics performance, whereas productivity and capacity attribute is related to the efficiency of the use of the resources. KPIs can therefore be used to measure the performance of a specific process of the supply chain, to supervise the progress of its performance over time and, through the implementation of benchmarking techniques, compare the performance of the supply chain with those of the supply chain of the other competing companies (benchmarking). KPIs should be easy to understand, essential and updated over time. The indicators selected by Griffis et al. (2007) can be considered those most used by logistics managers to assess SC performance (Figure 2).

Measure	Literature Support
On-Time Delivery Percentage	Bititci 2005; Ballou 2004; Murphy and Wood 2004; Rafele 2004; Coyle et al. 2003; Bowersox et al. 2002; Stock and Lambert 2001; Harding 1998; Johnson 1998; Boyd and Cox 1997; Davis 1993; Kaplan 1991; Kleinsorge et al. 1991; Wisner and Fawcett 1991
Logistics Costs as a Percentage of Sales	Bititci 2005; Ballou 2004; Bowersox et al. 2002; Stock and Lambert 2001; Gustin et al. 1995
Days Order Late	Chan et al. 2003; Bowersox et al. 2002; Johnson and Davis 1998; Davis 1993
Inventory Turnover Ratio	Bititci 2005; Wouters and Sportel 2005; Ballou 2004; Rafele 2004; Coyle et al. 2003; Bowersox et al. 2002; Keebler et al. 1999; Johnson 1998; Johnson and Davis 1998; Fisher 1997; Krupp 1994; Wisner and Fawcett 1991; Ellram et al. 1989
Complete Order Fill Rate	Ballou 2004; Rafele 2004; Chan et al. 2003; Coyle et al. 2003; Bowersox et al. 2002; Brewer and Speh 2000; Keebler et al. 1999; Harding 1998; Johnson 1998; Johnson and Davis 1998; Boyd and Cox 1997; Lee and Billington 1992; Ellram et al. 1989
Average Order Cycle Time	Ballou 2004; Murphy and Wood 2004; Rafele 2004; Chan et al. 2003; Coyle et al. 2003; Bowersox et al. 2002; Stock and Lambert 2001; Evers 1999; McMullen 1996
Order Cycle Time Variability	Ballou 2004; Bowersox et al. 2002; Stock and Lambert 2001; Ellram et al. 1989
Items Picked per Person per Hour	Wouters and Sportel 2005; Ballou 2004; Murphy and Wood 2004; Payne and Peters 2004; Coyle et al. 2003; Bowersox et al. 2002; Stock and Lambert 2001
Average Line Item Fill Rate	Ballou 2004; Murphy and Wood 2004; Coyle et al. 2003; Bowersox et al. 2002; Johnson 1998; Johnson and Davis 1998; Lee and Billington 1992; Harrington et al. 1991
Weeks of Supply	Bititci 2005; Bowersox et al. 2002; Johnson and Davis 1998; Krupp 1994
Average Backorder Fill Time	Bititci 2005; Rafele 2004; Bowersox et al. 2002; Johnson and Davis 1998
Sales Lost Due to Stockout	Stock and Lambert 2001; Fisher 1997; Emmelhainz et al. 1991
Percent Error Pick Rate	Murphy and Wood 2004; Rafele 2004; Bowersox et al. 2002; Stock and Lambert 2001; Brewer and Speh 2000
Logistics Costs per Unit	Wouters and Sportel 2005; Coyle et al. 2003; Bowersox et al. 2002; Brewer and Speh 2000

Figure 1. Example of SC performance indicators
Source: Griffis et al., 2007

4.3 Balanced ScoreCard (BCS)

Another important model for SC performance assessment is the Balanced Scorecard model (BCS), introduced by Kaplan and Norton (Kaplan and Norton, 1992); it proposes a balanced approach between financial measures and non-financial measures. Kaplan and Norton believed that the traditional financial measures (i.e. the indicator on return on investment - ROI) would offer an incomplete framework of the corporate performance and that did not provide a tool for continuous improvement and innovation. They argued instead the criteria for performance evaluation should also include non-financial indicators, which would consider customers, internal processes and learning and growth processes. These indicators are very important for the competitiveness of a company; in fact, they allow managers to consider all measures of performance and to assess whether it is possible to achieve improvement in a specific area, without affecting the performance of other areas (Wu and Chang, 2012). The BSC has been widely applied to many services sectors, such as banking (Beechey and Garlick, 1999), various commercial activities, such as customer relationship management (Kim et al., 2006) and the supply chain management - SCM (Brewer and Speh, 2000). However, there are few studies that investigate the potential application of BSC to SC performance evaluation with respect to the external relations (Wu and Chang, 2012).

4.4 Business Excellence Model (EFQM)

The Business Excellence Model (EFQM) model was introduced in 1992 by the

European Foundation for Quality Management to help businesses to be more competitive. The model provides a non-prescriptive framework based on nine criteria:

- Five are called "enablers" and reflect the tasks carried out by the company;
- Four are called "results" and reflect on what the company achieves.

Results are strongly dependent on enablers criteria. This model is usually used as a tool of quality control, so it has not to be limited to the evaluation of SC performance (Figure 3).

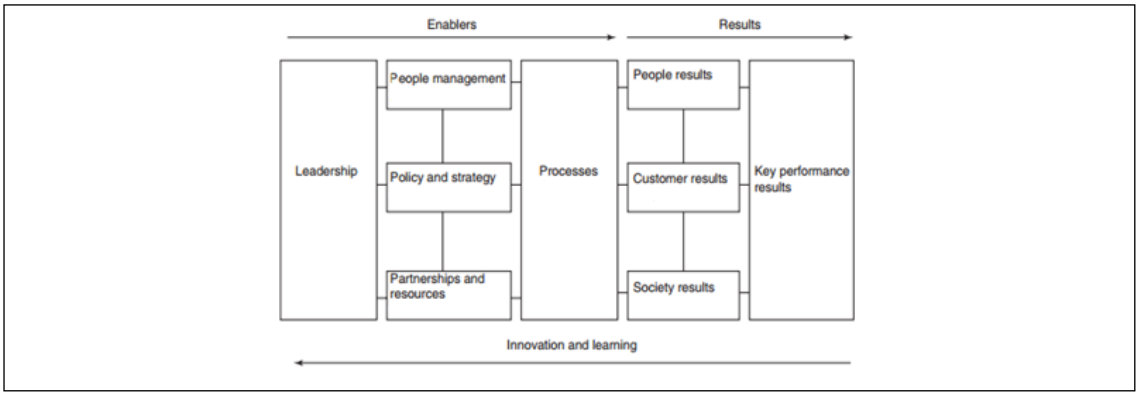

Figure 2. Business Excellence Model.
Source: McAdam, R. Business Excellence Model. Wiley Encyclopedia of Management

4.5 Performance Prism

The Performance Prism is designed to meet the needs of a business in a dynamic environment, in which variables and processes often change over time. This model considers the relationships between the different actors involved in the SC and the processes and activities they carry out within the SC. The stakeholders are the core of the model, which considers five different (but related with each other) performance perspectives (Neely et al., 2012):

1.Stakeholders satisfaction;
2.Strategies;
3.Processes;
4.Ability;
5.Stakeholders contribution.

However, despite being the model that considers more the contribution of stakeholders, this limits it in terms of effectiveness measurement; it offers few, if any, guidance as to the attributes should be identified and performance to be selected (Neely et al. 2012).

4.6 Supply Chain Operations Reference (SCOR)

The Supply Chain Operations Reference model (SCOR) is definitely the most used model within the SC performance assessment; it was proposed by the Supply Chain Council (SCC) to manage and evaluate the performance of the supply chain. SCOR has been widely used by many companies all over the world and it has become the standard

model for the management of the processes that characterize the supply chain (Hwang et al., 2008). It enables companies to analyze the performance of their supply chain in a systematic way by improving communication between the various members of the chain, while, at the same time, optimizing the network and the performance of each region and then of the supply chain as a whole. The model has a hierarchical structure characterized by three levels, for each of which processes and KPIs (shared into the areas: reliability, responsiveness, flexibility, cost and resources) are defined with a level of detail which increases from level 1 to level 3. The processes associated with each level are:

1.Source, ordering and receiving raw materials and products;
2.Make, manufacturing, producing, repairing, modifying or recycling materials and products;
3.Deliver, receiving, programming, taking, packing and delivering products that are ordered by customers;
4.Return, managing the logistics of returning products and goods not suitable for sale and packaging.

There is also another process, Plan, which involves all the previous processes. For each process it is also possible to identify three different decision levels: strategic, tactical and operational, corresponding respectively to the long (years), medium (months) and short (days) period (Souza, 2014).

5. Statistics analysis for supply chain performance assessment

Statistics analysis is widely used for supply chain management analysis (Vickery et al., 2003; Fugate et al., 2010; García et al., 2014; García-Alcaraz et al., 2015). In particular, descriptive statistics are used to describe data behaviour in a study. By providing simple summaries about the sample and the measures achieved, they represent the foundation of a quantitative analysis. Statistics can also help to identify the existing relations among variables. In particular, within the SC performance assessment, financial performance is usually chosen as dependent variable for regression analysis. Regression analysis, in fact, aims to identify the relationship between a dependent variable and one or more independent variables (Hwang et al., 2008; García-Alcaraz et al., 2015). If the model of the relationship is deemed satisfactory, given values for the independent variables, the estimated regression equation can be also used to predict the value of the dependent variable. When the relations analysis among variables is carried out, usually the reduction of the number of variables is advisable in order to consider only the most significant variables to explain the process. Factor analysis is widely used not only for this purpose, but also for detecting the structure in the relations among variables. This technique is commonly used for performance assessment (Vickery et al., 2003; García et al., 2014). Anyway, factor analysis is often used as confirmatory analysis before implementing structural equation modeling - SEM (Vickery et al., 2003). The latter represent a class of statistical models which can be considered confirmatory than exploratory technique. Factor analysis, path analysis and regression all represent special cases of SEM, but it is younger than factor and regression analysis (1960s). It is largely used within social and psychological science because it usually focuses on latent constructs (abstract psychological variables like "intelligence" or "attitude

toward the brand") rather than on the manifest variables used to measure these constructs. For its characteristics, SEM it has been applied also to SC performance assessment to explain direct and indirect relationships among performance variables (Vickery et al., 2003; Wisner, J. D., 2003; Fugate et al., 2010; García et al., 2014; García-Alcaraz et al., 2015).

6. Summary of the most relevant contributions from the scientific literature

The author selected the following papers as the most significant papers related to supply chain performance evaluation, published on international journals. USA is at the first place if both the geographic location of the studies and the number of citations are considered (Figure 4**Errore. L'origine riferimento non è stata trovata.** and Figure 5). Case study analysis (half of the sample in Table 1**Errore. L'origine riferimento non è stata trovata.**) are carried out by collecting data by means of questionnaires. Moreover, in the most of the cases considered, data analysis and performance analysis are carried by means of statistics methods and SCOR model (Figure 6). Also, the most used variable to performance assessment is "costs", followed by "financial performance" and "customer" (Figure 7). Table 2 shows a summary of the methodology used for performance analysis and assessment by the authors of the selected papers.

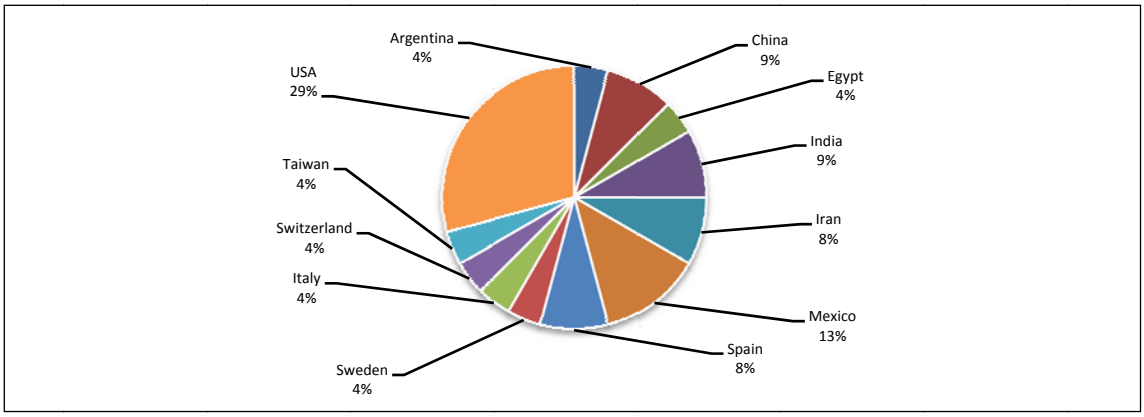

Figure 3. Geographic location of the researches

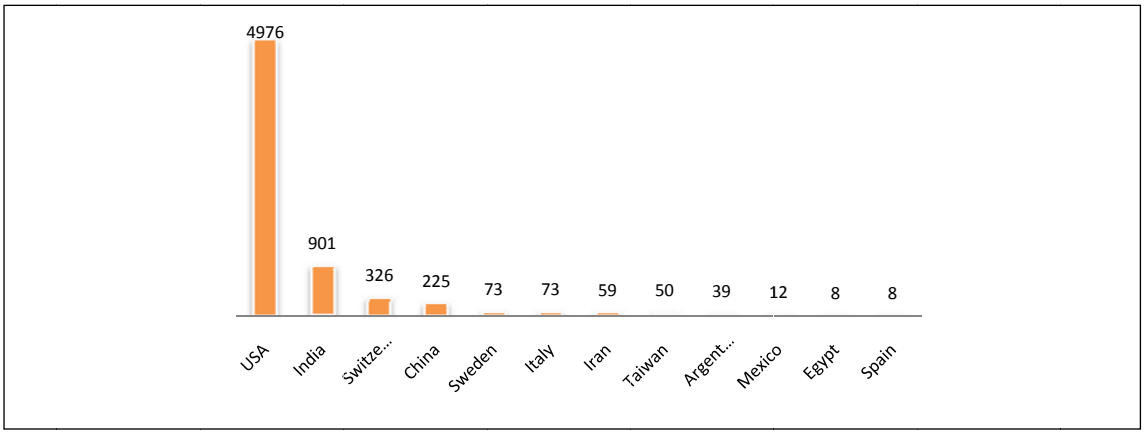

Figure 4. Ranking of citations by country

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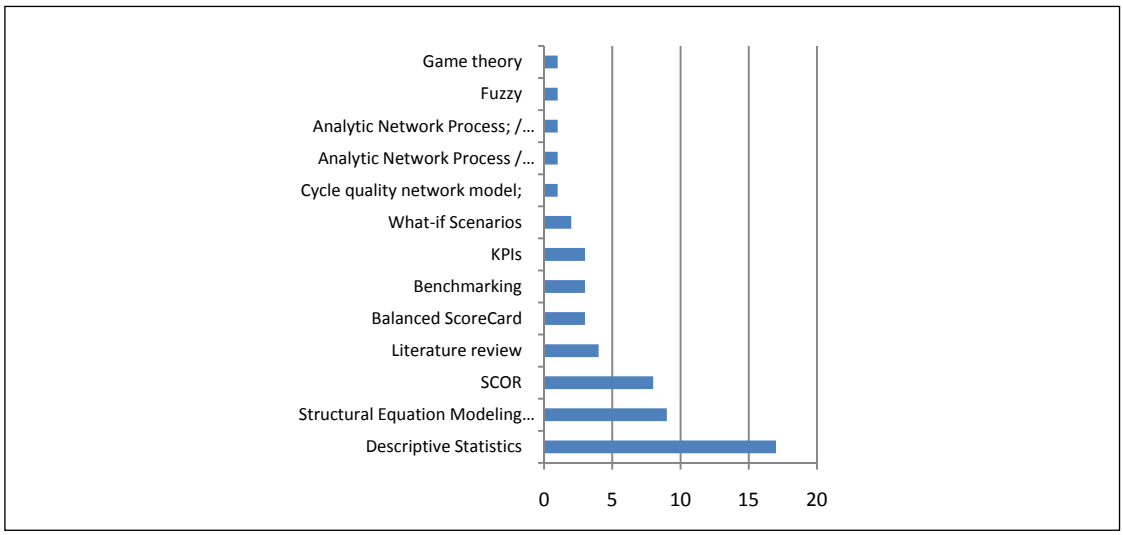

Figure 5. Summary of the methodology used for data analysis

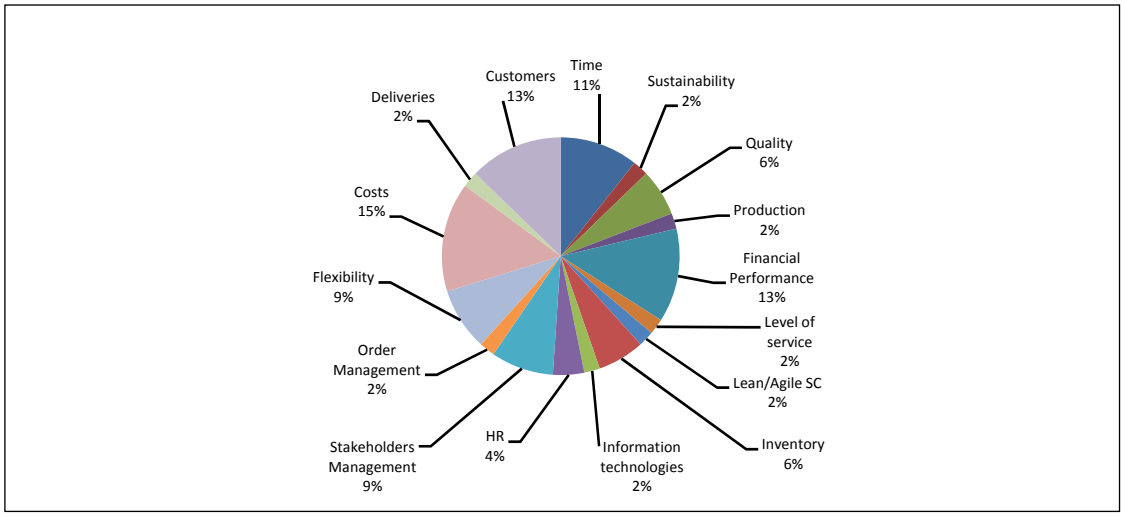

Figure 6. Variables used for performance assessment

Table 1: Summary of the most relevant contributions from the scientific literature

	Reference	*Journal*	*N. of citations*	*Organization*	*Country*
1	Beamon, B. M. (1998)	International journal of production economics	2061	University of Cincinnati	USA
2	Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004)	International journal of production economics	1392	University of Illinois at Springfield; The university of central Arkansas	USA
3	Vickery, S. K., Jayaram, J., Droge, C., & Calantone, R. (2003)	Journal of o8perations ma9nagement	770	Michigan State University; University of	USA

				South Carolina	
4	Agarwal, A., Shankar, R., & Tiwari, M. K. (2006)	European Journal of Operational Research	463	Indian Institute of technology; National Institute of Forged and Foundry Technology	India
5	Bhagwat, R., & Sharma, M. K. (2007)	Computers & Industrial Engineering	438	J.N.V. University	India
6	Gunasekaran, A., & Kobu, B. (2007)	European Journal of Operational Research	380	University of Massachusetts Dartmouth	USA
7	Wisner, J. D. (2003)	Journal of Business Logistics	344	University of Nevada	USA
8	Fleisch, E., & Tellkamp, C. (2005)	International journal of production economics	326	University of St. Gallen	Switzerland
9	Cai, J., Liu, X., Xiao, Z., & Liu, J. (2009)	Decision Support Systems	199	Peking University	China
10	Fugate, B. S., Mentzer, J. T., & Stank, T. P. (2010).	Journal of Business Logistics	89	Colorado State University ; University of Tennessee	USA
11	Persson, F., & Araldi, M. (2009)	Journal of Production Economics	73	Linköping Institute of Technology; University of Parma	Sweden; Italy
12	Griffis, S. E., Goldsby, T. J., Cooper, M., & Closs, D. J. (2007).	Journal of business logistics	70	Air Force Institute of Technology; University of Kentucky; The Ohio State University; Michigan State University	USA
13	Hwang, Y. D., Lin, Y. C., & Lyu, J. (2008)	International journal of production economics	50	Leader University; National Cheng Kung University	Taiwan
14	Naini, S. G. J., Aliahmadi, A. R., & Jafari-Eskandari, M. (2011)	Resources, Conservation and Recycling	49	University of science and techonology	Iran
15	Garcia, F. A., Marchetta, M. G., Camargo, M., Morel, L., & Forradellas, R. Q. (2012)	International journal of production economics	39	National University of Cuyo; Institut National Polytechnique de Lorraine	Argentina

16	Xiao, R., Cai, Z., & Zhang, X. (2009)	Progress in Natural Science	26	Huazhong University of Science and Technology; Wright State University	China; USA
17	Shafiee, M., Lotfi, F. H., & Saleh, H. (2014)	Applied mathematical modelling	10	Islamic Azard University	Iran
18	Agami, N., Saleh, M., & Rasmy, M. (2012)	Journal of Organizational Management Studies	8	Cairo University	Egypt
19	García, J. L., Rivera, L., Blanco, J., Jiménez, E., & Martínez, E. (2014)	International Journal of Production Research	4	Autonomous University of Ciudad Juarez; University of la Rioja	Mexico; Spain
20	Palma-Mendoza, J. A. (2014)	International Journal of Information Management	4	Instituto Tecnologico Autonomo de Mexico	Mexico
21	García-Alcaraz, J. L., Prieto-Luevano, D. J., Maldonado-Macías, A. A., Blanco-Fernández, J., Jiménez-Macías, E., & Moreno-Jiménez, J. M. (2015)	International Journal Adv Manuf Technol	4	Autonomous University of Ciudad Juarez; University of la Rioja	Mexico; Spain
22	Souza, G. C. (2014)	Business Horizons	3	Indiana University	USA

Table 2: Review of the methodology used

Reference	*Data collection method*	*Type of model*	*Performance measurement*	*Case Study*
Beamon, B. M. (1998)	-	Literature review	Costs; Customers; Responsiveness; Time; Flexibility	
Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004)	Questionnaire (ranking: low important-to-high important)	SCOR;	-	-
Vickery, S. K., Jayaram, J., Droge, C., & Calantone, R. (2003)	Questionnaires (mail); telephone calls; To the CEO of the organization	Correlation analysis; factorial analysis; Cronbach's alpha; Structural equativo models (SEM); Path models; Descriptive statistics	Financial performance; Information technologies; Supply chain integration; Customers	Automotive Industry Action Group (AIAG)
Agarwal, A., Shankar, R., & Tiwari, M. K. (2006)	Questionnaires to experts' opinion	Analytic Network Process; Correlation	Lead time; Costs; Quality; level of service; Lean/Agile SC;	-

		analysis		
Bhagwat, R., & Sharma, M. K. (2007)	-	Balanced ScoreCard;	Orders; customers; deliveries; Financial performance; costs	Manufacturing: 2 SME (India)
Gunasekaran, A., & Kobu, B. (2007)	-	Literature review	-	-
Wisner, J. D. (2003)	Questionnaires - Likert scale	Structural equation models (SEM); Hypothesis test; Cronbach's alpha; model fit test;	Supplier management; Customers; Supply chain Management	1,000 manufacturing firms and 2,000 service firms
Fleisch, E., & Tellkamp, C. (2005)	-	ANOVA; Hypothesis test; Simulation	Financial performance; costs; Inventory	Retail (supermarket)
Cai, J., Liu, X., Xiao, Z., & Liu, J. (2009)	Employees and Managers Interviews and Questionnaires	SCOR; KPIs; Correlation analysis; Activity Based Costing;	Costs; Financial performance; Customers; flexibility	Retail (electronic)
Fugate, B. S., Mentzer, J. T., & Stank, T. P. (2010)	Questionnaire - Likert Scale	Descriptive statistics; Hypothesis test; Structural Equation Models (SEM);	Efficiency, Effectiveness;	-
Persson, F., & Araldi, M. (2009)		SCOR; Simulation ("what if" scenarios)		Manufacturing: Ericsson; Autoliv
Griffis, S. E., Goldsby, T. J., Cooper, M., & Closs, D. J. (2007).	Questionnaires - Likert scale	KPIs; Hypothesis test (Hotelling T2 test)	Time; Costs; Inventory; Order;	-
Hwang, Y. D., Lin, Y. C., & Lyu, J. (2008)	Questionnaires - Likert scale	SCOR; Regression models; Cronbach's alpha;	-	Manufacturing:TFT-LCD industry
Naini, S. G. J., Aliahmadi, A. R., & Jafari-Eskandari, M. (2011)	-	Balanced ScoreCard; Game theory;	-	Automotive: SAIPA (Iran) the biggest auto maker
Garcia, F. A., Marchetta, M. G., Camargo, M., Morel, L., & Forradellas, R. Q. (2012)	Questionnaires	KPIs; Benchmarking; SCOR	KPIs with respect to the following areas: 1) quality; 2) timeliness; 3) Logistics costs; 4) productivity and capacity	Food industry: (wine production)
Xiao, R., Cai, Z., & Zhang, X. (2009)	-	SCOR; Cycle quality network model; Multi-objective fuzzy optimal model	Costs; sustainability; Ricycle	-

Shafiee, M., Lotfi, F. H., & Saleh, H. (2014)	-	Balanced ScoreCard; DEMATEL; Data Envelopment Analysis;	Financial performance; Efficience; Flexibility; Quality&Security; Customers	Food industry: 22 SC Iranian food industries
Agami, N., Saleh, M., & Rasmy, M. (2012)	-	Literature review	-	-
García, J. L., Rivera, L., Blanco, J., Jiménez, E., & Martínez, E. (2014)	Questionnaires	Structural Equation Models (SEM); descriptive statistics; factorial analysis; Cronbach's alpha;	relationships management; suppliers management; HR ; Just-in-time; Inventory; Productivity;	Manufacturing: assembly factory (maquilladores, Mexico)
Palma-Mendoza, J. A. (2014)		SCOR; Analytical Hierarchy Process (AHP);	-	-
García-Alcaraz, J. L., Prieto-Luevano, D. J., Maldonado-Macías, A. A., Blanco-Fernández, J., Jiménez-Macías, E., & Moreno-Jiménez, J. M. (2015)	Questionnaires - Likert scale	Descriptive statistics; Cronbach's alpha; Structural Equation Models (SEM); Hypothesis test; regression models; Path analysis	HR; Production processes; Inventory; Financial performance	-
Souza, G. C. (2014)	-	Literature review; SCOR	-	-

7. Conclusions

Based on several studies examined, the literature review on SCM showed that the effective management of the SC helps companies to acquire customers and to improve the level of service offered. However, improving the performance of a company is not simple (Gunasekaran et al., 2004).

The review showed that performance measurement is essential for an efficient planning and monitoring of activities within the decision making process. Despite most companies today use systems to measure performance of their internal and/or external processes, there are no many research studies that address the problem of balanced indicators under the SCM (Bhagwat and Sharma, 2007). There are also no indications of the number of indicators that should be used, nor there is a clear distinction among the indicators to be used for decisions to take at strategic, tactical and operational levels (Gunasekaran et al., 2001). The existing methodologies do not also clear how the most relevant processes for an efficient and effective SCM can be identified (Palma-Mendoza, 2014).

There is also a gap between research and application in measuring and improving SC performance (Cai et al., 2009). Also, the performance indicators are often chosen depending on the opinions expressed by experts in the field (by means of questionnaires in which it is asked to rate the usefulness of an indicator rather than another on the basis of a scale - Likert-type scales) rather than on a rigorous scientific evaluation that proved the real effectiveness (Griffis et al., 2007; García-Alcaraz et al., 2015; Hwang et al., 2008; Wisner, 2003; Gunasekaran et al., 2004).

There exists so the need to define a universally valid framework, that identifies the variables that most influence on the overall performance of the SC, and thus a tool which allows evaluating and monitoring them over time, and so making decision with the aim to optimize SC processes and improve SC performance.

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