Measuring Supply Chain Performance

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Abstract

In the last years performance evaluation issues have attracted the attention of many researchers and companies worldwide. However, most studies are still conducted focusing only on the manufacturing processes performance and associated with financial indicators.

Currently an important question is the necessity of expanding the concepts of performance evaluation to the supply chains, in order to adjust it to the contemporary supply chain management model.

This paper presents and discuss some key points and proposes a model concerning to the structure, design, implementation and management of a supply chain performance measurement system.

Introduction

In the last years it was possible to notice a series of significant changes regarding the way that business are accomplished. In connection with the market globalization process, managerial models have been constantly reviewed and improved, as well as new concepts and paradigms, such as the contemporary e-business and mass customization, have quickly emerged. It is in this competitive context that the Supply Chain Management (SCM) should be understood.

A supply chain can be represented by a group of integrated logistical processes that originates at the raw material source and comprise several companies, until delivering the products to final customer in the form of goods and aggregated services. In general, the complexity in managing the relationships of these chains increase with the number of companies participating in the supply chain. In Figure 1 some supply chains are illustrated through horizontal arrows running along a supplier, an assembler, a distribution center and a final consumer.

Currently it is important to recognize that the competition happens in fact among the supply chains, involving all the companies that participate in them, different from the established by Porter (1980), who affirmed that the competition takes place among the business units, in an isolated way. Considering the fact that competition is happening more and more among the virtual business units, and in order to make possible the management of the companies under this new perspective, recently several practices and new tools have being developed, most of them strongly based on information technology infrastructure. It is essential though, that the participant business units (players) establish a strategic alignment including the business goals along the whole supply chain, in a consistent and integrated way.

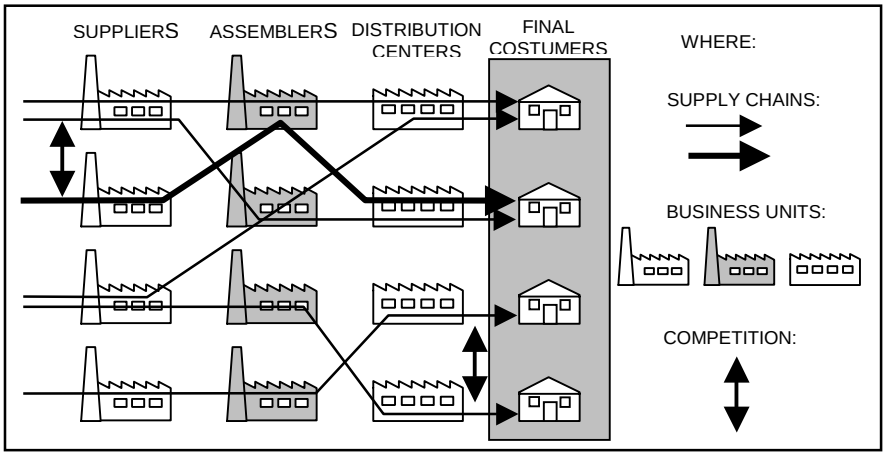

Figure 1: Supply chains and competition among virtual business

Under the managerial point of view, facing the implications brought by this new competitive paradigm, it is necessary to focus in the supply chain core business through the correct determination of the business unit's core competencies. In this direction, concepts such as partnership, outsourcing, Early Supplier Involvement (ESI), mass customization, Efficient Consumer Response (ECR), Vendor Managed Inventory (VMI), In-plant representatives and Postponed Manufacturing have emerged to help on this task. Consequently, it is also necessary to observe and to manage not only the business unit's performance but also the entire supply chain performance, turning the business unit into an effective SCM, that is, more effective and efficient.

In that context, this article aims to present some concepts regarding the SCM, including its strategic implications and some usual practices, as well as to provide important considerations concerning the performance evaluation of a supply chain.

Strategic Implications of the SCM Model

Vollmann & Cordon (1996) sustain that one of the main objectives of the SCM is to maximize the potential relationships among the productive chain parts with the objective to better assist the final consumer, through both final products costs reduction and perceived value addition. In this way, it is important to develop competencies along the whole supply chain, in order to better attend the final customers, increasing the products aggregated value and obtaining costs reductions. Figure 2 represents the two basic SCM objectives, which can provide higher flexibility in the products final price determination.

Under the SCM perspective, it is important to highlight three basic types of competencies:

- **distinct**: are relative to the competencies that guarantee to the business unit an unique competitive advantage, that is, they represent an exclusive knowledge, not reached by the competitors;
- **qualifying**: are relative to competitive needs in certain markets, such as ISO-9000 certification that became an essential condition for companies interested in conduct business with the European Economic Community;

- **basic**: are relative to necessity of pursuing competence in the tasks accomplishment that do not cause any direct impact in its products (for example, payment of the company's telephone bills).

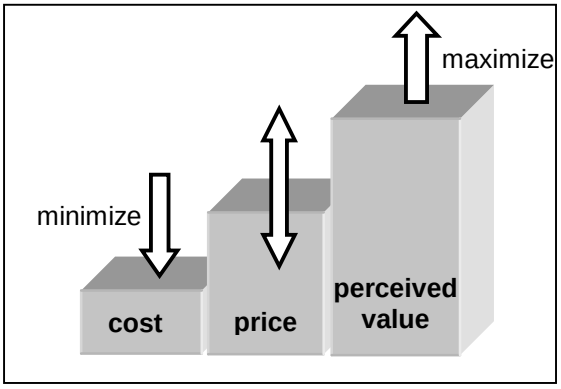

Figure 2: The two basic SCM objectives

In the SCM is desired the development of virtual business units with many of the benefits from the traditional vertical integration but without the common disadvantages regarding the relationship costs and their inherent flexibility loss. In this way, companies interested in improving its SCM performance as dealt below have implemented several concepts and practices worldwide.

SCM Concepts and Practices

Many companies today are adopting and implementing a series of practices and effective SCM concepts to operate adequately in the current competitive scenario. These practices seek, above all, the simplification and the achievement of more efficient productive chains.

Among these practices, Pires (1998) highlights:

- Relationship improvement with customers and suppliers, selecting only strategic players and developing collaborative and genuine partnerships along the entire supply chain.
- Information infrastructure integration, allowing just-in-time deliveries and stock levels reduction.
- Conjoined problems resolution and supplier involvement since the initial product development (Early Supplier Involvement - ESI);
- Product development considering logistical aspects, providing a superior logistics performance.
- Competitive strategy alignment and development of adequate performance metrics.

Furthermore, it is important to notice that, without the adoption of a suitable performance evaluation system in connection with the supply chain strategy, the managerial efforts should be harmed due to the lack of comparative parameters.

Performance Evaluation

From the managerial focus, the performance measurement can be defined as the information regarding the processes and products results, that allows the evaluation and the

comparison in relation to goals, patterns, past results and with other processes and products. Also, it is important to highlight that a managerial performance evaluation system needs to be focused on results, which should be guided by the stakeholder's interests.

Beamon & Ware (1998) affirm that the adoption of performance indicators should deal with the following questions:

- Which aspects should be measured?
- How to measure these aspects?
- How to use the measures to analyze, improve and control the productive chain quality?

It is noticed that this is not an easy task, once there are several indicators available and it is necessary to align the used measures with the involved companies goals. In this direction, Maskell (1991) emphasizes the establishment of a relationship between the performance measures and the company strategic objectives.

According to Beamon (1998), previous researches indicate that the exclusive use of costs as a performance indicator is common among the companies. This happens because the performance measurement through a single indicator is relatively simple. It should be attempted, even so, to the fact that this practice can provide very superficial information about the reality. Beamon (1996) also affirms that the chosen indicators should present simultaneously, inclusiveness (to include the measure of all the pertinent aspects), universality (to allow the comparison under several operational conditions), measurability (to guarantee that the necessary data are measurable) and consistency (to guarantee consistent measures with the objectives of the organization).

On the other hand, it is not recommended to simply discard costs as a performance indicator due to its importance. The alternative would be the adoption of multiple indicators, involving a cost combination with time, flexibility and quality, according to the company competitive priorities.

Traditionally, the performance evaluation is limited to an isolated company or productive process. For an effective SCM it is necessary to expand these concepts beyond the company limits, involving all the supply chain players. It is necessary then, the development of a performance evaluation system embracing all the business units. This can be achieved through the adaptation of the traditional performance evaluation systems.

Adapting Existing Performance Evaluation Systems to the SCM

In the specific case of a performance evaluation system for the SCM, it is necessary to guarantee the compatibility of the used measures along the whole supply chain. This means that the individual measures, for a certain business unit, should be interpreted and compared with all the remaining ones.

Figure 3 presents the adapted structure of a performance evaluation system to the SCM.

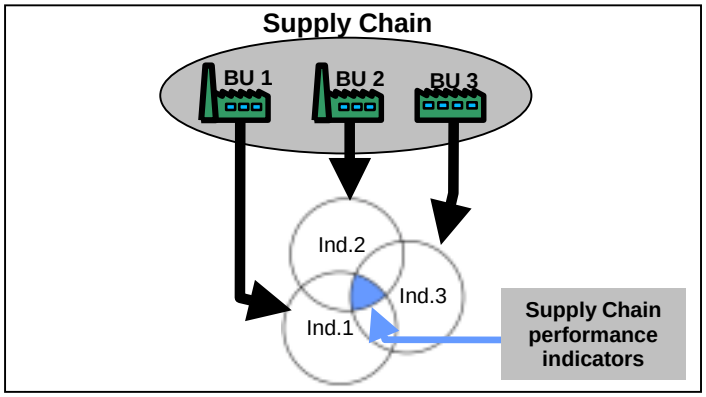

Figure 3: The structure of a SCM performance evaluation system.

The model illustrated by the Figure 3 presupposes the existence of an individual group of indicators (represented by ind. 1, ind. 2 and ind. 3), used in each one of the business units. Besides, there are some common indicators to the whole productive chain and these common indicators will determine the supply chain performance.

Recently, Pinto (1998) developed an interesting model to be adapted in favor of the supply chain performance evaluation. In this model, after the indicators determination, a radar diagram is used. Figure 4 brings an example regarding a sole business unit, according to the competitive priorities, represented by R (resources), E (exits) and F (flexibility).

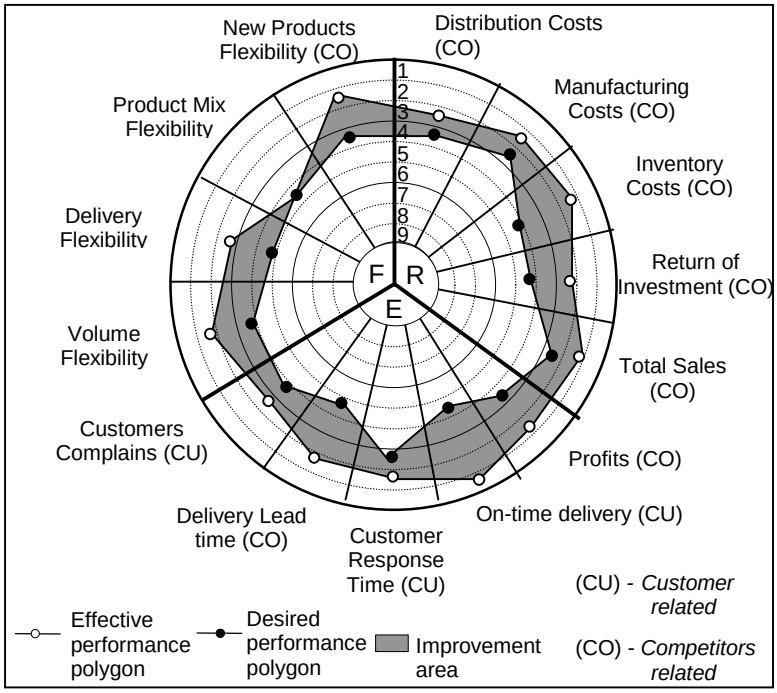

Figure 4: Result of a typical radar diagram exemplifying the simultaneous presentation of the three competitive priorities for a business unit (adapted from Pinto, 1998).

In the diagram of the Figure 4, the performance indicators are classified into: “customer related” (CU) and “competitors related” (CO).

The “customer related” indicators are those regarding the results obtained by the company in terms of the criteria used by the customers to evaluate the company and/or its products performance.

The “competitors related” indicators are those concerning the results obtained by the company in comparison to its competitor’s performance (Pinto, 1998).

The diagram background consists of nine concentric enumerated rings, representing two different scales. The first scale expresses the importance attributed by the customer to the performance indicator. This is called the “customer's scale” (Table 1) regarding the CU indicators.

Order winning criteria	1	Provides a crucial advantage to the customers – it’s the major competitive impulse
	2	Provides an important advantage to the customers – it’s always considered
	3	Provides an useful advantage to most customers – it’s usually considered
Qualifying criteria	4	It’s at least at a good level considering the industrial pattern
	5	It’s at the average level considering the industrial pattern
	6	It’s a little behind of the industrial pattern levels
Less important criteria	7	Usually not considered by customers
	8	Rarely considered by customers
	9	Never considered by customers

Table 1: The “customer’s scale” (adapted from Hill, 1989).

The second scale expresses a comparison to the competitor’s performance. This scale is called “competition scale” (Table 2) regarding the CO indicators.

Another notable characteristic of this system is the possibility of attributing different weights for the indicators, considering that some indicators are more important than others. That can be done trough variations of the radial sections angles so that, the greater the angle, the more important the indicator.

Adapting this system to the supply chain analysis it is possible to build individual diagrams, regarding each one of the supply chain players, in one single diagram, representing each business unit, as well as its competitive priorities in a quadrant. Figure 5 depicts a diagram representing the entire supply chain performance.

Superior performance than the competitors	1	Consistently and considerably better than then closest competitor
	2	Consistently and clearly better than then closest competitor
	3	Consistently and marginally better than then closest competitor
Same performance as the competitors	4	Usually marginally better than most competitors
	5	Approximately the same as most competitors
	6	Usually a little behind major competitors
Lower performance than the competitors	7	Usually and marginally behind most competitors
	8	Usually behind most competitors
	9	Consistently behind most competitors

Table 2: The “competitor’s scale” (adapted from Pinto, 1998).

The advantage of this kind of radar diagram is in the construction flexibility and in the easy visualization of the performance indicators.

In the diagram presented in the Figure 4 it is possible to analyze the performance for each one of the four business units involved in a hypothetical supply chain. Each business unit is

represented at a quadrant, where the chosen performance indicators can be viewed, represented in Figure 4 by letters from A to N.

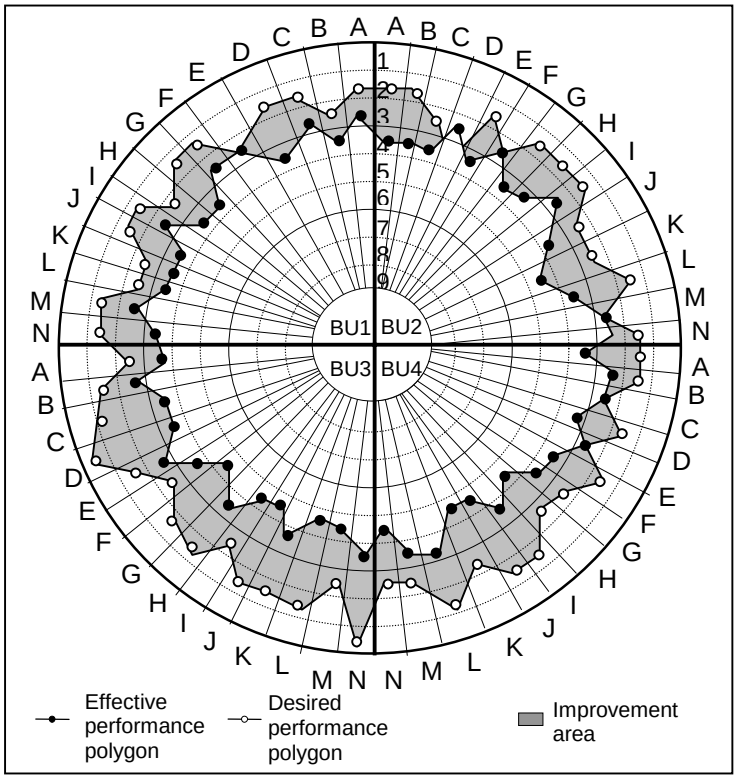

Figure 5: Example of a performance evaluation diagram for a supply chain considering four business units (BU1, BU2, BU3, BU4).

Final Remarks

Certainly the world's competitive scenario is going through a series of changes in the current days. Among these changes, the supply chains role stands out, attempting to bring competitive advantages to companies inserted in that atmosphere in constant transformation. This is transforming the SCM and logistical operations from an operational to a strategic function.

This is aligned with others works, such as Stuart (1997) who identifies, in the supply chain, a continuous need of objectives reassessment, including frequent exchange of planning information and a permanent necessity for performance measurement. Fawcett *et at.* (1997) also complement the scenario definition, alerting that, without the clear understanding of the values that should be supplied to the customers, elevating their perspectives for the achievement of competitive success, the companies cannot select the strategic capabilities that will lead to their own long-term competitiveness.

This way, the correct use of performance measurement for the supply chains represents a fundamental need for the organization's success. In order to compete in its respective marketplaces, companies should guarantee that their suppliers' performance as its own capacities meet or overcome those presented by the competitors.

This article proposes a flexible conceptual model for supply chains performance evaluation through an adaptation of the models proposed by Pinto (1998) and Beamon (1999), through which becomes possible to evaluate the supply chain performance in an integrated way, allowing an uniform measurement along the whole productive chain, and helping to identify the virtual business unit's weak points. The paper also discuss the necessity that supply chains have to achieve, simultaneously, a high efficiency level and the ability to react, in an efficient way, to frequent changes in the competitive environment. It also deals with the performance indicators determination for the evaluation of the whole productive chain. Finally, it is necessary to emphasize that the presented model is still being evaluated with real data. In the near future, it will be possible to validate it in terms of its real applicability and return.

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