



## SUPPLY CHAIN ASSESSMENT - SELECTED METHODOLOGICAL ISSUES

Marek Fertsch

Poznan University of Technology, Poznań, Poland

**ABSTRACT.** The article describes the issue of supply chain assessment in the aspect of various supply chains comparison. The first section of the paper introduces methods used in supply chain assessment. Next, there are two examples of real supply chains to show how difficult it is to compare them. Based on the presented issues a concept of supply chain assessment which allows to make comparisons is presented.

**Key words:** supply chains, benchmarking in supply chains, SCORM.

### INTRODUCTION

Companies in developed countries are forced to struggle with intense competition and continuously improve their competitive advantage. The improvement is achieved through continuous implementation of new solutions and actions. Comparing the company to the best competitors or companies from other lines of business is one of the ways of selecting new solutions and actions. The method is called benchmarking. In short, benchmarking is a way of searching the best courses of actions leading to the most effective performance.

However, a research made by Pennsylvania State University - the Center for Supply Chain Research and Supply Chain Council [Grenoble, Novack 2006] shows that it is not simple to use benchmarking in practice. In the analyzed group of companies from the United States, which used supply chain benchmarking (manufacturers, logistics operators, retailers and wholesalers) only transport (72%), warehouse management (63%), inventory management (51%) and customer service (50%) were benchmarked by comparing the company with other ones. Referring to the benchmarking used in the analyzed companies 88% of them analyzed delivery quality and, based on that, they assessed their suppliers and 68% of them also analyzed delivery punctuality.

The conclusions that may be drawn from the research are, in the authors' opinion, the following:

- supply chain benchmarking is commonly perceived as a tool for strengthening competitive advantage within supply chain and of the supply chain itself. Nevertheless, it is used by few companies.

- companies which use supply chain benchmarking restrict its use to only a few fields of their business activity,

- the supply chain benchmarking efficiency is reasonable. There were no companies which would be fully unsatisfied with the achieved results. None of them were fully satisfied either.

In the cited article's authors' opinion supply chain benchmarking is neither easy nor simple. They state that it is caused by difficulties in selecting appropriate comparison metrics, difficulties in acquiring data and selecting companies to compare.

## **SUPPLY CHAIN BENCHMARKING - AVAILABLE TECHNIQUES AND TOOLS**

The "SCORM model" (Supply Chain Operations Reference Model) elaborated by Supply Chain Council is the most commonly known and widespread supply chain benchmarking technique [Christopher 2000; Kasprzak 2005]. The SCORM model is a diagnostic tool for supply chains, which helps the user define the irregularities in the supply chain, delete them and compare the results with other chains. It consists of:

- descriptions of standard processes and actions,
- standard connections between processes and actions,
- a set of metrics for process efficiency monitoring.

The range of SCORM model involves key supply chain processes, from identifying customer needs, through supply and contacts with suppliers, manufacturing and distribution of products and financial flows. It involves neither product designing and developing nor after-sales service. The processes in the SCORM model are divided into four basic groups and the model itself encompasses four levels of particularity. The goal of the SCORM model is to ensure standard approach to measuring results of supply chain through creating a point of reference to other companies, the best in the business, and using common benchmarking measures. In the common measurement system a set of twelve metrics described as SCORM Level 1 Metrics play a significant role. The main are: delivery quality and punctuality and supply chain costs.

The fact that the SCORM model ignores such processes as product designing and development and after-sales service creates significant conflicts in using them by manufacturers and distributors. The issue is pointed out by G. Islei and R. Cuthbertson in an article about the results of supply chain efficiency research made by Templeton College - University of Oxford [Islei, Cuthbertson 2006]. The article contains also a proposal of differentiation of supply chain efficiency metrics depending on the branch of the supply chain and shows the results of pilot research in two branches - consumer goods and durables. In both cases different metrics were used. However, a common structure was assumed - division into groups with efficiency measured by supply chain costs, competitiveness measured by costs and supply chain financial metrics, ability to create value for customer measured by assessment of the supply chain's influence on creating value for customer and assuring them with a perspective of future development.

However, in the contemporary economy there are not only classical supply chains which assure customers with access to specific standard products on standard conditions. There are also supply chains which, apart from playing their key role, put stress on some aspects of their activity, thus, improving their competitive advantage by offering a product which is unique in terms of delivery terms but still remains a standard product. Other supply chains specialize in providing their customers with unique products. Both cases require individual approach of supply chain assessment and benchmarking.

Agile supply chains are an example of the first mentioned approach. They focus on flexibility adjusted to customer needs, production organization and continuous implementation of changes [Levine 1996]. Agile production organization at the level of manufacturing processes was presented in study [Stachowiak, Fertsch 2006]. G. Sardana offers a set of metrics for measuring efficiency of agile supply chain [Sardana 2006]. He suggests to assess four dimensions of agile supply chain:

- organization efficiency,
- process efficiency,
- quality,

- supply chain actors' satisfaction (suppliers, customers, employees).

The author of the article offers a range of values connected with each assessed dimension and the way of measuring them. The results of the measurement are summed up according to a special formula taking the weight of each dimension into account. The values constitute the general metric for supply chain assessment.

Supply chains in electronic economy are an example of supply chains assuring their customers with access to unique products. Assessment of efficiency of such supply chains is presented in article [Chun-Yu et al, 2006]. The article describes the concept of efficiency measurement process divided into four stages. However, the efficiency metrics are not presented. Instead, the rules of their selection are described. It may be expected that applying the efficiency measurement method proposed in the cited article will lead to a situation that different values and parameters of supply chain will be assessed in each case.

## **METHODOLOGICAL PROBLEMS WITH COMPARING AND ASSESSING CLASSICAL SUPPLY CHAINS - EXAMPLE**

Let's take two supply chains:

The first one consists of a consumer durables manufacturer with their suppliers. Main processes in the supply chain are:

- product designing involving two stages - designing a standard product and adjusting it to customer's needs. In the first stage, before the product is introduced to the market, a project of basic modules and production technology of manufactured elements together with the technology of assembly of ready product is prepared. Stage two, after accepting customer's order, consists in creating detailed solutions for product construction and fitting. These solutions take specific customer requirements into consideration. The production technology is slightly modified in this stage. The assembly technology remains in principle constant.

- sales and after-sales service - the character of delivered products decides that producer's marketing activity is strongly constrained and only refers to public relation. The sales activity starts as soon as a potential customer comes and it refers to identification of specific customer requirements, settlement of price and delivery time as well as signing the contract. The after-sales service involves delivery of spare parts as well as repairs and modernization during product use.

- order fulfillment - it involves production planning in the order model, searching specific suppliers, equipment elements adjusted to customer needs, production and supply in cooperation with suppliers and assembly of ready product.

The second described delivery process consists of a consumer durables manufacturer and their suppliers. Main processes of the supply chain are:

- production and sales planning - based on market research and long-term demand forecasts. The sales quantity and target market are determined by means of general metrics.

- product designing - since the company offers standard products which do not require customization, in the new product designing process the technical level of the biggest competitors' products, current trends in product construction and capabilities of suppliers of components are taken into account. In this stage suppliers of materials and components are searched and long-term delivery agreements are made. The production technology is in principle constant and is not modified at the time of introducing a new product.

- distribution - company sells its products via specialized agent network - wholesalers and retailers. The agents also handle the after-sales service. Hence, when introducing a new product to the market the manufacturer should introduce it to the agents' trade offer, prepare the delivery schedule and carry out a promotional campaign.

- production - it consists in planning in compliance with fixed delivery schedules, taking suppliers' capacity into consideration. Maximization of production resources use is the main criterion in production planning.

Even a superficial comparison shows that the above described supply chains operate in significantly different conditions. Using the SCORM model in their case, especially the SCORM Level 1 Metrics, would probably make the latter supply chain acquire better opinions. The methodological problem consists in that the first of the compared supply chains will never be able to achieve the same values as the latter. It results from differences between operating conditions of both supply chains. In that case, there is no point in comparing them.

## SUPPLY CHAIN ASSESSMENT METHODOLOGY

The concept of supply chain assessment methodology presented in the article is based on a similarity analysis of operating conditions of compared supply chains. The analysis consists of three stages:

- a) Stage 1: creating models of compared supply chains and calculating a synthetic indicator for comparing both supply chains.

In the first stage a "master" supply chain must be taken. Such a supply chain becomes a reference point for comparison. It consists in a set of supply chain characteristic put in order in terms of importance. For the master chain the value of all elements of the vector must equal 1.

The second stage consists in classifying the characteristics of the supply chain compared to the master one by means of a two-grade scale 0 or 1 ( 0 in case of being unimportant, 1 in case of being important) and summing up all "1" values for the compared chain.

The third stage consists in calculating a synthetic indicator for comparing both supply chains according to the following formula:

$$R'' = 1 - (R - R')/R \quad (1)$$

where:

$R''$  - synthetic indicator for comparing both supply chains,

$R$  - size of the set of important characteristics for the master chain,

$R'$  - sum of the characteristics for which the compared supply chain is similar to the master one.

- b) Stage 2: calculating the similarity of processes performed within the compared supply chains. It can be made by means of the following formula:

$$p_{sr} = m_p + m_w / 2m_w \quad (2)$$

where:

$p_{sr}$  - similarity rate of processes performed by the compared supply chains,

$m_p$  - number of processes performed by the compared supply chain,

$m_w$  - number of processes performed by the master supply chain.

- c) Stage 3: calculating the aggregated similarity indicator for the compared supply chains. It can be made by means of the following formula:

$$P_i = R_{i,} + p_{sr} \quad \text{when } R_{i,} + p_{sr} \leq 1 \text{ or } 1 \text{ in the opposite case} \quad (3)$$

where:

the symbols are the same as in formulas (1) and (2)

## SUMMARY

Supply chain benchmarking is neither easy nor simple. There are many techniques for comparing supply chains. Each of them is characterized by particular constraints or is meant to be used for specific types of supply chains. Comparing and assessing classical supply chains is not free from methodological problems either. This paper describes a concept of supply chain assessment methodology. The methodology, according to the author's opinion, may be used for comparing and assessing supply chains regardless of the line of business. The proposed methodology requires empirical verification.

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## OCENA ŁAŃCUCHÓW DOSTAW - WYBRANE PROBLEMY METODYCZNE

**STRESZCZENIE.** W artykule poruszane są problemy oceny łańcuchów dostaw w kontekście porównywania funkcjonowania różnych łańcuchów. Artykuł rozpoczyna prezentacja stosowanych metod oceny łańcuchów dostaw. Następnie, na przykładzie dwóch rzeczywistych łańcuchów dostaw przedstawione są problemy z ich porównaniem. Na bazie

tych problemów przedstawiona zostaje koncepcja metody oceny funkcjonowania łańcuchów dostaw umożliwiające ich porównywanie.

**Słowa kluczowe:** łańcuchy dostaw, benchmarking w łańcuchach dostaw, SCORM.

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Marek Fertsch, assistant professor  
Institute of Management Engineering  
Poznan University of Technology  
ul. Strzelecka 11  
Poznań, Poland  
e-mail: [Marek.Fertsch@put.poznan.pl](mailto:Marek.Fertsch@put.poznan.pl)