Since the early 1990s, various authors have been enlarged their considerations about logistics and supply chain management. What can be observed in the existing literature – although its widespread theory about performance measurement and cost management – is a lack of a structured method to proceed a practical implementation of performance evaluation systems using a business logistics approach. This paper intends to present results of a doctoral research developed to design a logistics performance evaluation system, which was built using processes-
based management concepts to synchronize logistics measures with corporate strategy, focusing on key performance measures. As a research project outcome, different tools like network modelling, balanced scorecard and activity-based costing were integrated in a system designed for decision-making on logistical management.

1 INTRODUCTION

Nowadays, enterprises are facing an environment of high competitive level. Globalization of business relations increase the importance and complexity of logistical challenges faced by companies. Thus, management of logistic networks become a vital factor of competitiveness and, consequently, different approaches to improve enterprise performance are required, including quantitative evaluation of its logistical processes.

According to Christopher (1998), Dornier et al. (1998), Keebler et al. (1999), Schōnsleben (2000), Simchi-Levi et al. (2000) and Shapiro (2001), supply chain management and performance measurement have becoming mandatory disciplines to maintain high service level and low costs on logistics, because logistical activities are related to products, orders and information that flow through factories, wholesalers, retailers and carriers around the world.

Various enterprises are measuring cost of independent activities, but are not paying sufficient attention to measure performance on the whole integrated logistical process. Some reasons are given (Keebler et al., 1999): there are too many measures being collected and these measures are set independently by functional managers and not connected to logistical processes; measures to
evaluate performance are often not completely synchronized to corporate strategy; and implementation of a successful processes-based measurement program is a complex work.

2 RESEARCH IN BUSINESS PERFORMANCE EVALUATION

During the last years, academicians have significantly enlarged their investigation on business performance evaluation (Rolstadas, 1995; Lebas, 1995; Shapiro, 1999; Lapide, 2001; Epstein and Manzoni, 2002; Slagmulder, 2002).

Andersson et al. (1989) underlined that there was a lack of connection between physical and economical measurements. According to Kaplan and Norton (1992), performance need to be measured by an integration of four perspectives – financial, customer, internal processes, and learning and growth – to provide a better linkage between operational processes and strategic planning.

McCormack et al. (2003) emphasize that, although historical logistics measurement have maintained a functional perspective, a processes-oriented approach is more appropriate in today’s competitive environment.

management is given and characteristics of an ideal measurement system are discussed. Finally, levels of measurement and performance report structures are suggested.

Shapiro (2001), Chopra and Meindl (2001) use a quantitative perspective and present an approach based on operations research. An overview of supply chain models and modelling systems is given, describing fundamentals of optimisation models. Applications on strategic, tactical and operational supply chain planning are also presented through numerous examples of performance evaluation.

Also Monahan (2000) and Ragsdale (2001) provide a spreadsheet approach for modelling and analysis of managerial problems, using deterministic and probabilistic models which are suitable to solve logistical problems (Bertrand and Fransoo, 2002).

What can be observed in the existing literature is a lack of an integrated model to carry on a practical implementation of performance evaluation systems using a business logistics approach.

3 DESIGNING LOGISTICS PERFORMANCE EVALUATION SYSTEMS

In our research project we developed a business logistics performance evaluation system – see figure 1 –, which was designed using processes-based management concepts taking into account the following recommendations (Keebler et al., 1999): synchronize logistics measures with corporate strategy; identify and understand customer needs and evaluate costs of logistics services; adopt a processes-based management, focusing on key performance measures.
In this section, it will be detailed the integrated model to design logistics performance evaluation systems. This model, inspired on the SCOR Model, developed by the Supply-Chain Council (SCC, 2002; Meyr et al., 2002; Bolstorff and Rosenbaum, 2003), was built based on past
experiences achieved in research projects developed in several companies that manufacture
intercity and urban buses, computer equipments for bank automation and industrial control, and
shoes and leather products.

3.1 Strategic Analysis using Balanced Scorecard and Strategy Maps

The balanced scorecard strategy map (Kaplan and Norton, 2000) is a useful tool to clarify
strategies, identify the key internal processes that drive strategic success and align investments to
improve logistics performance.

According to Kaplan and Norton (2004), a strategy map – see figure 2 – provides a framework to
link intangible assets to value creating processes on financial, customer, internal process and
learning and growth perspectives.

Financial perspective describes the tangible outcomes in traditional financial terms and customer
perspective defines the value proposition, which provides the context to create value for
customers.

To achieve desired outcomes, both in financial and customer perspectives, it is necessary to
create value through internal processes, which are performed by human resources, information
and organisational structures. Therefore, learning and growth perspective helps to identify the
intangible assets that must be aligned to the critical internal processes.
Figure 2 – A Strategy Map to Design Logistics Performance Evaluation Systems
3.2 SCOR Model Approach and Mapping of Logistical Processes

The SCOR Model approach is based on five management processes – plan, source, make, deliver and return (SCC, 2002).

*Plan* processes are responsible to accomplish market demand, developing a course of action which meets sourcing, production and delivery requirements.

*Source* processes are in charge to procure materials to be transformed into finished products by *make* processes.

*Deliver* processes includes order management and distribution management to satisfy customer demand and *return* processes are associated with returning or post-delivery customer support.

The logistical processes that were depicted in the strategy map are then classified according to SCOR Model.

In using a workflow tool for mapping of processes (Sharp and McDermott, 2001; Aalst and van Hee, 2002) – see figure 3 – logistical processes can be connected by physical and information flows (Hines *et al.*, 2000; Handfield and Nichols, 2002).
Figure 3 – SCOR Model and Mapping of Logistical Processes
3.3 Competitive Priorities and Logistics Performance Metrics

According to Krajewski and Ritzman (2002), competitive priorities are the operating advantages that internal processes of a firm need to outperform its competitors.

To achieve the desired outcomes, it is necessary to select competitive priorities which are linked to productivity and growth strategies – in a financial perspective –, and that have impact on price, conformity, availability and selection – in a customer perspective, as shown on figure 4.

![Diagram showing the impact of internal processes perspective on customer perspective](image)

**Figure 4** – Internal Processes Perspective Impact on Customer Perspective
Five competitive priorities were selected – cost, quality, delivery, responsiveness and flexibility. These competitive priorities are connected to the internal processes and define logistics performance metrics, as shown on table 1.

Table 1 – Competitive Priorities and Logistics Performance Metrics

<table>
<thead>
<tr>
<th>Competitive Priorities</th>
<th>Logistics Performance Metrics</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plan</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>Percentage of Developed Products over Total Demand</td>
<td>75% (min.)</td>
</tr>
<tr>
<td>Delivery</td>
<td>Time to Create a Production Order</td>
<td>3 days (max.)</td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>Percentage of Materials Subject to Incoming Inspection</td>
<td>15% (max.)</td>
</tr>
<tr>
<td></td>
<td>Percentage of Materials Rejected in Incoming Inspection</td>
<td>2% (max.)</td>
</tr>
<tr>
<td></td>
<td>Percentage of Approved Suppliers</td>
<td>60% (min.)</td>
</tr>
<tr>
<td>Delivery</td>
<td>Time to Complete a Purchasing Order</td>
<td>5 days (max.)</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Percentage of Accomplished Purchasing Orders</td>
<td>90% (min.)</td>
</tr>
<tr>
<td><strong>Make</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>Production Cost of Packages</td>
<td>$ 0,15 per kg</td>
</tr>
<tr>
<td>Quality</td>
<td>Percentage of Rejected Packages</td>
<td>0,7% (max.)</td>
</tr>
<tr>
<td><strong>Deliver</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>Distribution Cost: Packages to Supermarkets</td>
<td>$ 45 per ton</td>
</tr>
<tr>
<td></td>
<td>Distribution Cost: Bottles to Stores</td>
<td>$ 4,80 per lot</td>
</tr>
<tr>
<td>Delivery</td>
<td>Distribution Time: Packages to Supermarkets</td>
<td>24 h (max.)</td>
</tr>
<tr>
<td>Quality</td>
<td>Physical Losses to Distribute Bottles to Stores</td>
<td>0,5% (max.)</td>
</tr>
<tr>
<td><strong>Return</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delivery</td>
<td>Time to Discard Materials and Products</td>
<td>5 days (max.)</td>
</tr>
</tbody>
</table>
These logistics performance metrics can be evaluated by means of performance indicators. Table 2 presents, as an example, some logistics performance indicators for the distribution process which is mapped on figure 5.

Figure 5 – Mapping of Distribution Process
Table 2 – Logistics Performance Indicators for the Distribution Process

<table>
<thead>
<tr>
<th>Process</th>
<th>Logistics Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution</td>
<td>Distribution Cost: Packages to Supermarkets: Cost (DA + DC + DE + DF)</td>
</tr>
<tr>
<td></td>
<td>Distribution Cost: Bottles to Stores: Cost (DB + DC + DE + DG)</td>
</tr>
<tr>
<td></td>
<td>Distribution Time: Packages to Supermarkets: Instant D3 – Instant D1</td>
</tr>
<tr>
<td></td>
<td>Physical Losses to Distribute Bottles to Stores: Quantities ((D2 – D4) / D2)</td>
</tr>
</tbody>
</table>

The map of distribution process – see figure 5 – presents initial events, like available packages and bottles in the factory, activities performed – transportation DA and DB, warehousing DC, direct sales DD, shipping DE, delivery DF and DG –, monitoring points D1, D2, D3 and D4, and final events, related to products distributed to supermarkets, stores and final consumers.

4 FINAL REMARKS

In this article we have presented results achieved in a doctoral research which was concluded by the end of March 2004. In our research project we have proposed an integrated model to design performance evaluation systems, which was built using processes-based management concepts to synchronize logistics measures with corporate strategy, focusing on key performance measures.

The integrated model uses strategy maps from Balanced Scorecard, defining financial targets, customer needs and logistical processes. In a second step, the model suggests a workflow tool to map logistical processes, using the SCOR Model approach.
Finally, to evaluate logistics performance, this integrated model recommends logistics performance metrics derived from the competitive priorities selected to accomplish strategic objectives.

REFERENCES


