The increasing competitive pressure resulting from operations activities and markets globalization are forcing enterprises to reorient their strategies, operations systems, processes and procedures to sustain their competitive positions. This paper presents a Delphi experiment, based on a discussion about the roles that a performance measurement system should perform. The measurement system is studied in the context of an operations strategic management system that is used to identify the main roles that the measurement system should perform. The generated framework that is theoretical in essence is refined by a modified Delphi experiment. The understanding of the performance measurement system roles contribute for better design, implementation and use of this system. The main value of the present paper is the theoretical exercise, used to create and to refine the framework. The systemic design approach used will found future research to generate practical solutions for the design and use of operations strategic management system. Continuous improvement, organizational learning and the management of change process are required properties for the strategic management of the operations function.

Palavras-chaves: operations strategy, performance measurement, strategic management
1. Introduction

The increasing competitive pressure resulting from operations activities and markets globalization, are forcing enterprises to reorient their strategies, operations systems, processes and procedures to sustain their competitive positions. This changing process could be supported by an operations management system redesign, which establishes as its main orientation, the development of a strategic management dynamic capability (Teece et al., 1997). The competitive arena complexity and dynamics that embrace enterprises’ operations systems need to be assessed and integrated to organizations performance management. The redesign of operations systems covers organizational and management processes. Particularly, organizations are paying closer attention to the changing nature of operations systems performance, to the point that operations strategic management system used in enterprises performance management is the main focus of redesign projects (Gomes et al., 2004).

There is a common belief in the operations management practices in organisations that if the performance measurement system is redesigned, there will a positive impact in the organisation’s overall performance (Bourne et al., 1999). That belief is often the basic reason for starting the redesigning process; however, the recent research results suggest that there is no success guarantee. In fact, the main issue is related to the operation and management of a strategic system (Bourne et al., 2005).

It is also important to highlight that for improved performance, the strategic management system that encompasses the measurement subsystem should be conceived to: deploy enterprise strategic performance management instead of performance measurement systems; develop dynamic rather than static strategic management systems; enhance the flexibility of performance measurement systems, improving its capability to cope with organisational changes (Neely, 2005).

The presented paper shows a discussion about the roles that a performance measurement subsystem should perform as being part of an operations strategic management system. Based on
a modified Delphi experiment, the roles are discussed and refined. The result is a ranked set of roles that a performance measurement could play, depending on levels of strategic importance.

The paper is structured in the following sections: initially it is defined a theoretical set of assumptions that define roles for strategic performance management. The theoretical synthesis is developed in the format of Tables that identify, organize and define the measurement system roles. Using the theoretical construction as an input for the Delphi experiment, it is refined and the final result is a consensual list of roles that could be performed by a strategic performance management system.

2. Developing measurement system fundamentals

A strategic performance management system may be defined as a system that uses information to produce a positive change to organisational culture, systems and processes. This impact on organizations is achieved by the agreement upon performance goals, the allocation and definition of resources priorities, informing managers to review or to maintain the current policy or plans to meet these goals, and the sharing of the performance results in the task of pursuing those goals (Amaratunga and Baldry, 2002). Implicitly, a role for the performance measurement subsystem is identified as part of the strategic performance management system content definition. The performance measurement system is responsible for the strategy implementation management process. The strategic management system should be able to follow and ‘control’ the strategy implementation process.

There is a common view that the initial building blocks of all performance measurement initiatives, as they are materialized in a performance measurement system, are performance measurement recommendations (Folan and Browne, 2005). These recommendations define the content and structures of the measures, which in turn could be organized in a framework that informs the performance measurement system design.

The content definition of measures, their structure and the subsequent selection and organization of those measures are strongly linked to their ‘utility’ which defines the
measurement system. In this instance the focal point is the process of selecting measures to be included in the system design. A framework for the measures selection process may be founded in the competitive dimensions of manufacturing or service operations, as those dimensions are customized and refined for that purpose. The dimensions categories are organized around competitive patterns as price (cost/operational efficiency), quality (process and product), time (dependability and agility), flexibility (process and product) and innovation (process and product). These competitive dimensions may be performance dimensions of the operation system (Platts, 1995; Leong et al., 1990; Slack, 1987).

Having defined the role of the performance measurement system in the context of a strategic management system, the core ‘functionalities’ associated to the system are identified next. The association between roles, functions and capabilities of the operations strategic management system can be very useful for its design specification by establishing causality between roles and organisational resources. Globerson’s (1985) performance criteria define the system functionalities as: strategic orientation as performance criteria are chosen from the organization’s objectives; evaluated organizational unit has control over the performance criteria; and the performance criteria definition should be a result of a participative interaction of the involved actors (e.g. customers, suppliers, employees, managers). There may be a strategic realization function, as the criteria follow the organization’s objectives. Another function emerges from the management definitions, which state that the system should have a participative conception process and also have ‘control’ over the evaluated organizational unit. A strategic management function can be identified based on those assumptions.

Maskell (1991) has also developed relevant principles for the performance measurement system design: a changing nature in measures; measures conceived as part of a fast feedback subsystem (the performance measurement subsystem); and measures designed to stimulate the development of a continuous improvement capability rather than simply monitor the operations strategy. Although a strategic management function is identified in the implementation of performance measurements, this role is related to continuous improvement development.
Blenkinsop and Davis (1991) expand the functional definitions of measurement systems when they identify properties that the system should have, especially, when those are related to organizational integration and differentiation. The properties cover improvements of management system integration and differentiation in both horizontal and vertical dimensions of the organizational structure. They also emphasise the importance of covering the long, medium and short term perspectives of the life cycle of an organization when designing the performance measurement system.

Based on a literature review, Gomes et al. (2004) identify several characteristics of performance measurement systems:

- Measures must involve relevant non-financial information based on key business success factors (Clarke, 1995).
- Systems should be implemented to articulate strategy and monitor business results (Grady, 1991).
- Measures and related systems should be based on organizational objectives, critical success factors, and have a customer orientation. One of the main tasks should be monitoring both financial and non-financial aspects of the obtained results (Manoochehri, 1999).
- Performance system must dynamically follow the strategy (Bhimani, 1993).
- Performance system should accomplish the requirements of specific situations in operations, be long term oriented, and be simple to understand and implement (Santori and Anderson, 1987).
- Performance system should be linked to reward systems (Tsang et al., 1999).
- Financial and non-financial set of measures should be coherent and consistent with the strategic framework (Drucker, 1990; McNair and Mosconi, 1987).

It can be seen from Gomes et al. (2004) analysis that there is a changing nature in the performance system (re)design and management. The system should be integrated with the business strategy, adapting to and monitoring its financial and non-financial aspects. The
performance measurement system is an integrative management system that interrelates the business performance dimensions with the functions action plans (e.g., strategy of operations, human resources, technology, marketing, and finance).

The content analysis of the role of a performance measurement subsystem that is part of an operations strategic management system is summarized in Table II.
Table II - The structural roles of a strategic performance measurement system

<table>
<thead>
<tr>
<th>Role</th>
<th>Perspective</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produce positive change in organisational culture, systems and</td>
<td>Strategic performance management system definition</td>
<td>Bourne et al. (2005); Neely (2005); Amaratunga and Baldry (2002); Manooechehri (1999); Bhimani (1993); Blenkinsop and Davis (1991)</td>
</tr>
<tr>
<td>processes, in order to contribute to the strategic vision realization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance measurement system should provide a closer understanding of customer needs, in order to create a perceived value for customers</td>
<td>Customer driven strategy</td>
<td>Neely et al. (2005); Bourne et al. (2005); Kennerley and Neely (2003); Neely et al. (2002); Kennerley and Neely (2002); Johnston et al. (2002); Kaplan and Norton (2001); Neely et al. (2000); Manooechehri (1999); Ghalayini and Noble (1996); Kaplan and Norton (1992); Globerson (1985)</td>
</tr>
<tr>
<td>Implement strategic management functionality in the strategic operations management system, providing the system with the jointly improvement of operational efficiency and overall business effectiveness</td>
<td>Strategic management function</td>
<td>Henry (2006); Neely (2005); Gomes et al. (2004); Kaplan and Norton (1992); Globerson (1985)</td>
</tr>
<tr>
<td>Develop a continuous improvement capability through implementation and management of an integrated operations strategic management system</td>
<td>Continuous improvement capability development</td>
<td>Neely (2005); Gomes et al. (2004); Kennerley and Neely (2003); Kennerley and Neely (2002); Johnston et al. (2002); Kaplan and Norton (2001); Neely et al. (2000); Ghalayini and Noble (1996); Maskell (1991); Johnson and Kaplan (1987)</td>
</tr>
<tr>
<td>Ensure that the performance management system covers long, medium and short term perspectives</td>
<td>Life cycle orientation for performance system design</td>
<td>Henry (2006); Neely et al. (2005); Chenhall (2005); Bourne et al. (2005); Flynn and Flynn (2004); Gomes et al. (2004); Slack et al. (2004); Masken and Platts (2000); Blenkinsop and Davis (1991)</td>
</tr>
<tr>
<td>Performance measurement system result of measures definitions and performance frameworks recommendations (This assumption explain the performance measurement design process role)</td>
<td>The systemic and hierarchical approach</td>
<td>Folan and Browne (2005); Gomes et al. (2004); Blenkinsop and Davis (1991); Maskell (1991); Globerson (1985)</td>
</tr>
<tr>
<td>Performance responsible for articulating strategy and monitoring business results</td>
<td>Strategy realization through the monitoring of the organization’s results</td>
<td>Gomes et al. (2004); Neely et al. (2005); Bhimani (1993); Kaplan and Norton (1992); Blenkinsop and Davis (1991); Grady (1991); Santori and Anderson (1987)</td>
</tr>
<tr>
<td>Measurement of business results implemented using financial and non-financial aspects of business performance (In fact the performance design should guarantee)</td>
<td>Financial and non-financial nature of the organization’s performance</td>
<td>Gomes et al. (2004); Neely et al. (2002); Manooechehri (1999); Clarke (1995); Kaplan and Norton (1992); Blenkinsop and Davis (1991); Drucker (1990); Maskell (1991); McNair and Mosconi (1987)</td>
</tr>
</tbody>
</table>

Source: authors
Having developed an understanding about the performance measurement system’s role, it is possible to use these construction as a guide for performance measurement system (re)design.

3. The Delphi experiment

The modified Delphi experiment is based on a collective and interactive process that involved 20 experts operations strategy, performance measurement system design, operations and production management and service management. The experiment was conducted and organized in three main phases: a semi-structured interview that was used to identify performance measurement roles, through its functions and characteristics; a seconded phase was developed in order to create a consensus about performance measurement systems roles and; a third phase that create a consensus about the roles priorities, in a ranked list format. The results showed in this are mainly concerned with the consensual analysis of the roles by themselves.

The interviews are analyzed by cognitive maps and showed that the roles proposed in Table II could be synthesized and reorganized, representing a refined understanding about performance measurement roles. Figure 1 shows cognitive maps examples extracted from some interviews. Table III shows the refined list of roles (Lee et al., 1992).
The integration of productive chain with an approach to sustainable manufacturing.

Table III constitute the main information that is used on the second phase and was refined by the individuals’ interviews. The Delphi experiment is used to reach a consensual perception about the measurement system roles.

Table III - Strategic performance measurement system refined roles

<table>
<thead>
<tr>
<th>Performance measurement systems should…</th>
<th>Academic 1</th>
<th>Academic 2</th>
<th>Academic 3</th>
<th>Academic 4</th>
<th>Academic 5</th>
<th>Academic 6</th>
<th>Academic 7</th>
<th>Academic 8</th>
<th>Academic 9</th>
<th>Academic 10</th>
<th>Academic 11</th>
<th>RANKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>produce positive change in organisational culture.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>produce positive change in organisational systems and processes.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>provide a closer understanding of market needs to create a perceived value for customers.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>implement strategic management functionality in the strategic operations management system, providing the system with the jointly improvement of operational efficiency and overall business effectiveness.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>develop a continuous improvement capability through implementation and management of an integrated operations strategic management system.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>show how the system design requirements lead to desirable results.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>22</td>
</tr>
<tr>
<td>be responsible for articulating strategy and monitoring business results.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>comply with external requirements, not directly managed by organisation.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: authors

The Delphi experiment developed on phase 2 was an electronic exercised through e-mail. Table IV shows the individual answers that were used to composed the ranked list presented in Table V.

Table IV – Delphi experiment Phase 2 analysis
Source: authors

Table V shows a ranked list that evolved from a consensual analysis of performance measurement roles (Linstone and Turoff, 2002).

Table V - Strategic performance measurement system Delphi Phase 2

<table>
<thead>
<tr>
<th>Performance measurement systems could…</th>
</tr>
</thead>
<tbody>
<tr>
<td>implement strategic management functionality in the strategic</td>
</tr>
<tr>
<td>operations management system, providing the system with the</td>
</tr>
<tr>
<td>jointly improvement of operational efficiency and overall</td>
</tr>
<tr>
<td>business effectiveness.</td>
</tr>
<tr>
<td>be responsible for articulating strategy and monitoring</td>
</tr>
<tr>
<td>business results.</td>
</tr>
<tr>
<td>produce positive change in organisational systems and processes.</td>
</tr>
<tr>
<td>develop a continuous improvement capability through implementation and management of an integrated operations strategic management system.</td>
</tr>
<tr>
<td>produce positive change in organisational culture.</td>
</tr>
<tr>
<td>provide a closer understanding of market needs to create a</td>
</tr>
<tr>
<td>perceived value for customers.</td>
</tr>
<tr>
<td>show how the system design requirements lead to desirable</td>
</tr>
<tr>
<td>results.</td>
</tr>
<tr>
<td>comply with external requirements, not directly managed by</td>
</tr>
<tr>
<td>organisation.</td>
</tr>
</tbody>
</table>

Phase 3 refined the rank order established by the lines of Table V, and the order was not substantially modified, but the roles were classified in strategic and systemic functional aspects. Table V show us that a performance measurement design is contingent to its environment, and that the roles follow this assumption creating a coherent set of design propositions.

4. Conclusion

Comprehension of the performance measurement system roles is essential for
understanding the entire operations strategic management system dynamics. The roles dialectics played by performance measurement systems, acting as medium for operations strategy realization or as enabler for strategic management system redesign, is the key foundation for organizational learning. Capabilities were identified to support measurement system design, implementation and management. Particularly, organizational learning capability, continuous improvement capability and strategic management capability were highlighted.

The market and resources based approaches used in operations strategy could be integrated to the operations strategic management system through different feedback loops that implement the retroactive and predictive strategic control strategies. Structurally the strategic management system could integrate the long and short term perspectives. The process of performance measurement creation and operation is related to a life cycle model of interplay between design and implementation. The strategic control system architecture should also represent the multi dimensions of the operations performance, approaching them with multivariable techniques. It also important to manage the hierarchy that is established between the business performance dimensions (e.g. price, quality, time, flexibility, innovativeness), according to the competitive patterns and set by the operations strategy. The operations strategy formulation process analyses the qualifying and the winners competitive dimensions, dealing with the trade-offs and planning the paths and trajectories for capabilities development. The predictive control could be realized through capabilities development, which belongs to the operations vision definition. Supported by concepts like positions, processes, paths and trajectories, the framework for the predictive control strategy could be conceived. Theses elements strongly influenced the performance measurement system behaviour and are the background for formulating the proposed roles.

The roles were generated by three refining studies, starting from theoretical assumptions that were refined by expert’s interviews and tested by a Delphi experiment. The refining process gave maturity to the research in studying and approaching performance measurement system roles.
The Delphi experiment proved to be a powerful methodological technique in order to reach consensus about the system roles. These roles could be used to generate a system design specification, but it should be investigated in-depth by case studies and generate propositions for a survey, which could finally create design recommendations.

The resulting list of performance measurement system roles is being used as the input of another research based on case studies. The case study protocol is guided by the identified roles and is conceived in order to identify the performed roles.

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