Abstract Number: 015-0710

Operations strategy and performance measurement roles

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POMS 21st Annual Conference

Vancouver, Canada

May 7 to May 10, 2010

Abstract

Companies' environment and global competition are forcing them to revise the way they design and implement their strategies and management systems. Business and functional management systems should develop specific capabilities to deal with a changing and complex environment, that is, strategic and operational plans should be continuously assed and updated. This paper frame a discussion based on operations strategy framework. The main issue is to interrelate operations strategy with performance measurement in a strategic management framework. Performance measurement roles are revised in order to assess their alignment with new design requirements for operations strategic management. Based on a set of updated performance measurement systems roles, a case study protocol is developed and applied to two engineering service companies. Although classical roles as performance control is still the main focus of operations performance measurement systems, the evidences collected show a growing use of operations strategic management systems for continuous improvement management.

Keywords: operations strategy, strategic management, performance measurement

Introduction

The multi-dimensional characteristics of enterprise performance are challenging operations system management models. Such characteristics are exemplified by the involved factors complexity; the dynamic associated with internal and external variables that define operations system strategic management; the operations strategy planning systems links that inter-relate short and long term perspectives; and the increasing use of resource and competence based models in operations strategy specification and design (Tang, 2009, Chiesa *et al*., 2008).

According to Gomes *et al*. (2004), the strategic management system redesign process requires a 'balanced', 'integrated', 'linked', 'flexible', 'multifaceted' and 'multidimensional' management system. Such characteristics should reflect the performance measurement system specification (PMS), when describing the entire strategic operations management system. These requirements are not currently well developed and integrated to strategic operations management processes, and could not offer opportunities for firms better understand their operations systems environment and to increase their performance level (Taticchi and Balachandran, 2008, Slack, 2000; Platts, 1995).

Bourne *et al*. (1999) pointed out that there is a common belief around organisations' operations management practices that if the performance measurement system is redesigned, there will be a positive impact in organisation's overall performance. That belief is often the basic reason for starting redesigning processes; however, recent research results suggest that there is no evidence guarantying success in those initiatives (Bourne *et al*., 2005).

It is also important to highlight that for improving 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 aims to discuss and to identify what are the performance measurement system roles that a measurement system should play, in order to attend new system design requirements. The study is based on operations strategic management models and integrated to an operations strategy framework. The research process is based on case studies applied to two engineering service companies.

The paper is structured in the following sections: initially it is defined a set of assumptions that define roles for PMS. The synthesis is developed in the format of Tables that identify, organise and define the measurement system roles. Using this PMS roles set as an input for a case study protocol design, two case studies were developed. Case studies were used to identify the most relevant roles that the studied PMS are performing.

Content analysis

A strategic performance management system can be defined as a system that uses information to produce a positive change in organisational culture, systems and processes (Jazayeri and Scapens, 2008, Bititci *et al*., 2006, Amaratunga and Baldry, 2002).

Bititci *et al*. (1997) define performance measurement systems as information systems that enable performance management process to function effectively and efficiently. Efficiency and effectiveness properties qualify system operation.

As a result of the established management mental model, routines and procedures used for the purpose of assessing enterprises' performance are perceived as being an important issue in practioners and academics agenda. There is a common sense that the initial building blocks of all performance measurement initiatives, as they are materialized in a performance measurement system, are performance measurement recommendations. These recommendations basically define the contents and structures of measures; organising them in a framework that could inform performance measurement system design (Folan and Browne, 2005).

Measures content definition, their structure, selection and organisation are strongly related to their 'utility' in the measurement system. A framework for measures selection can be founded in manufacturing or service operations competitive dimensions. These dimensions could be categorised and organised 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) (Verbeeten and Boons, 2009, Folan *et al*., 2007, Melnyk *et al*., 2004, Platts, 1995, Leong *et al*., 1990, Slack, 1987).

Miller and Roth's (1984) taxonomy for manufacturing strategy combines and organise competitive patterns. They identified three types for the strategy development: Marketeers' strategy that is founded in manufacturing process reliability, particularly in quality (process and product) and time (dependability and agility) dimensions;

Caretakers' strategy that is focused in low price (conformance quality, dependable delivery and operational efficiency); and Innovators' strategy, which is based on differentiation, it is oriented to quality (product) and it is not placed in price competition. Frohlich and Dixon (2001) revisited the study of Miller and Roth (1984) to verify if the taxonomy is still valid and to test the model in different countries and regions. They contributed Caretakers and Innovators types validation, proposing that the Innovators' type should be named Specialists' strategy (performance and conformance quality), to be coherent with segmentation concept of Porter's model (1985), and to don't be related to product innovation. Porter (1985) observed that shifts in the industry structure could happen over time, leading companies to review their strategies. Precisely, this is what happens to Marketeers' strategy that was closely identified with the differentiation generic strategy of Porter's (1985) model, but it evolved over time to be founded in product innovation and development. This change moves Marketeers' strategy to Designers' strategy. There were other emergent models that will need more investigation, which indicates that there are specific roles to be developed by all actors in global markets. One of the emergent types could be named Servers' strategy, based on service capabilities and mass customization's strategy that is focused on flexibility. Part of the operations or manufacturing strategy design process is justified by, based a strategy core type selection. Thus, performance measurement system design process is influenced by this design choice, in the sense that the main performance dimensions are identified by manufacturing strategy types.

Defined the performance measurement system structure, it could be presented a process framework.

Process analysis

There are four main processes related to performance measurement: design, implementation, use and refreshing. Refreshing process could be broadly understood as the continuous system redesign (Bourne *et al*., 2005; Neely *et al*., 2000; Bourne *et al*., 2000).

Kaplan and Norton (1992) developed a procedural framework to manage organisations' strategy, through the processes of design, implementation, use and refresh. The proposed four stages or processes used implement the balanced scorecard management system could be stated as follow:

- 'Translating the vision' is closed related to PMS design process, developing and operationalising organisation's strategic vision.
- "Communicating and linking" is the process associated to implementation, deploying strategic vision into functional objectives.
- "Business planning" is the process of assessing value creation through the integration of business and financial plans. This management process is responsible for vision realization.
- ''Feedback and learning'' process develops the strategic learning organizational capability, and it could be used to refresh the strategic management system.

The study of performance measurement systems implementation success and failure would be helpful for understanding the dynamics and structure that found this process. It also would be useful for the construction of an operations strategic management system

design specification. The performance measurement system is an important part of the strategic management system, as it governs the dynamics of the entire system.

Nine factors are pointed out by Franco-Santos and Bourne (2003) as producing a relevant impact on the way organisations manage through measures:

1. The organisational culture, stated by a set of beliefs and values, could be grounded in a participative and continuous improvement oriented environment.
2. The management leadership for managing through measures and the management team commitment to the strategic PMS.
3. The existence of a compensation link based on strategic performance measurement system information.
4. The development of a continuous and corporative educational process to develop and update the strategic performance measurement system understanding.
5. The quality of communication and reporting, as they are open, clear, with timeliness and easy to understand.
6. The continuously review and update of the strategic performance measurement system.
7. The simplicity of data collection, analysis and interpretation processes, especially used to understand trends. The support that the IT systems provide for developing data processes.
8. The industry and business competitiveness, overall performance, long-term versus short-term focus and government regulations.

9. A clear and customized strategic performance measurement system framework.

Bourne (2005) organises the factors that influence performance measurement systems implementation in three main categories, which are related to purpose, structure and culture. Purpose analysis shows that there are two main orientations for PMS implementation: they could be focused on measurement system improvement; or they could be founded in a more open perspective, looking for a better management of the whole business management system. Structural studies show how implementation process is organized and its relationships with parent company interventions. Cultural dimension shows the importance in developing a learning perspective.

Recent studies on performance measurement system are looking for an in-dept comprehension of why performance measurement initiatives fail. This understanding could help to identify the main role of a performance measurement system, which is in the last instance could be related to the development of a strategic management system (Henri, 2006; Bourne, 2005; Neely, 2005, Kaplan and Norton, 1992).

The implementation process highlights the importance of change process enablers related to performance measurement systems, especially those related to changes in culture, systems and processes. A continuous improvement role could be played in managing factors that enable and block the implementation process.

A performance measurement system may lose its effectiveness over time if it is not redesigned, in order to better attend new environmental and organisational demands. Three of the processes presented by Neely *et al*. (2000) - design, implementation and refreshing processes – deal directly with changes in the measurement system. Managing

through measures could be an approach to develop and implement a role related to change management in measurement systems (Bourne *et al*., 2005; Franco-Santos and Bourne, 2005).

The performance measurement system strategic management enables organisations to develop continuous improvement and organizational learning capabilities. The measurement system should sustain their importance and utility for the organisation and its users, engaging them in an evolutionary process for developing organisational and individual competences (Kennerley and Neely 2003, Kennerley and Neely, 2002, Johnston *et al*., 2002, Kaplan and Norton, 2001, Neely *et al*., 2000; Manoochehri, 1999 Ghalayini and Noble, 1996).

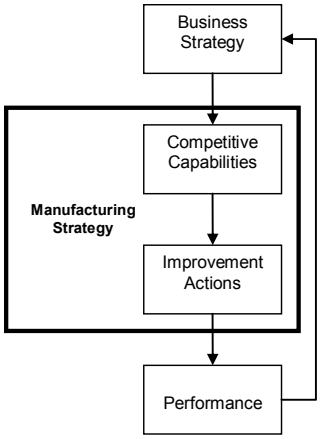
The refreshing process could be settled as an embedded functionality of a strategic management system. Its main role is coordinating the performance measurement system redesign as a result of its use and interaction with its environment.

Established the content and processes related to PMS, it is possible to integrate them in a management system.

Developing the strategic management view

Strategic control system concept was first presented when performance measurement systems were introduced. Measurement systems are part of a wider system, which includes goal setting, feedback, and reward functions (Neely *et al*., 2005).

Frohlich and Dixon (2001) developed a strategic management framework for testing and revisng the manufacturing strategy taxonomy proposed by Miller and Roth (1994). Figure 1 represents the research framework rationality and Exhibit 1 presents the competitive capabilities content that founds the proposed manufacturing strategy types.



Source: Frohlich and Dixon (2001)

Figure 1 – Research framework

The analysis developed by Frohlich and Dixon (2001) is based on an intrinsically closed loop nature that governs the strategy process realization, setting operational references to manufacturing strategy that are derived from competitive capabilities, which in fact are used to generate improvement actions.

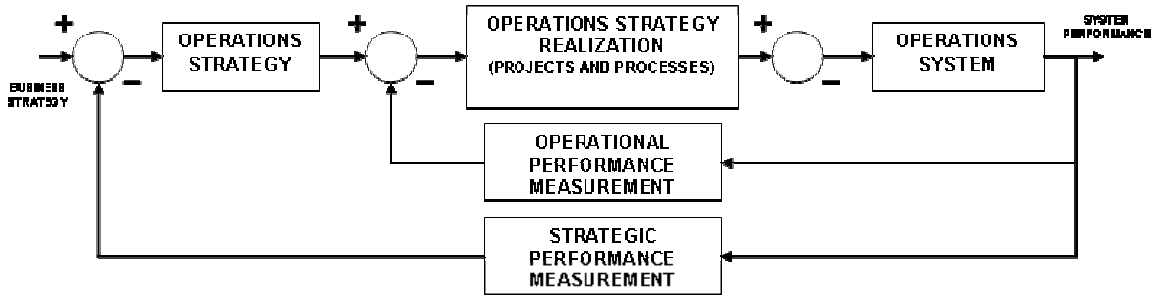
Exhibit 1 – Competitive capabilities

Competitive capability	Definition
Price:	
- low price	Compete on price
Flexibility:	
- design flexibility	Make rapid design changes and/or introduce new product quickly
- volume flexibility	Respond to swings in volume
- broad product line	Deliver a broad product line
Quality:	
- conformance	Offer consistent quality
- performance	Provide high performance products
Delivery:	
- delivery speed	Deliver products quickly
- dependability	Deliver on time
Service:	
- after-sales service	Provide after-sales services
- broad distribution	Distribute the product broadly
- advertising	Advertise and promote the product

Source: Frohlich and Dixon (2001)

Hrebiniak and Joyce (1984) model the interaction between strategy, behaviour and action. They identified that there is an intrinsic behaviour strategic control, which regulate human actions. In this context, control means that performance measurement and feedback loops guide action. Performance measure system introduction as one element of a strategic control system can be used to influence behaviour (Pinheiro de Lima *et al*., 2009, Olsen *et al*., 2007, van Veen-Dirks, 2005, Neely *et al*., 2005, Ketokivi and Schroeder, 2004).

The developed theoretical construction presented in this section aims to organise and frame the rationality that rules operations strategic management system - OSMS. Figure 2 shows OSMS architecture, identifying its subsystems. The 'plant' or the real world system is the operations systems, which is strategically managed by operations strategy subsystem, planning subsystem and performance measurement subsystem. Double feedback loops intend to represent monitoring (operational feedback loop) and refreshing (strategic feedback loop) functions and processes (Pinheiro de Lima *et al*., 2008, Pilkington and Fitzgerald, 2006, Nilsson and Olve, 2001).



Source: Pinheiro de Lima *et al*. (2008)

Figure 2 – The operations strategic management system

Questions that emerge at this point are: “Why rely on feedback control systems to strategically manage operations system?” and “Does this not retrocede to a management systems’ mechanistic view, denying a continuous changing nature of strategy view and considering operations systems as a closed loop system?”

A well known performance measurement framework is Kaplan and Norton’s (1992) ‘Balanced Scorecard’, which provides a planning technique and performance measurement framework within the same management system. It can be classified as a strategic management framework since it integrates strategic map processes to performance dimensions. The system creates customer focused value through improvement actions and business processes development. The balanced scorecard model is based on ‘innovation action research’ and uses a methodology that integrates design, implementation and operation of a strategic management system (Kaplan, 1998). Through the evolution of performance measurement frameworks, the balanced integrated approach expands to a total integrated approach, with evidence of an evolutionary or co-evolutionary process. Exhibit 2 shows the main characteristics that could be used to define an evolutionary or life cycle model for strategic performance measurement systems. Radnor and Barnes (2007) also highlight the movement from operational performance measurement to an integrated performance management approach.

Empirical studies coordinated by Henry (2006), Chenhall (2005), Chenhall (2003) and Simons (1991) on the use of measurement systems strategic control investigate the levers used in organizations to measure and manage performance. They found two patterns in managing a measurement system: diagnostic simple feedback control and interactive control. Bourne *et al*. (2005) use their frameworks to compare the results of average-

performing and high-performing business units. In the former, the strategic management system logic is adherent to simple feedback control. In the latter, strategic management systems are based on both, interactive and simple feedback control approaches.

Exhibit 2 – The strategic performance evolutionary process.

Phase	Description
1	The performance measurement matrix integrates different dimensions of performance, employing the generic terms 'internal', 'external', 'cost' and 'non-cost'. The matrix enhances the perspective to external factors (Keegan *et al*., 1989).
2	The strategic measurement, analysis, and reporting technique – SMART – developed by Cross and Lynch (1989) uses a hierarchic, performance pyramid structure to represent the integration between organizational vision and operations actions. There is a interplay between external and internal orientations to improve the internal efficiency and the external efficacy.
3	The performance measurement model proposed by Fitzgerald *et al*. (1991) integrates determinants and results of the operations systems performance, exploring causalities between them. Measures are related to results (competitive position, financial performance) or are focused on the determinants of the results (e.g. cost, quality, flexibility).
4	The Balanced Scorecard (BSC), proposed by Kaplan and Norton (1992) constitute a multidimensional framework, based on financial, customer, internal processes and learning and growth dimensions, which integrates structural and procedural frameworks for designing a strategic management system.
4	The integrated dynamic performance measurement system – IDPMS – conceived by Ghalayini *et al*. (1997) incorporates the performance the dynamic features and the integrative properties. The integration process involves the management function, process improvement teams and the factory shop floor. The system creates a dynamic behaviour that articulates its specification and the reporting process.
5	The dynamics features are presented in the Neely et al. (2002) performance prism. This is a scorecard based system for measuring and managing stakeholder relationships. The framework is conceived to cover stakeholder satisfaction, strategies, processes, capabilities, stakeholder contribution dimensions. The main objective of the strategic management system is to deliver stakeholder value.

The literature indicates that engagement and interaction intensity with performance measurement processes could have a great impact on overall business performance if complementary roles are managed. This is suggested by Simons (1991) and in this paper applied to the strategic management system as suggested by Bourne *et al*. (2005).

Henry (2006) approaches performance measurement systems based on a diagnostic and interactive use of management control systems. He identified two roles that work simultaneously but with different purposes: the diagnostic use represents a mechanistic

control approach and the interactive use an organic control system. The diagnostic use defines the performance measurements system role as a measurement tool and the interactive use defines the performance measurements system role as a strategic management tool.

Gomes et al. (2004) question if the state-of-the-art in performance measurement systems is ready to offer to the practicing managers a really integrated solution. It should have characteristics and features like inclusiveness, completeness, timeliness, universality, measurability, consistency, integrity, flexibility and ethical. Exhibit 3 shows some definitions about these properties.

Exhibit 3 – Integrated performance measurement system characteristics and features

Characteristic or feature	**Definition**
Inclusiveness	Measuring all pertinent aspects
Completeness	The extent to which the model can take account of all relevant performance factors
Timeliness	Aims to describe how long PMS takes to analyze collected data
Universality	Allow comparison under various operations conditions
Consistency	Measures consistent with organisation goals
Integrity	Integrity of a system refers to PMS capability to promote integration between different business areas
Flexibility	To make possible dynamic trade-offs through selection, development and exploitation of superior capabilities in the context of the operations strategy realization
Ethical	To support socially responsible business practices

Source: adapted from Gomes *et al*. (2004)

Gomes et al. (2004) also stated that performance measurement must be grounded on information availability, reliability and responsibility. PMS should be seen as complete organisational system, rather than isolated functional subsystems. They must be evaluated not based only on their integrative features, but also with respect to their capabilities for dynamic managing efficiency and effectiveness performance related factors.

Based on content and process analysis expert interviews and a Delphi experiment was conducted and generated a PMS roles reference list. Exhibit 4 describes these identified PMS roles that will found a case study research protocol that is described in next section (Pinheiro de Lima *et al*., 2009a, Pinheiro de Lima *et al*., 2009b, Pinheiro de Lima *et al*., 2008).

Exhibit 4 – Roles of a performance measurement system

Performance measurement systems could…		**Perspectives**
Roles	implement strategic management functionality in the strategic operations management system, providing the system with the jointly improvement of operational efficiency and overall business effectiveness.	Strategic management function
	be responsible for articulating strategy and monitoring business results.	Strategy realization through organisation's results monitoring
	produce positive change in organisational systems and processes.	Strategic performance management system definition – information flow
	develop a continuous improvement capability through implementation and management of an integrated operations strategic management system.	Continuous improvement capability development
	produce positive change in organisational culture.	Strategic performance management system definition – internal environment
	provide a closer understanding of market needs to create a perceived value for customers.	Customer driven strategy
	show how the system design requirements lead to desirable results.	Systemic design approach
	comply with external requirements, not directly managed by organisation.	Contingency view

Presented the theoretical references case studies could be planned. It will be shown results from two engineering services studies.

Case study protocol

The case study protocol is fundamentally oriented to identify what are the roles that companies are playing in their day to day operations. The assessment of the PMS roles that are being performed by companies is the last step in the proposed research protocol.

Exhibit 5 - Case study protocol

Research Protocol			
Main Goal	To study production systems' performance measurements use		
Specific Goals	**Steps**	**Operational Procedures**	**Results/Outputs**
SG 0: Research Group			
To classify company operation	To classify enterprise in terms of industry, size, organisational model, production	To interview company's designated research project coordinator.	Company identification and classification according standards and public references.
To define a research group, including key companies' employees and research academics	To identify a qualified company expert group for the research project purposes, using company's value chain as the main context.	To select companies' professional based on their responsibilities or competences related to: industrial engineering; manufacturing engineering, process engineering, production planning and control, quality management, logistics management, supply chain management and product design.	Peoples research project related expertises.
SG 1: Performance Dimensions			
To build a performance matrix through operations' performance dimensions.	To identify the relevant aspects that define performance, focusing on a specific business unit and product family.	In a group meeting it will be discussed the most important aspects that define business performance, covering strategic and operational issues.	Business performance dimensions statements.
	To assess performance dimensions regarding customer demands and competitors performance benchmarking.	In a group meeting it will be generated an assessment related to customers demands and competitors performance benchmarking, using for that purpose scales proposed by Slack [29].	Performance dimensions assessment regarding customer demands and competitors performance benchmarking.
	To synthesize all the gathered performance information in a performance matrix.	In a group meeting plot the results of performance assessment in Slack's [29] performance matrix.	Performance matrix representation.
SG 2: Performance measures			
To formalize performance measures using a structured approach.	To select a group of performance measures, specially those related to winners factors.	In a group meeting it will be selected a group of measures related to winners factors. The measures will ranked by their contribution to operations strategy development.	Group of selected performance measures.
	To formalize performance measures using the structure proposed by Neely *et al* . [30]	To interview company's professionals that are responsible for the selected performance measures in order to formalize the selected performance measures..	Structured and operational description of the selected performance measures.
SG 3: Performance measurement system roles			
To identify the roles that the studied performance measurement system are playing.	To interview the employees that are responsible for the selected performance measures.	Based on a semi structured interview protocol, to recover the interviewees' perception about the structure, processes and uses of the selected performance measures.	Interviewees' perception about performance measures design and use.
	To represent the performance measurement system processes associated to: design, implementation, use and refresh (redesign).	To identify and to represent the informational flux and activities related to performance measures design, implementation, use and refresh (redesign).	Performance measurement system activities and processes representation.
	To identify the performance measurement system roles that are being played by the studied system.	To related the selected performance measures to a set of predefined performance measurement system roles.	List of performance measurement system played roles

Initially, it is important to formalize some key information about operations strategy, performance measures and PMS processes. Initially, it is created a strategic context and further PMS roles are assessed. This is the main guideline of the case study protocol development. Exhibit 5 shows the proposed procedures for case studies implementation.

The case study protocol was applied to a pilot case for testing the proposed procedures. The results were used for refinement and the information collected from the pilot case was integrated to the entire set of case studies.

Companies' PMS roles

The case study protocol is being applied in service and manufacturing companies. Companies are being chosen by their experience in managing through measures. It will be shown results from two case studies, particularly related to engineering service companies. Companies are identified in this paper as DELTA and EPSILON.

DELTA is a business unit of a large engineering service company that develops factory engineering design for pulp & paper and feed & biofuel industries. Its operations are managed through a corporative ERP system.

EPSILON is a small engineering service company that produces geographical information system reports for public urban planning and for the extractive and minerals mining industries. Its management system is based on TQM definitions, particularly those defined by ISO 9000 standards and PNQ quality award.

Exhibit 6 and Figure 3 show results of DELTA strategic analysis, used to identify order winners and qualifying factors. These factors influenced directly PMS roles identification.

Exhibit 6 – DELTA performance matrix data

Performance criteria	Customer assessment	Competitive analysis	Identitication
Accessibility	9	6	I
Customer service (attendance)	7	5	H
Competence	2	3	C
Consistency	2	2	B
Credibility	1	1	A
Cost	4	6	F
Flexibility	5	5	G
Speed of delivery	4	2	D
Tangibility	4	5	E

Legend

Customer assessment
Winners factors
1. Is is the most important factor perceived by customer - real source of competitive advantage
2. It is an important factor that has always been considered by customers in their decision processes
3. It is nornally considered by customers in their decision processes
Qualifying factors
4. Customers perceived that this factor should be lightly abouve overall sector performance, to qualify companies to offer their products
5. Customers perceived that this factor should be according to overall sector performance, to qualify companies to offer their products
6. Customers perceived that this factor should be closed to overall sector performance, to qualify companies to offer their products
Less important factors
7. Normally, this factor is not perceived by customers, but it could be considered in future relationships
8. It is rarelly considered by customers in their decision processes
9. t is not considered by customers in their decision processes, and probably it will never will

Competitive analysis
Better than competitors
1. It has a consistently and remarkable better performance than its best competitor
2. It has a consistently better performance than its best competitor
3. It has a consistently and lightly better performance than its competitors
Aligned to competitors
4. It has a frequently better performance than its competitors
5. It has performed as competitors overall performance
6. It has performed closed to its competitors
Worst than competitors
7. Usually and lightly worst than its best competitors
8. Frequently worse than its competitors
9. Consistently worse than its competitors

It could be identified in DELTA performance matrix that there different 'action' areas demanding actions that will be integrated to its operations strategy.

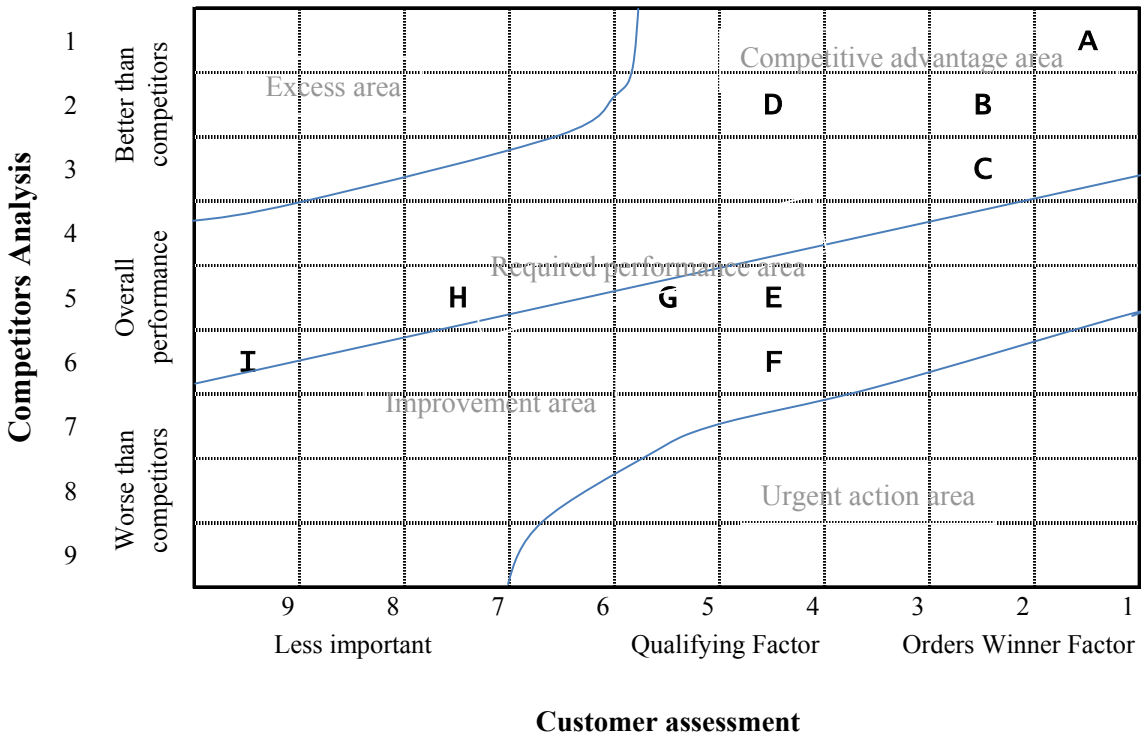


Figure 3 – DELTA performance matrix

Exhibit 7 and Figure 4 show results of EPSILON operations strategy study, used to identify order winners and qualifying factors. These factors are directly connected to PMS roles identification.

Exhibit 7 - EPSILON performance matrix data

Performance criteria	Customer assessment	Competitive analysis	Identitication
Competence	2	3	B
Consistency	4	5	D
Credibility	5	4	E
Cost	1	5	C
Flexibility	5	5	F
Speed of delivery	6	6	G
Tangibility	2	1	A

Legend

Customer assessment
Winners factors
1. Is is the most important factor perceived by customer - real source of competitive advantage
2. It is an important factor that has always been considered by customers in their decision processes
3. It is nornally considered by customers in their decision processes
Qualifying factors
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4. It has a frequently better performance than its competitors
5. It has performed as competitors overall performance
6. It has performed closed to its competitors
Worst than competitors
7. Usually and lightly worst than its best competitors
8. Frequently worse than its competitors
9. Consistently worse than its competitors

Besides identifying 'action' plan areas, EPSILON performance matrix also shows order winners and qualifying factors positioning.

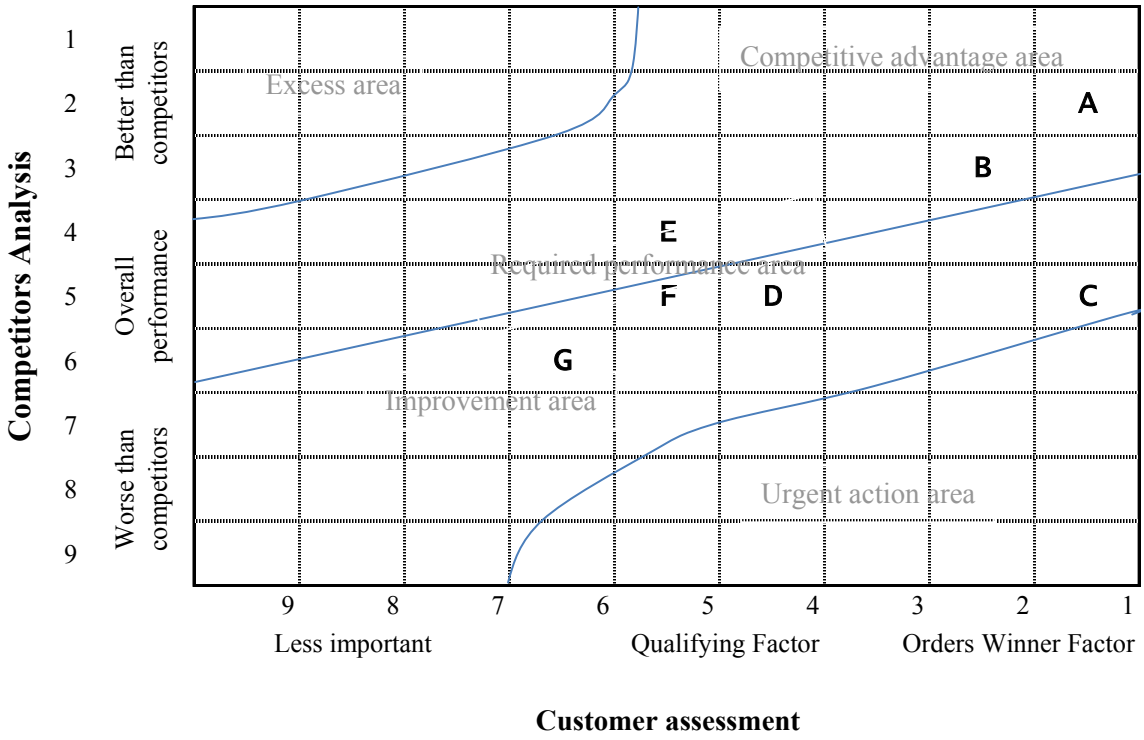

Figure 4 – EPSILON performance matrix

Presented some information about companies strategic context it could be discussed the identified PMS roles.

Results presented in Exhibit 8 show what are the most valued roles played by companies' PMS.

Exhibit 8 - PMS roles

		DELTA	EPSILON
PMS Roles	implement strategic management functionality in the strategic operations management system, providing the system with the jointly improvement of operational efficiency and overall business effectiveness.	+++	+
	be responsible for articulating strategy and monitoring business results.	+	
	produce positive change in organisational systems and processes.	+	
	develop a continuous improvement capability through implementation and management of an integrated operations strategic management system.	++	++
	produce positive change in organisational culture.		
	provide a closer understanding of market needs to create a perceived value for customers.		+++
	show how the system design requirements lead to desirable results.		
	comply with external requirements, not directly managed by organisation.		

It is important to observe that companies DELTA and EPSILON cited as the most important role to be played by their PMS, to develop a strategic management capability and to be customer oriented. Only company DELTA mention a traditional PMS role in controlling the strategic process development. Evidences show that both companies are approaching their PMS in a strategic way.

Continuous improvement is also seen as an important role to be played by PMS. The studied companies comprehend the entire process of managing through measures and uses measurement information to improve their processes and management systems.

Company DELTA also pointed out ‘change process’ management as a key area for reviewing organisations’ PMS.

Conclusion

Performance measurement system roles comprehension is a key condition 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, it is a necessary condition for organisational learning. Capabilities were identified to support measurement system design, implementation and management. Particularly, market orientation capability, continuous improvement capability and strategic management capability were highlighted.

The roles were generated by three refining previous 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 project in studying and approaching performance measurement system roles as they were confirmed in case studies reinforcing their contents and 'rank'.

The case studies show that the roles played by PMS are contingent to strategy and should be integrated to operations strategic management design recommendations.

PMS design recommendations are in constant evolution and should be reviewed based on measures use and its integrations to operations strategy process.

Roles are in fact meta design requirements that will result in functional systems specifications, that is, roles will be performed based on developed technical and organisational competences that are mobilized through systems functions and resources.

Acknowledges

Authors wish to thank Letícia Almeida and Carlos Monteiro, whose contribution and dedication give the opportunity for studying DELTA and EPSILON companies.

References

Amaratunga, D. and Baldry, D. (2002), "Moving from performance measurement to performance management", Facilities, Vol. 20 No. 5/6, pp. 217–223.

Bititci, U.S., Carrie, A.S. and McDevitt, L. (1997), "Integrated performance measurement systems: a development guide", International Journal of Operations & Production Management, Vol. 17 No. 5, pp. 522-534.

Bititci, U.S., Mendibil, K., Nudurupati, S., Garengo, P. and Turner, T. (2006), "Dynamics of performance measurement and organisational culture", International Journal of Operations and Production Management; Vol. 26 No. 12, pp. 1325-1350.

Bourne, M.C.S. (2005), "Researching performance measurement system implementation: the dynamics of success and failure", Production Planning and Control, Vol. 16 No. 2, pp.101-113.

Bourne, M.C.S., Kennerley, M.P. and Franco-Santos, M. (2005), "Managing through measures: a study of impact on performance", Journal of Manufacturing Technology Management, Vol. 16 No. 4, pp. 373-395.

Bourne, M.C.S., Mills, J.F., Bicheno, J., Hamblin, D.J., Wilcox, M., Neely, A.D. and Platts, K.W. (1999), "Performance measurement system design: testing a process approach in manufacturing companies", International Journal of Business Performance Measurement, Vol. 1 No. 2, pp. 154-170.

Bourne, M.C.S., Mills, J.F., Wilcox, M., Neely, A.D. and Platts, K.W. (2000), "Designing, implementing and updating performance measurement systems", International Journal of Operations and Production Management, Vol. 20 No. 7, pp. 754-771.

Chenhall, R.H. (2003), "Management control systems design within its organizational context: findings from contingency-based research and directions for the future", Accounting, Organisations and Society, Vol. 28 No. 2/3, pp. 127-168.

Chenhall, R.H. (2005), "Integrative strategic performance measurement systems, strategic alignment of manufacturing, learning and strategic outcomes: an exploratory study", Accounting, Organisations and Society, Vol. 30 No. 5, pp. 395-422.

Chiesa, V., Frattini, F., Lazzarotti, V. and Manzini, R. (2008), "Designing a performance measurement system for the research activities: A reference framework and an empirical study", Journal of Engineering and Technology Management, Vol. 25 No. 3, pp. 213-226.

Folan, P. and Browne, J. (2005), "A review of performance measurement: towards performance management", Computers in Industry, Vol. 56 No. 7, pp. 663–680.

Folan, P., Browne, J., Jagdev, H. (2007), "Performance: its meaning and content for today's business research", Computers in Industry, Vol. 58, No. 7, pp. 605-620

Franco-Santos, M. and Bourne, M.C.S. (2003), "Factors that play a role in managing through measures", Management Decision, Vol. 41 No. 8, pp.698-710.

Franco-Santos, M. and Bourne, M.C.S. (2005), "An examination of the literature relating to issues affecting how companies manage through measures", Production Planning and Control, Vol. 16 No. 2, pp.114-124.

Frohlich, M.T. and Dixon, J.R. (2001), "A taxonomy of manufacturing strategies revisited", Journal of Operations Management, Vol. 19 No. 5, pp. 541-558.

Ghalayini, A.M. and Noble, J.S. (1996), "The changing basis of performance measurement", International Journal of Operations and Production Management, Vol. 16 No. 8, pp. 63-80.

Gomes, C.F., Yasin, M.M. and Lisboa, J.V. (2004), "A literature review of manufacturing performance measures and measurement in an organizational context: a framework and direction for future research", Journal of Manufacturing Technology Management, Vol. 15 No. 6, pp. 511-530.

Henry, J. F. (2006), "Management control systems and strategy: a resource-based perspective", Accounting, Organizations and Society, Vol. 31 No. 6, pp. 529–558.

Hrebiniak, L.G. and Joyce, W.F. (1984), Implementing Strategy, Macmillan, New York.

Jazayeri, M. and Scapens, R. W. (2008), "The business values scorecard within BAE systems: the evolution of a performance measurement system", The British Accounting Review, Vol. 40 No. 1, pp. 48-70.

Johnston, R., Brignall, S. and Fitzgerald, L. (2002), "Good enough performance measurement: a trade-off between activity and action", Journal of the Operational Research Society, Vol. 53 No. 3, pp. 256-262.

Kaplan, R.S. (1998), "Innovation action research: creating new management theory and Practice", Journal of Management Accounting Research, Vol. 10 No. 1, pp. 89-118.

Kaplan, R.S. and Norton, D.P. (1992), "The balanced scorecard – measures that drive performance", Harvard Business Review, Vol. 70 No.1, pp. 71-79.

Kaplan, R.S. and Norton, D.P. (2001), The strategy focused organization: how balanced scorecard companies thrive in the new business environment, Harvard Business School Press, Boston.

Kennerley, M.P. and Neely, A.D. (2002), "A framework of the factors affecting the evolution of performance measurement systems", International Journal of Operations and Production Management, Vol. 22 No. 11, pp. 1222-1245.

Kennerley, M.P. and Neely, A.D. (2003), "Measuring performance in a changing business environment", International Journal of Operations and Production Management, Vol. 23 No. 2, pp. 213–229.

Ketokivi, M.A. and Schroeder, R.G. (2004), "Perceptual measures of performance: fact or fiction?", Journal of Operations Management, Vol. 22 No. 3, pp. 247-264.

Leong, G.K., Snyder, D.L. and Ward, P.T. (1990), "Research in the process and content of manufacturing strategy", OMEGA International Journal of Management Science, Vol. 18 No. 2, pp. 109-122.

Li, P., Tang, G. (2009), "Performance measurement design within its organisational context: evidence from China", Management Accounting Research, Vol. 20 No. 3, pp. 193-207.

Manoochehri, G. (1999), "Overcoming obstacles to developing effective performance measures", Work Study, Vol. 48 No. 6, pp. 223-229.

Melnyk, S.A., Stewart, D.M. and Swink, M. (2004), "Metrics and performance measurement in operations management: dealing with the metrics maze", Journal of Operations Management, Vol. 22 No. 3, pp. 209-218.

Miller, J.G., Roth, A. (1994), "A taxonomy of manufacturing strategies", Management Science, Vol. 40 No.3, pp. 285–304.

Neely, A.D. (2005), "The evolution of performance measurement research: developments in the last decade and a research agenda for the next", International Journal of Operations and Production Management, Vol. 25 No. 12, pp. 1264-1277.

Neely, A.D., Gregory, M.J. and Platts, K.W. (2005), "Performance measurement system design: a literature review and research agenda", International Journal of Operations and Production Management, Vol. 25 No. 12, pp. 1228-1263.

Neely, A.D., Mills, J.F., Platts, K.W., Richards, H., Gregory, M.J., Bourne, M.C.S. and Kennerley, M.P. (2000), "Performance measurement system design: developing and testing a process-based approach", International Journal of Operations and Production Management, Vol. 20 No. 10, pp. 1119-1145.

Nilsson, F. and Olve, N.G. (2001), "Control systems in multibusiness companies: from performance management to strategic management", European Management Journal, Vol. 19 No. 4, pp. 344-358.

Olsen, E.O., Zhou, H., Lee, D.M.S., Ng, Y., Chong, C.C. and Padunchwit, P. (2007), "Performance measurement system and relationships with performance results: a case analysis of a continuous improvement approach to PMS design", International Journal of Productivity and Performance Management, Vol. 56 No. 7, pp. 559-582.

Pilkington, A. and Fitzgerald, R. (2006), "Operations management themes, concepts and relationships: a forward retrospective of IJOPM", International Journal of Operations & Production Management, Vol. 26 No. 11, pp. 1255-1275.

Pinheiro de Lima, E., Gouvêa da Costa, S.E. and Angelis, J.J. (2008), "The strategic management of operations system performance", International Journal of Business Performance Management, Vol. 10 No. 1, pp. 108-132.

Pinheiro de Lima, E., Gouvêa da Costa, S.E. and Reis de Faria, A. (2009), "Taking operations strategy into practice: developing a process for defining priorities and performance measures", International Journal of Production Economics, Vol. 122 No. 1, pp. 403-418.

Pinheiro de Lima, E., Gouvêa da Costa, S.E., Angelis, J.J., and Garbuio, P.A.R., (2009b), "A consensual analysis about strategic performance measurement systems roles," Proceedings of the 20th International Conference on Production Research, August 2-6, Shanghai, China, 1-6.

Pinheiro de Lima, E., Gouvêa da Costa, S.E., Angelis, J.J., and Pepino, S., (2009a), "Reassessing performance measurement systems roles," Proceedings of the 16th International EurOMA Conference, June 14-17, Gothenburg, Sweden, 1-10.

Platts, K.W. (1995), "Integrated manufacturing: a strategic approach", Integrated Manufacturing Systems, Vol. 6 No. 3, 1995, pp. 18-23.

Porter, M.E. (1985), Competitive advantage: creating and sustaining superior performance. The Free Press, New York.

Radnor, Z. J. and Barnes, D. (2007), "Historical analysis of performance measurement and management in operations management", International Journal of Productivity and Performance Management, Vol. 56 No. 5/6, pp. 384-396.

Simons, R. (1991), "Strategic orientation and top management attention to control systems", Strategic Management Journal, Vol. 12 No.1, pp. 49-62.

Slack, N. (1987), “The flexibility of manufacturing systems”, International Journal of Operations and Production Management, Vol. 7 No. 4, pp. 35-45.

Slack, N. (2000), “Flexibility, trade-offs and learning in manufacturing system design”, International Journal of Manufacturing Technology and Management, Vol. 1 No. 4/5, pp. 331-348.

Taticchi, P. and Balachandran, K.R. (2008), “Forward performance measurement and management integrated frameworks”, International Journal of Accounting and Information Management, Vol. 16 No. 2, pp. 140-154.

van Veen-Dirks, P. (2005), “Management control and the production environment: A review”, International Journal of Production Economics, Vol. 93-94, pp. 263-272.

Verbeeten, F.H.M. and Boons, A.N.A.M. (2009), “Strategic priorities, performance measures and performance: an empirical analysis in Dutch firms”, European Management Journal, Vol. 27 No. 2, pp. 113-128.