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Operations performance measurement systems roles

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Abstract

A new competitive arena for enterprises' strategy development is evolving, forcing them to redesign their management systems. Particularly, organisations are focusing on performance measurement systems revision. The present research is based on case studies that are used to investigate performance measurement system uses. Companies were selected based on their experience in performance measurement and cover manufacturing and service operations. Results confirmed the traditional use of measurement systems, but they also pointed out a proactive use for measurement systems. Conclusions show an expanded set of performance measurement system roles that are used to challenge the established operations management structures and processes.

Keywords
Performance measurement, operations strategy, strategic management

1. Introduction
New socioeconomic and organisational models are emerging and forcing enterprises to reorient their strategies, operations systems and processes. Changing processes' dynamic and complexity are influencing the way operations management systems are designed. Special attention is being given to strategic management and performance measurement issues [1-4].

Performance Measurement System (PMS) roles comprehension is crucial for operations strategic management system redesign. Roles dialectics played by performance measurement systems, acting as medium for operations strategy realization or as enabler for strategic management system redesign, is a key foundation for organisational learning and defines the main context of this paper [5-10]. In order to identify performance measurement system roles, prior to this research a literature review was conducted and contribute for generating a initial list of roles and functions. This theoretical construction was used to prepare a semi-structured interview protocol applied to 20 experts. Eleven academics in the fields of performance management, operations strategy, production planning and control and supply chain management, and nine operations managers of manufacturing and services companies were interviewed and also participated in a Delphi experiment. The final consensual list of PMS roles is used in this paper for structuring a case study protocol.

The presented research is exploratory by nature, related to performance measurement system roles identification. The research process is based on case studies applied to three manufacturing and to three engineering service companies. The main research purpose is to understand and to identify what are the roles that a performance

measurement system could perform. These roles lead to strategic management system functions identification, which define the scope of operations management system design recommendations.

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, six case studies were developed. Case studies were used to identify the three most relevant roles that the studied PMS is performing.

2. Performance measurement

Information generated by strategic performance management systems could be used to produce a positive change in organisational culture, systems and processes. Organisations performance are related to several activities that are carried out by their systems and processes as: agreement upon performance goals are developed; allocation and definition of resources priorities are discussed; information is disseminated to managers for reviewing or maintaining current strategic policies or plans; and performance results are shared in the task of pursuing strategic goals [11]. Implicitly to these observations, a role for performance measurement subsystem is identified as part of strategic performance management system content definitions. The performance measurement system is responsible for strategy implementation management process. The strategic management system should be able to follow and 'control' the strategy implementation process.

In performance measurement initiatives, there is a consensus that the initial building blocks for designing the measurement system are performance measurement system recommendations. These recommendations define measures contents and structures that could be integrated to a conceptual framework, in order to inform the performance measurement system design [9].

The measurement system main purpose is essentially defined by measures 'utility', which is embedded in measures content and structure. Measures will be selected by their utility and alignment to organisations' strategy and the process of selecting measures is a focal point in measurement system design. Conceptual framework for measures selection process could be based on manufacturing or service operations competitive dimensions as those dimensions are customised and refined for that purpose. Performance dimensions categories are organized taking into account competitive patterns as price (cost/operational efficiency), quality (process and product), time (dependability and agility), flexibility (process and product) and innovation (process and product) [12-14].

Having defined the performance measurement system recommendations requirements, functionalities related to this system could be identified next. Globerson's [15] performance criteria define system functionalities as: strategic orientation as performance criteria are chosen from the organization's objectives; evaluating if organizational unit has control over performance criteria; and the performance criteria definition should be a result of involved actors participative interaction (e.g. customers, suppliers, employees, managers). It could be identified a strategic function, as performance design criteria follow organisation objectives. Otherwise, from management definitions, which state that the system should have a participative conception process and also have 'control' over the evaluated organisational unit, a strategic management function can be also identified.

Relevant principles for performance measurement systems design are also developed by Maskell [16], which highlight the following characteristics: the changing nature in measurement initiatives; measures should be conceived as part of a fast feedback management systems; and measures should be designed for stimulating continuous improvement capability rather than simply monitor operations strategy. Although a strategic management function is identified in the implementation of performance measurements, a specific role could be related to continuous improvement capability development.

Blenkinsop and Davis [17] identify properties that PMS systems should have, especially, when those are related to organisational integration and differentiation. These properties cover horizontal and vertical dimensions of organisational structure. They also emphasise the importance of covering long, medium and short term perspectives. It could be used for that purpose an organisation life cycle model, as performance measurement system are being designed and renewed.

Gomes et al. [18] identify several characteristics of performance measurement systems that are summarized as follows: measures should embrace relevant non-financial information based on strategic business objectives [19];

measurement systems should be implemented to deploy strategy and monitor business results [20]; measurement systems should be based on organisational objectives, key success factors, and have customer orientation. One of the main tasks should be monitoring both financial and non-financial aspects of business results [21]; performance measurement system should dynamically follow strategy [22]; PMS should accomplish specific requirements of day to day operations, be long term oriented, and be simple for understanding and implementing [23]; measurement systems should be linked to reward systems [24]; and financial and non-financial measures set should be coherent and consistent to a strategic framework [25, 26].

It could be identified in Gomes *et al*. [18] synthesis that there is a changing nature in PMS (re)design and management. The system should be integrated to business strategy monitoring its financial and non-financial aspects. PMS is an integrative management system that interrelates business performance dimensions to action plans.

Previous research works synthesized a list of PMS roles, based on a set of experts interviews and a Delphi experiment. Table 1 shows a list that will be used in this paper as a reference for case study protocol design [27-30].

Table 2: PMS roles

Performance measurement systems could…		ID	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.	PR1	Strategic management function
	be responsible for articulating strategy and monitoring business results.	PR2	Strategy realization through organisation's results monitoring
	produce positive change in organisational systems and processes.	PR3	Strategic performance management system definition – information flow
	develop a continuous improvement capability through implementation and management of an integrated operations strategic management system.	PR4	Continuous improvement capability development
	produce positive change in organisational culture.	PR5	Strategic performance management system definition – internal environment
	provide a closer understanding of market needs to create a perceived value for customers.	PR6	Customer driven strategy
	show how the system design requirements lead to desirable results.	PR7	Systemic design approach
	comply with external requirements, not directly managed by organisation.	PR8	Contingency view

It is and ordered list of PMS roles, showing PR1 as the most relevant role for academic and professional experts. The roles could be classified in strategic or systemic and functional aspects. It is important to observe that a performance measurement design is contingent to its environment, and the roles should follow this assumption creating a coherent set of design propositions.

The performance measurement system roles resulting list is used this paper as input for a case studied based. The case study protocol is guided by the identified roles and it is conceived to test the adherence of the proposed roles versus companies' performed ones. Roles could be seen as 'meta' design requirements that could be materialized by systemic capabilities and finally resulting in functional systems specifications.

3. 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. Initially, it is important to formalize some key information about operations strategy, performance measures and PMS processes. First, it is created a strategic context and then PMS roles could be

assessed. This is the main guideline of the case study protocol development. Table 2 shows the proposed procedures for case studies implementation.

Table 2: Case study protocol

Research Protocol				
Main Goal	To study production systems' performance measurements use			
Specific Goals	**Steps**	**Research Technique**	**Operational Procedures**	**Results/Outputs**
SG 0: Research Group				
To classify company operation	To classify enterprise in terms of industry, size, organisational model, production	Interview ITW0	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.	Executive Meeting	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.	Workshop WSH 1	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.	Workshop WSH 1	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 [31].	Performance dimensions assessment regarding customer demands and competitors performance benchmarking.
	To synthesize all the gathered performance information in a performance matrix.	Workshop WSH 1	In a group meeting plot the results of performance assessment in Slack's [31] 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.	Workshop WSH 2	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*. [32]	Interview ITW1	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.	Interview ITW2	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).	Workshop WSH 3	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.	Workshop WSH 3	To related the selected performance measures to a set of predefined performance measurement system roles.	List of performance measurement system played roles

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

4. Companies' PMS roles

The case study protocol was applied to six companies, and company ALPHA was used as a pilot. Companies were chosen by their experience and PMS maturity level in management through measures.

ALPHA is a medium size business unit of a large company in the automotive industry, that is, an auto parts supplier. Its operations management system is based on lean production techniques. The operations management system is formally integrated to the company business planning through a 'Hoshin Kanri' framework.

BETA is a medium size company in the package industry, particularly producing solutions for the household appliance manufacturers. Its manufacturing management system is based on and ERP information system that integrates the whole factory and administrative systems.

GAMMA is a small production business unit of a public company, responsible for ID manufacturing. Its production management system is essentially base on productivity factors that are integrated to an annual strategic planning system.

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.

ZETA is a small engineering service company that designs, integrates and manages automated management systems for gas stations. Its operations are managed through a customized project management system.
The results presented in Table 3 show what are the most valued roles played by companies' PMS.

Table 3: PMS roles

		ALPHA	BETA	GAMMA	DELTA	EPSILON	ZETA
Performance Measurement System Roles	PR1	+++	++	+	+++	+	
	PR2	++			+		+++
	PR3				+		
	PR4		+	+++	++	++	++
	PR5		+++	++			
	PR6	+	+			+++	
	PR7			+			+
	PR8						

It is important to observe that traditional PR2 and PR7 are cited and played by companies, however great attention is being given by companies to strategic management, customer needs, cultural issues and continuous improvement. 'Change process' management would be a key area for reviewing companies' PMS.

5. Conclusion

Performance measurement system roles comprehension 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 organisational learning. Capabilities were identified to support measurement system design, implementation and management. Particularly, organisational learning 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 in studying and approaching performance measurement system roles and 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.

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.

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