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Researching performance measurement systems

An information systems perspective

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Abstract

Purpose – This paper aims to clarify the notions that underlie performance measurement systems (PMS) and to propose an information systems (IS)-based characterisation and definition of PMS, that is, as a performance management information system (PMIS).

Design/methodology/approach – Research on PMS can be enhanced by a clear, precise and uniform characterisation of this research object in IS terms A classification scheme is developed and the contribution areas of an IS perspective to PMS research are presented and exemplified.

Findings – The knowledge developed in IS research in the form of IS theories, models and methods can be applied in research on PMS, particularly in empirical studies that analyse the individual and organisational behaviours associated with the PMS phenomenon.

Research limitations/implications – The conceptualisation and definition of PMS, as found in the literature, have not truly reflected their basic nature and characterisation as IS.

Practical implications – The research benefits of an IS-based approach are illustrated through a PMS usage model founded on IS theory. In so doing, a contribution is made to the PMS research field by reinforcing its theoretical and empirical foundations.

Originality/value – This study proposes a novel and demonstrably useful IS-based perspective, including an improved conceptualization and definition of PMS.

Keywords Performance management systems, Information systems, Organizational performance, Performance measures

Paper type Conceptual paper

Introduction

In the new global economy, many business enterprises must achieve "world-class" status (Cagliano and Spina, 2002), that is, a level of excellence such that they can compete on a world-wide basis. Performance measurement systems (PMS), such as Kaplan and Norton's (1992, 1996a) Balanced Scorecard, focus on organisational performance and, although the impacts of these systems on organisational performance is a much debated question (Townley *et al.*, 2003), they may be considered as a means of reaching performance objectives, thus the interest in these systems and their use. Considering their support role in both tactical and strategic decision making (Kueng *et al.*, 2001), PMS are designed for executives (although not exclusively), and thus have an executive information system (EIS) component (Turban *et al.*, 2002, 2007). PMS can be used collectively by the managers of the organisation

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(Kaplan and Norton, 1996b; Lorino, 2001; Fernandez, 2005). As internal systems, they have either been acquired as packaged software or developed for the specific needs of the firm (Kueng, 2000; Sharif, 2002). As external systems, they are accessible in the form of external diagnostic tools (Cagliano *et al.*, 2001; Delisle and St-Pierre, 2006), with or without a benchmarking function, and are used on an *ad hoc* and discretionary basis.

Since the early 1990s, a number of researchers have shown interest in PMS that support organisational and managerial development in both large and small business enterprises (Bourne *et al.*, 2000; Garengo *et al.*, 2005), and in public or government organisations (Ho and Chan, 2002). However, there has been an evolution in the conceptualisation and definition of these systems since they first appeared as objects of management research. In conjunction with the evolution of information technologies, including web-based technologies, PMS can be enriched with new system functionalities that allow them to move beyond simple measurement by providing more extensive and customised support for decision making in the firm. Through this enrichment, PMS now play a more important role in the organisation, extending beyond control toward support for continuous improvement and managerial development (Sinclair and Zairi, 2000).

In light of this evolution, there is a need for a renewed conceptualisation and better definition of PMS as a research object, in terms of their essential characterisation as information systems (IS), if one wishes to study these systems, and understand in particular the individual and organisational behaviours associated with PMS usage and management practices. In this regard, the conceptualisations and definitions of PMS in the literature require more precision and completeness. For instance, a definition wherein a PMS "is a balanced and dynamic system that is able to support the decision-making process by gathering, elaborating and analysing information" (Neely *et al.*, 2002) does not sufficiently specify the unique characteristics of such systems that distinguish them from other types of management decision-support systems.

Mainly, originating in management accounting and operations management studies (Neely *et al.*, 1995; de Toni and Tonchia, 2001), the PMS research domain to-date has developed outside the IS research field. A few researchers have attempted to establish links between IS and PMS (Bititci *et al.*, 1997a; Kueng *et al.*, 2001), but these attempts have been isolated. References to IS research are thus rare in PMS studies and, as defined presently in the PMS literature, these systems are not present in the mainstream of IS knowledge. While seemingly related systems such as EIS have been the object of past IS research (Bergeron *et al.*, 1995), these systems have evolved differently and thus cannot be assimilated to PMS.

In their recent literature review, Franco-Santos *et al.* (2007, p. 799) counted no less than 17 definitions of business PMS, underlining that a no-consensus situation on PMS definition can "inhibit the development of the field". Research is more problematic when the basic concepts and definitions that underlie a research object lack clarity, precision, and uniformity. Accumulating and integrating research results into a coherent body of knowledge is more difficult, as the lack of a common language renders studies less comparable. Conceptual and definitional imprecision also makes it more difficult to import knowledge from other disciplines or fields, knowledge that could provide a deeper understanding of the phenomena under study. For instance, the study of individual and organisational behaviours related to PMS usage could

greatly benefit from applying the theories and models developed and validated in the IS field.

This paper aims to clarify the notions that underlie PMS and to propose an IS-based characterisation of PMS. First, these notions and their evolution will be presented. Second, from an IS perspective for characterising PMS, a definition of PMS as a performance management information system (PMIS) will be enunciated, and a classification scheme developed for PMIS. Third, the contribution areas of an IS perspective to PMS research will be presented and exemplified. An illustration of the research benefits of such an approach is then provided with the help of a PMS usage model founded on IS theory and developed from previously validated IS models. The paper concludes with its contributions to PMS research.

Notion and evolution of PMS

A number of parallel developments have led to the notion of a (information) system that measures the performance of business enterprises in a multi-dimensional manner, that is, not solely through financial statements. In the 1980s, among other developments, the activity-based costing (ABC) and activity-based management (ABM) approaches extended the firm's performance logic beyond the purely financial by highlighting the cause-effect relationships that could explain the performance of the firm's operations and production function, thus using financial and other types of measures. The phrase "performance measurement system", although already present in management literature (Ridgway, 1956, p. 240: "system of performance measurement"), began to appear more frequently in the early 1990s, mainly in the fields of management accounting and operations management, and was marked by Neely *et al.*'s (1995) founding review of the PMS literature. In the same decade, this expression also started to appear more often in professional publications, targeting the management accounting profession, among others (e.g. CMA, 1999).

The basic notions that underlie PMS have also evolved over time to arrive at the present ways in which these systems are conceptualised, designed, and implemented in organisations. These notions include:

- the focus of PMS, namely the notion of performance itself and its dimensions;
- the performance logic that guides the design of PMS (architecture and performance measurement framework); and
- the system characteristics of PMS (definition, organisational role and information output).

As presented in Table I, these notions evolved notably in the early 1990s. As one observes the four-period temporal scale used (before 1980, 1980-1989, 1990-1999, 2000 and after), PMS notions seem more evident as such in the literature after 1990. The first observable activities were those that defined measurement approaches; one then saw the development of measurement frameworks that were proposed to practitioners.

Before 1980, the situation was generally the following: unidimensionality of performance, essentially financial, focusing on results (retrospective management). Measurement frameworks were thus rather limited to the financial aspects of performance, as traditionally exemplified by the use of financial ratios such as return-on-assets and earnings-per-share. In the 1980s, performance was still envisioned as essentially financial in most organisations, but new measures of operations/

Table I.
Evolution of PMS notions

Notions	Before 1980	1980-1989	1990-1999	2000 and after
Focus				
Definition of performance	Essentially financial performance	Operational performance extended beyond costs (ABC, and ABM)	Performance defined in relation to strategic objectives; in relation to stakeholder expectations	Performance defined as increasing the value/cost ratio in relation to society's expectations (multiple stakeholders) and the firm's strategic objectives
Dimensions of performance		Operational aspects of performance	Diversity of aspects: performance of the manufacturing strategy (costs-productivity, production cycle, flexibility, quality). Financial performance Managerial performance (employees, clients, innovation, processes, learning, knowledge management, etc.)	Extension to the long term and the social aspect
Performance logic				
Architecture	Vertical	Vertical and somewhat horizontal	Vertical, horizontal, balanced (with both vertical and horizontal integration)	
Performance measurement frameworks[a]	Du Pont Pyramid of financial ratios (1903-1910)	Performance measurement matrix (1989)	Results and determinants framework (1991), Performance pyramid (1991), business excellence model (1992), process-oriented framework, (1996), Balanced Scorecard (1992, 1996), integrated performance measurement system (1997)	Performance Prism (2002)
System characteristics				
PMS definition			"set of metrics used to quantify both the efficiency and effectiveness of actions" (Neely *et al.*, 1995) Information system "at the heart of the performance management process" [. . .] "which enables the closed loop deployment and feedback systems" [. . .] (and) "which should integrate all relevant information from relevant systems" (Bititci *et al.*, 1997a; Kueng *et al.*, 2001)	

(*continued*)

Table I.

Notions	Before 1980	1980-1989	1990-1999	2000 and after
				"a balanced and dynamic system that is able to support the decision-making process by gathering, elaborating and analysing information" (Neely *et al.*, 2002; Garengo *et al.*, 2005)
Organisational role			Support for decision making, continuous improvement, strategy diffusion and development, operations-strategy alignment, managerial development	
Information output		Quantitative, operational, internal, short-term value, result oriented	Balanced: quantitative-qualitative, results-determinants, operational-strategic, internal-external, short- and long-term value	

Notes: [a]Performance measurement matrix (Keegan *et al.*, 1989); results and determinants framework (Fitzgerald *et al.*, 1991); performance pyramid (Lynch and Cross, 1991); business excellence model (European Foundation for Quality Management, 1992); Process-oriented framework (Brown, 1996); Balanced Scorecard (Kaplan and Norton, 1992, 1996b); integrated performance measurement system (Bititci *et al.*, 1997b); performance prism (Neely *et al.*, 2002)

production performance appeared, extending beyond costs (e.g. ABC and ABM). Information output was essentially quantitative, operational in nature, internal, of short-term value, and focused on results, but began to present cause-effect linkages (e.g. cost drivers in ABC) that provided a prospective view of operations and production management. This led some to propose operational performance measurement models that took into account the firm's strategic objectives, such as Keegan *et al.*'s (1989) Performance Measurement Matrix or models focused on quality, customer satisfaction, time reduction, and cost reduction. With the 1990s, systems became more integrated in functional (hierarchically) and inter-functional (across business functions) terms (Neely *et al.*, 2000). Also, in line with Skinner's (1974) early work, a pre-occupation with strategic alignment became more apparent, notably with Kaplan and Norton's (1992) Balanced Scorecard.

PMS focus: the notion of performance

A consensus on the definition of organisational performance is yet to be achieved. As identified by authors such as Quinn and Rohrbaugh (1983) and Tangen (2004), there are two dominant perspectives, one being objective/economic/rational (productivity, efficiency, profitability, competitiveness, etc.), the other being subjective/political/systemic (coherence, value of human resources, satisfaction of stakeholders, adaptability, etc.). All agree however that defining organisational performance constitutes a complex problem (de La Villarmois, 2001). Strategic management research has put forth two perspectives, one that is outward oriented and focuses on the attainment by the firm of a favourable competitive position in the market (Porter, 1991; Teece *et al.*, 1997), and another that is inward oriented and focuses on the contribution of the firm's unique resources and competencies (Penrose, 1959; Barney, 1991). Performance would be achieved by firms that adopt both perspectives in a complementary fashion without compromising their financial health (Raymond and St-Pierre, 2007). The definition of organisational performance used within the PMS literature reflects this diversity in terms of the number of performance dimensions to be covered by these systems.

Definition of performance. In the early 1990s, given that the definition of performance is founded on the firm's strategic objectives (Kaplan and Norton, 1996b), performance is also starting to be viewed from another perspective, that is, taking into account not only the interests and expectancies of owners and stockholders but also of other concerned entities such as customers, employees, suppliers, and government (Bititci *et al.*, 1997b). This stakeholder orientation is further extended to other important stakeholders, such as society and future generations (Neely *et al.*, 2002). For instance, Lorino (2001) defines performance as a notion relative to the value/cost ratio, where value is a judgement made by society on the utility of the firm's products/services in response to society's needs, and where cost is a monetary measure of the resources consumed. This focus on stakeholders even overtakes the focus on strategy, as is the case for Neely *et al.*'s (2002) Performance Prism.

Dimensions of performance. The dimensions of performance measured were initially mainly financial (profitability, liquidity, and financial health), then more balanced with an operational perspective (e.g. costs, responsiveness, quality, productivity and flexibility). Neely *et al.*'s (2002) definition of a PMS states that a PMS is a "balanced" system. Following their review of the literature, Garengo *et al.* (2005) confirm that a PMS

must have the capacity to evaluate the organisation in its entirety and to integrate all functions/dimensions in balance with the importance given to each (in view of the firm's strategic objectives). Sinclair and Zairi (2000) add that balance means including external benchmarks in addition to internal measures. Consequently, a PMS must necessarily include various types of indicators, managed in a co-ordinated way. Multidimensional, balanced or integrated models of performance measurement are developed from such a holistic perspective.

Performance logic. The firm's performance logic is a notion that refers to the set of cause-effect relationships, by which organisational determinants (e.g. management practices) produce certain results in the form of increased or decreased performance (Lorino, 2001). Causal paths of performance thus inter-relate these determinants and results. For instance, certain human resource management practices should produce a "motivated employee" result which, in conjunction with other determinants, should produce a "product quality" result, which in turn should produce a "customer satisfaction" result. Initially, these causal paths are specific to each firm, and refer to a state of ideal equilibrium also specific to each firm (Drucker, 1954; Ridgway, 1956).

To simplify the task of modelling the firm's performance logic, performance measurement frameworks were proposed by a number of researchers. The generic frameworks of performance logic that appeared in the late 1980s present various architectural forms, i.e. vertical forms (e.g. organisational functions and levels), horizontal forms (e.g. intra- and inter-organisational processes) and balanced forms, the latter integrating both vertical and horizontal logics. Each of these frameworks adopts a specific management perspective such as process-based management (Neely *et al.*, 2000) and stakeholder-based management (Neely *et al.*, 2002). Thus, constituting the conceptual foundation of a PMS, a performance measurement framework also constitutes its procedural component along with other components, namely people, data, and software (Kueng *et al.*, 2001). To this effect, the necessity for PMS to refer to an enterprise model is underlined (Rolstadas, 1998; de Toni and Tonchia, 2001).

The performance measurement frameworks that have been proposed have evolved from being uni- to multi-dimensional (e.g. Fitzgerald *et al.*'s (1991), results and determinants framework), from a vertical-hierarchical structure to an horizontal process-based structure (e.g. Brown's (1996), processes-oriented framework), and from being based on lagging measures to also include leading measures (e.g. European Foundation for Quality Management's (1992) business excellence model) (Neely *et al.*, 2000). Later on, frameworks based on a multiple-stakeholder perspective of performance have appeared (e.g. Bititci *et al.*'s (1997b), integrated PMS). As actually applied in organisations however, Kaplan and Norton's (1992, 1996a) Balanced Scorecard is the best-known framework and is the conceptual basis for numerous PMS that have been the object of empirical research (Mavrinac and Vitale, 1998; Bourne *et al.*, 2000).

System characteristics of PMS

In parallel to the previously described conceptual evolution of PMS, there has also been an extension in the meaning given to these systems in terms of their role in the organisation. From being merely performance "measurement" tools, some see PMS as becoming performance "management" tools (Kaplan and Norton, 1996b; Sharif, 2002).

Made possible by advances in information technology (IT) such as data-warehousing, data-mining, expert systems and other artificial intelligence technologies, and web-based technologies and services, this evolving role for PMS is explained by the need for more integrated management information in a globalised business environment where decision making requires reliable and complete information that is rapidly and easily accessed. The initial data capturing-processing-communicating functionalities of PMS are thus enriched to include added tasks such as evaluation/diagnostic, and recommendation of action plans (Kueng *et al.*, 2001; Sharif, 2002; Garengo *et al.*, 2005). Thus, while not necessarily IT-based at the outset, PMS, as with any information system, can achieve enhanced efficiency and effectiveness by using IT (Bititci *et al.*, 1997a).

PMS definition. Following their review of the PMS literature, Neely *et al.* (1995, p. 110) defined a PMS as "the set of metrics used to quantify both the efficiency and effectiveness of actions". A later definition, given by Bititci *et al.* (1997a) and adapted by Kueng *et al.* (2001, p. 5), extended the meaning of PMS by defining them as IS and support of performance management:

> At the heart of the performance management process (i.e. the process by which the company manages its performance), there is an information system which enables the closed loop deployment and feedback system. *This information system is the performance measurement system* which should integrate all relevant information from relevant systems.

Thus, are attributed to PMS the basic IS tasks of gathering, storing and processing performance-relevant data, and disseminating performance-relevant information. Using advanced IT, these systems can also help in defining performance indicators, in analysing performance-relevant information, in generating possible actions, and in prioritising alternatives (Kueng *et al.*, 2001). PMS can also be integrated with other organisational systems such as accounting IS and enterprise systems (de Toni and Tonchia, 2001; Sharif, 2002).

Organisational role of PMS. A PMS is essentially meant to support managers in their decision making. While a control role was initially given to these systems, later emphasis was placed on their contribution to the continuous improvement of performance (Neely *et al.*, 1995), to the definition, deployment and diffusion of strategy (Kaplan and Norton, 1996b), to the alignment of operations with strategic objectives, to managerial development (Garengo *et al.*, 2005), and to organisational learning (Kueng *et al.*, 2001). de Toni and Tonchia (2001) add that a PMS can support activities management, human resource management, and competitive benchmarking. Summarising, Kueng *et al.* (2001, p. 6) consider a PMS to have the following roles:

> [...] tracks the performance of an organisation, supports company internal and external communication regarding performance, helps managers by supporting both tactical and strategic decision-making, captures knowledge in a company, and facilitates organisational learning.

There is thus a "dynamic" aspect to the role of PMS in their capacity to monitor the firm's internal and external contexts on a continuous basis and to integrate and to help in revising strategic objectives and priorities (Garengo *et al.*, 2005).

Information output. The firm's performance logic must be reflected to managers in the information provided to them by the PMS through performance indicators. These indicators are meant to give a balanced view of performance, i.e. quantitative/

qualitative, results/determinants, operational/strategic, internal/external, retrospective/prospective, short- /long-term values (Lorino, 2001). The use of these indicators is facilitated through their aggregation (by performance dimension, by strategic business unit, etc.) and their integration within the performance management model (Fernandez, 2005).

An IS perspective for characterising PMS

Whatever the perspective from which it is approached, be it management accounting, operations management or IS, the study of PMS requires an empirical circumscription of their configuration in organisations. In studying their use for instance, it is necessary to identify the characteristics by which PMS present themselves to users. One can surmise that characterising PMS by the role they play in organisations (e.g. operational and/or strategic control, coordination), while necessary, is not sufficient. For instance, both a costing system and a production system can provide information through performance indicators and thus be viewed as a PMS, whereas one can reasonably expect the antecedents and consequences of system use to be quite different in each case.

Of the previously cited definitions, none is precise enough for the purpose of studying the individual and organisational behaviours associated with the use and management of these systems. Previous definitions are also insufficient for an information artefact whose practice in organisations one wants to understand and eventually improve. In empirical studies, there is a problem of specifying research variables when the object of whom the usage is studied has not been previously characterised in its essential dimensions (Alter, 2006). Thus, there is a need for ways of characterising these artefacts in terms of information output (scope, form and quality) and socio-technical attributes (user-friendliness, accessibility and security).

The IS perspective gives access to knowledge and ways that can be useful in researching PMS. Given that the IS discipline has developed theories, models and methods for characterising and researching information artefacts in organisations, it thus provides theoretical, empirical and methodological bases for the study of PMS, including systems development, use and evaluation.

Convergence of measurement and information artefacts

While certain efforts have been made to position PMS in relation to IS in general (Bititci *et al.*, 1997a; Kueng, 2000; Kueng *et al.*, 2001), to the best of our knowledge, there has been as-of-yet no attempt to study PMS on the basis of their characterisation as IS.

In the IS field, there is at the outset a type of information system that would bear some resemblance to PMS, namely EIS, also known as executive support systems. Destined for executive users, these systems support strategic management and decision making (Turban *et al.*, 2002), having been the object of empirical research since the early 1980s (Watson *et al.*, 1991; Bergeron *et al.*, 1995). While PMS have a number of points in common with EIS, the PMS literature reviewed here makes no reference to these studies and to the knowledge garnered from them. Yet, one would think that the theories, models and methods developed to study EIS could also be applied to PMS. Hence, a first step in circumscribing PMS from an IS perspective consists in distinguishing them from EIS. As presented in Table II, the two types of

Characteristic		EIS (1980-1999)	PMS (1990 and after)
User		Top-managers at first, then extends to all managers	Top-managers, but all decision-makers engaged in performance management can also be users
Focus	Management level	Critical success factors Survival and success	Multidimensional performance, defined in relation to strategy and important stakeholder expectations
	Scope: dimensions of performance	Mostly intra-organisational; various functions and processes No specific consideration of stakeholders The balanced view is not an objective of the system	Holistic and balanced view of the organisation: all dimensions, functions, critical processes and activities of the organisation Includes data/information from important multiple stakeholders and competitors
Architecture		Vertical	Horizontal (processes and projects) Vertical (functions) Balanced (horizontal and vertical
Alignment		Not necessary aligned on the performance logic of the organisation	Ideally aligned on the performance logic of the organisation (embodied in a performance measurement framework)
Function	Expected organisational role	To support executive work	To support decision making, continuous improvement, strategy diffusion and development, and alignment of operations with strategy To promote managerial development For benchmarking purposes
	Information output: form	Key performance indicators related to critical success factors	Balanced performance indicators
	Information output: nature	Quantitative, emphasis on results, operational and strategic, mostly internal	Balanced: quantitative and qualitative, performance results and determinants, operational and strategic, internal and external, short- and long-term value

Table II.
PMS compared to EIS

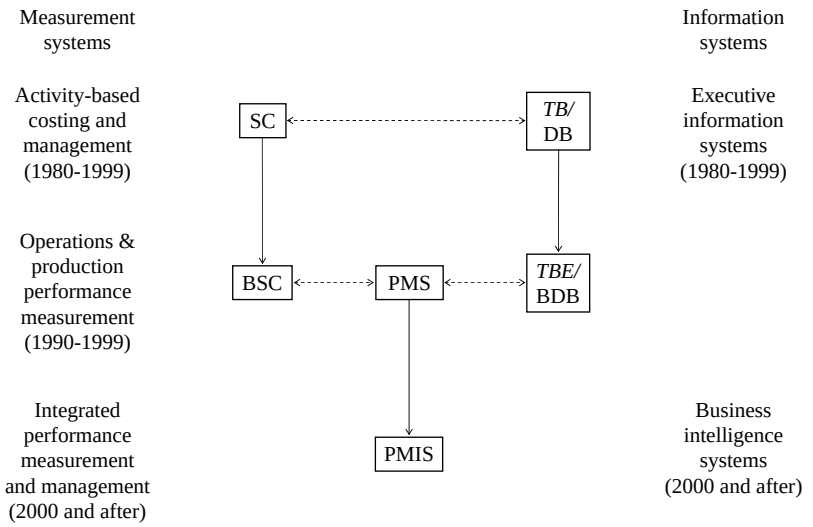
systems are compared on the basis of five characteristics that are meant to clearly and fully describe them as both IS and information artefacts, namely the systems' user, focus, architecture, alignment, and function.

From this table, one can clearly see that PMS differ from EIS in many important aspects. First, a PMS focuses on performance from a richer multi-dimensional perspective that goes far beyond the EIS focus on critical success factors in reflecting the organisation's performance logic and the various performance stakeholders such as employees and customers. Second, a PMS is conceptually based on a performance measurement framework that is ideally aligned with the firm's business model and performance information needs, whereas this notion of "strategic alignment", crucial in explaining the performance outcomes of IS (Chan and Horner Reich, 2007), is not as evident in the conceptualisation of EIS. Third, PMS are intrinsically more dynamic and

evolutionary in order to maintain their alignment, their balance, and their relevance as the internal and external environments change, and new strategic management priorities emerge.

Comparing PMS with EIS has one drawback however, in that PMS really emerged in the 1990s, ten years after EIS, and thus benefited from greater advances in IT. In fact, PMS are presently still benefiting from IT-related developments, whereas this cannot be said with the same certainty for EIS as these systems have more or less fallen out of favour, in both research and practice since the late 1990s, and have evolved toward forms that are likened today to "business intelligence systems" (Turban *et al.*, 2002). One could in fact say that EIS, as well as management accounting systems and operations management systems are the predecessors of PMS within the greater business intelligence family that tends to integrate all IS in the organisation and make their information accessible to executives in answer to their personal needs. It is important to note that researchers have followed organisational practices in this regard, with studies of EIS seemingly ceasing (in the IS field) in the late 1990s, at the time when research on PMS was noticeably emerging.

In terms of the actual tools used to manage performance in organisations, the evolution of the notion of "dashboard", "tableau de bord" in French, further illustrates EIS and PMS developments, as shown in Figure 1. This notion, used in the French management literature in the last 50 years, represents a succinct information presentation mode, based on the "cockpit" metaphor (Georges, 2002), where indicators are immediately captured through ergonomically designed graphics (Epstein and Manzoni, 1998). This presentation mode makes it easier to understand the cause-effect



SC: Scorecard BSC: Balanced Scorecard
TB: Tableau de Bord DB: Dashboard *TBE: Tableau de Bord Équilibré* BDB: Balanced Dashboard
PMS: Performance Measurement System PMIS: Performance Management Information System

Figure 1.
Convergence of measurement and information artefacts

relationships between the performance of actions and the performance of processes. A dashboard provides executives with a set of indicators that allows them to monitor and control the firm's progress. Hence, some authors view EIS as management dashboards that translate a set of strategic objectives into critical success factors, to which are associated key performance indicators (Palpanas *et al.*, 2007). However, following the evolution of management measurement systems, the notions of scorecard and "tableau de bord" or dashboard have evolved into a balanced form, away from EIS, into full-fledged PMS (Kaplan and Norton, 1998; Edwards and Thomas, 2005; Fernandez, 2005).

Given the preceding analysis of the conceptualisation and evolution of PMS since their advent as IS artefacts and objects of research, one can attempt a more precise definition, in the following form:

> An information system based on a holistic (multidimensional/balanced/integrated) view of organisational performance, as conceptualised through a performance measurement model, in support of executive decision-making and strategic management, by producing information in a manner that reflects the performance logic (determinants/results) of the organisation.

To avoid semantic confusion however, there is a need to change the appellation of PMS. Given that advances in IT now allow these systems to go beyond simply "measuring", a more generic designation is required to include systems that are not only measurement tools but also management tools. Returning to Figure 1, it thus seems logical to propose PMIS as the new appellation to be used henceforth.

PMIS classification scheme

Given the evolution of IT in the last 20 years, the problem of defining the object of study (the artefact) has been a constant one in IS research (Orlikowski and Iacono, 2001), and the study of PMIS could benefit from the experience gained from this research. Indeed, Franco-Santos *et al.* (2007) confirm that researchers have defined PMS in many different ways. This research domain thus faces an ontological problem in that the object of research, namely the PMIS artefact, is lacking a widely recognised common definition.

Requiring clarification as to what truly constitutes a PMIS artefact, empirical research faces certain limitations in terms of transparency, comparability and generalisability (Franco-Santos *et al.*, 2007). Also, this situation does not favour the exploration of PMIS whose configurations differ from the "tried-and-true" (Neely, 2005). This could explain the popularity of Balanced Scorecard-based PMIS within both researcher and practitioner communities, and consequently the limited implications up to now of research on alternative PMIS configurations or approaches.

Classification schemes are meant to structure our comprehension of phenomena, being particularly useful in typifying artefacts by a broad set of criteria that are neither necessary nor sufficient, i.e. polythetic classes, categories or clusters in which these artefacts are regrouped on the basis of similarity indices across criteria, dimensions or axes (Sokal, 1974). In the case of IS, these schemes help "to improve our understanding of the field and to rationalise IS research efforts" (Ein-Dor and Segev, 1993, p. 185). From the IS perspective, to classify PMIS could facilitate the delimitation work of these systems for empirical research purposes. Referring to PMIS with an IS research

approach would help in identifying PMIS *in situ* as an artefact whose attributes (informational, functional and technological) have to be made explicit.

PMS notions, previously exposed in Table I, are reorganized following three main themes that represent a possible basis for the development of a PMIS classification scheme. These themes were retained for their relevance and their capacity to distinguish these systems from others with regard to their use as IS artefacts. As shown in Table III, the coverage of the various dimensions of performance, the management level addressed by the PMIS and the architecture of the PMIS are joined under the "alignment and scope" criterion. The organisational role of the PMIS and the information output are joined under the "management support sophistication" criterion. Finally, given that IT enables greater PMIS efficiency and effectiveness (Bititci *et al.*, 1997b; Kueng *et al.*, 2001), it is given importance as a distinct criterion, namely the "IT sophistication" level of the PMIS.

Alignment and scope. The first criterion for classifying PMIS is linked to the quality of information, to the system's capacity to provide information that is useful (relevant and complete) to manage the firm's performance. This implies that the information provided is aligned with the firm's performance logic, i.e. alignment of the PMIS with the definition of performance and priorities of the firm's managers, and with the firm's organisational structure and process architecture. The alignment and scope of the PMIS will thus be evaluated by the extent of its coverage of the various dimensions of performance, by its capacity to measure in a prospective as well as in a retrospective manner (temporal coverage), by the decision-making levels covered (strategic and operational management levels) and by its architectural coverage, both vertical/function based (sales and marketing, production, HRM, etc.) and horizontal/process based (operational processes, managerial processes and projects). Note that this framework is compatible with de Toni and Tonchia's (2001, p. 51) classification of PMS models based on "architectonic connotations: vertical, balanced (or a tableau), horizontal (or by process)".

Management support sophistication. This criterion refers to the capacity of the PMIS to provide support for users in managerial processes related to performance. Management support sophistication is thus evaluated with regard to the organisational role of the PMIS in terms of its capacity for performance measurement and/or management, and to its level of user-friendliness in terms of information output. Performance measurement capabilities include evaluation, computation and relativisation. Performance management capabilities include explanation (cause-effect), diagnosis, interpretation, simulation, recommendation and benchmarking. User-friendliness of information output can be evaluated in terms of format (text, colour, graphics, etc.) and type of measurement unit (monetary, physical, temporal, ratios, etc.).

IT sophistication. The third classification criterion is based on the capacity of the PMIS to provide information that is reliable, concise, up-to-date and synchronous, and to provide it to the right users in a timely manner. IT sophistication is thus evaluated by the extent of the system's integration with other organisational IS or sources of information. For instance, when connected to an ERP system, the PMIS can access in real-time an integrated and synchronous dataset that covers most, if not all, of the firm's transactions and operational activities. The extent to which the system is accessible and secured will also be evaluated (interactivity, points of access,

Table III.
Characterisation of a PMIS classification scheme

	Alignment and scope		Management support sophistication		
Coverage of performance	Management level	Architecture	Organisational role	Information output	IT sophistication
Dimensional	Strategic	Vertical	Measurement	Format	Integration
Operational	SWOT	Production	Evaluation	Textual	Data collection
Market	Resources and	Marketing/sales	Computation	Colour	PMIS components
Financial	competencies	HRM	Relativisation	Graphical	Other IS
					Web
Societal	Operational	Logistics			
Environmental	Delays	Accounting/finance	Management	Measurement unit	
Learning	Costs		Explanation	Monetary	Access/interface
Innovation	Quality	Horizontal	Diagnostic	Physical	Interactivity
	Productivity	Operational processes	Interpretation	Temporal	Points of access
Temporal		Managerial processes	Scenarios	Ratios	Personalisation
Retrospective		Organisational	Recommendation		Information
		projects	Benchmarking		diffusion
Prospective					Security

personalisation/user-profiling and secured access), including the extent to which performance data are collected and performance information is diffused throughout the organisation. Finally, IT sophistication implies features such as the use of web-based technologies and real-time processing.

As shown in Figure 2, systems that relate to the measurement and/or management of performance can be classified on the three preceding criteria. For instance, a system whose underlying performance framework corresponds to Neely *et al.*'s (2002) Performance Prism provides interpretations and recommends action plans to the user, is integrated through an IT-based infrastructure with other organisational IS, and is accessible online would satisfy all three criteria. A system operated by an external provider that offers to the firm, on an *ad hoc* basis, a multi-dimensional comparative diagnostic of its performance, accompanied by interpretations and recommendations but without online access to the performance information, would be ranked lower on the "IT sophistication criterion" (e.g. the PDG™ benchmarking system as described by St-Pierre and Delisle, 2006). Whereas, a computer-based accounting system or costing system that is integrated to the firm's other organisational IS and is accessible online would be ranked lower on both the "alignment and scope" and "management support sophistication" criteria.

Calls have been made in IS research to adequately identify the IS artefacts that are studied as to their design, implementation and use (Weber, 2003). To this effect, a classification framework that is focused on such artefacts becomes an indispensable theoretical and empirical tool, be it for the study of PMIS as well as the study of IS in general. Also, a more precise characterisation of PMIS becomes even more important, given the great diversity of such systems brought about by the rapid evolution of the IT and network infrastructures that enable them and by the nature of performance information needs that are specific to each business environment. In this sense, without

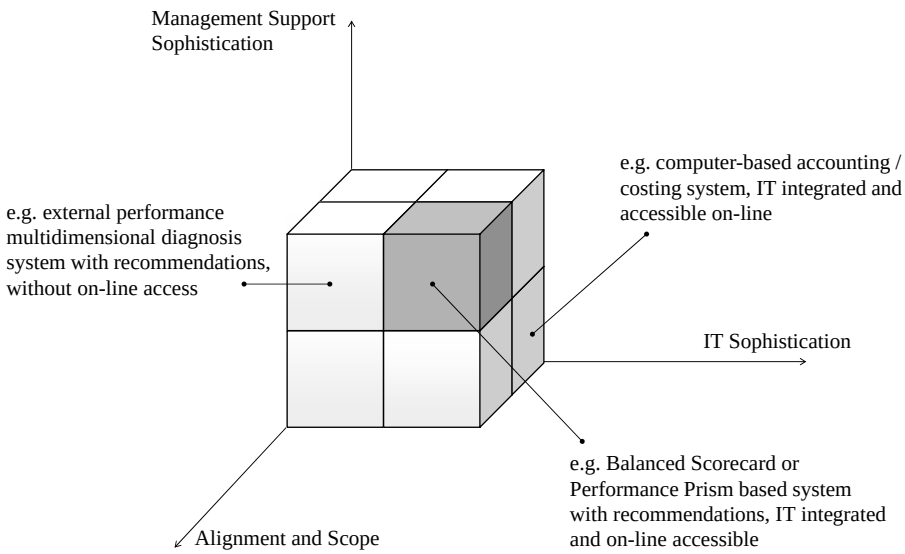


Figure 2.
Application of the proposed PMIS classification scheme

pretending to be exhaustive in its criteria (and with its empirical validity yet to be tested), the proposed classification scheme may be useful.

Contribution of an IS perspective to PMIS research

The potential areas of contribution of an IS perspective to PMIS research are numerous and varied in level and nature. Current PMIS research problems (Neely, 2005; Bourne *et al.*, 2005; Garengo *et al.*, 2005; Garengo and Bititci, 2007) can be categorised under the standard IS "life cycle" (IS development, IS use, IS evaluation), viewed through the lens of IS theories and models, and approached with the help of IS research methods and tools, as illustrated in Table IV with representative examples.

Research questions on PMIS development (e.g. on developing dynamic and evolutionary PMIS, on PMIS alignment, and on PMIS implementation success factors) could benefit from the models and methods proposed in the IS development literature, as framed for research purposes by Iivari *et al.* (2001). Research questions on PMIS use (e.g. on the types and contingencies of use, on the use of PMIS in decision making, and on PMIS configurations in SMEs) could benefit from adapting and applying previously validated IS research models such as the technology acceptance model (TAM) (Davis *et al.*, 1989) and the information systems success model (ISSM) (DeLone and McLean, 2003), as will be illustrated further. And in operationalising these models, one could

	PMIS development	PMIS utilisation	PMIS evaluation
Problematisation	How can robust and flexible PMIS be developed?	How are PMIS actually used in organisations?	What are the advantages of using PMIS?
	How can we ensure that the PMIS matches the firm's environment, strategy, structure, and culture? (Neely, 2005)	What type of PMIS artefacts are found in organisations (in SMEs in particular)?	How to evaluate the contribution of PMIS at the individual, group, organisational and network level?
	What are the factors of PMIS implementation success and failure?	What are the explanatory factors of PMIS use? What are the factors that moderate this use? (Garengo and Bititci, 2007)	How to relate the contribution of PMIS to organisational performance? (Bourne *et al.*, 2005)
IS theories and models	For example, IS development methods and approaches framework (Iivari *et al.*, 2001)	For example, TAM (Davis *et al.*, 1989) For example, ISSM (DeLone and McLean, 2003)	For example, IT business value (Melville *et al.*, 2004)
IS methods and tools	For example, IS prototyping (Baskerville, 1999)	For example, determinants of IS use (Venkatesh *et al.*, 2003) For example, measurement tools focused on the IS artefact (Bergeron and Raymond, 1992)	For example, entrepreneurial IS evaluation approach (Serafeimidis and Smithson, 2000)

Table IV.
Contribution of an IS perspective to PMIS research

refer to various IS measurement methods and tools designed to characterise PMIS artefacts (Bergeron and Raymond, 1992) and PMIS use (Venkatesh *et al.*, 2003). Research questions on PMIS evaluation (e.g. on the advantages of using PMIS and on the contribution of PMIS to organisational performance) could refer to models and methods proposed in the IS evaluation literature such as Melville *et al.*'s (2004) model of IT business value, and Serafeimidis and Smithson's (2000) entrepreneurial IS evaluation approach.

An illustration of the research benefits: PMIS use research

An IS-based characterisation would facilitate the import of knowledge from the IS field or discipline, knowledge that could provide a deeper understanding of the PMIS phenomenon. For instance, much remains to be learned of their actual use as there have been as of yet few empirical studies of PMIS usage. PMIS studies that would resort to validated theories and models of IS usage could help in answering such questions as: How are PMIS actually used in organisations? What type of PMIS artefacts are found in organisations (in SMEs in particular)? What are the explanatory factors of PMIS use? What are the factors that moderate this use?

Such studies could benefit from the recurrent constructs of antecedents and consequences of IS use offered by DeLone and McLean's ISSM (1992) later updated (DeLone and McLean, 2003), as well as by Davis *et al.*'s TAM (1989). These models stood out by the continuance of their constructs, after a review of theories and models of IS use that focused on their chronological examination and their cross-influences and convergences. While the TAM explains IS use by perceived usefulness, perceived ease of use, and intention to use, the ISSM incorporates information quality, system and service quality, as antecedents of IS use, and also intention to use as in the TAM. Also, many empirical studies that have used the TAM have included contextual variables such as facilitating conditions, social influence, and user habits and experience that originate mainly from behavioural theory. Both the TAM and the ISSM offer widely accepted and validated representations and explanations of the IS use phenomenon.

Yet, a precise definition and characterisation of PMIS has to be considered in order to give these models a level of contextualisation and specification suited to the context of PMS. This would allow for a better understanding of usage problems that are specific to PMIS and would provide actionable insights in proposing appropriate solutions to these problems.

As an illustration, Figure 3 shows a research model on PMIS use, incorporating both TAM and ISSM constructs. One can observe the particular importance a definition and characterisation of PMIS would have in using such an approach, by defining and specifying the "information output quality" and "system quality" constructs. One can also observe the benefits of using context-dependent antecedent constructs, related in particular to the type of information produced by a PMIS, and individual and organisational consequences specific to this type of information, including performance outcomes.

Once the necessary preliminary IS characterisation of PMIS has been done, it becomes both feasible and worthwhile, to apply IS theories and models in describing and understanding the use and impacts of PMIS in organisations.

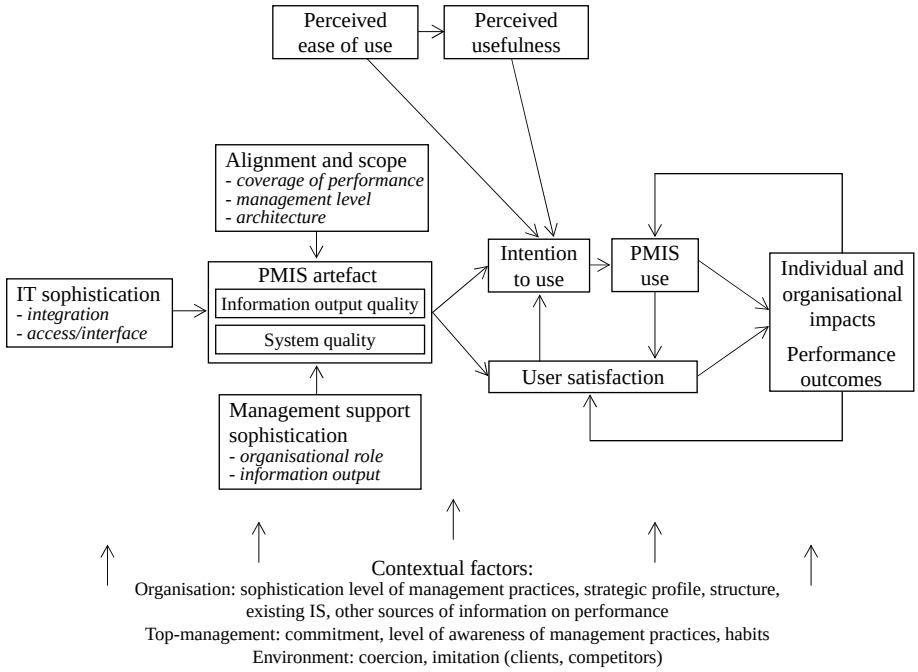


Figure 3.
Research model on PMIS use

Implication for future PMIS research

A tangible and precise characterisation of PMS constitutes a necessary condition to understand their use in organisations and to evaluate their impacts. A set of performance indicators, however balanced, holistic or aligned it may be, cannot play its expected role if the system configuration that renders it operational is a deterrent to its use. The study of PMS use and impacts presents difficulties in that many factors must be taken into account and their effects must be distinguished (Neely *et al.*, 2004). Recognising the system's various attributes (e.g. informational, functional and technological) represents a step in this direction. The IS perspective gives access to added knowledge, ways and means through IS theories, models and methods for characterising and researching information artefacts such as PMS or rather PMIS in organisations.

To substantiate the implications of an IS perspective for PMIS research, and after a preliminary clarification of the notions that underlie PMS, a situation of convergence between performance measurement artefacts and IS artefacts of the "management support system" type was first exposed. Referring to a method widely used in IS research to characterise IS artefacts, a classification framework was then proposed for PMIS research. This framework aims to found the specificity of PMIS as providers of multi-dimensional, balanced and integrated information on organisational performance. There followed a presentation and exemplification of potential contributions of the IS perspective to PMIS research in the form of theories, models and methods that could provide some guidance for research on PMIS development, PMIS use and PMIS evaluation. Thus, PMIS research agendas such as the one

proposed by Garengo *et al.* (2005) on the causes that prevent or hinder the use of PMIS, could benefit from being envisioned from an IS perspective. This was illustrated by combining the proposed PMIS classification framework with a PMIS usage model founded on IS theory and developed from previously validated IS models. This also implied proposing a definition of PMS that delineates their nature as IS, and a more generic term, namely "PMISs".

For empirical research, the IS perspective with its means of identifying and characterising IS artefacts provides better control of artefact-related variables and thus allows for finer explanations of PMIS-related phenomena (usage, problems of practice and more appropriate solutions). It also provides greater construct validity to the PMIS artefact, given that this research object is identified and defined from its essential characteristics. The classification framework provides a stronger ontological basis to the PMIS construct, thus freeing it from its more familiar empirical expressions (e.g. PMIS based on the Balanced Scorecard) and allowing it to be explored in other less well-known expressions that nonetheless correspond to the essential definition of a PMIS. Hence, a window is opened for an empirical exploration of PMIS that is more anchored in the reality of organisations, and less influenced by the "labelling" power of software vendors and by the problems that ensue (Ein-Dor and Segev, 1993). In particular, this would help in coping with the greater diversity of PMIS in certain types of organisations (e.g. in SMEs when compared to large enterprises) and in comparing across types (e.g. in the public sector when compared to the private sector). Finally, given the capacity to compare and generalise on a clearer and more rigorous basis, this IS characterisation effort should favour the integration of present and future knowledge into a coherent body of PMIS research.

A lack of consensus on the conceptualisation and definition of PMIS is seen by a number of researchers to have an inhibiting effect on the development of this research field (Franco-Santos *et al.*, 2007). This field could thus be more occupied by the disciplines that have developed knowledge in identifying and defining the PMIS artefact. With the evolution of IT, PMIS in their empirical manifestations could be assimilated to the "management support systems" that are at present an object of IS research (Turban *et al.*, 2007). In this context, of artefact convergence, establishing links with the IS field would be desirable. This would provide more grounding to the efforts aimed at defining the PMIS artefact, yet without negating what distinguishes PMIS from other IS in the organisation with regard to their informational content and organisational role. Beyond definitional work, a wide field for future PMIS research is opened through the contribution of theories, models and methods from the IS discipline.

While the proposed PMIS classification framework requires empirical validation, it does include all of the system characteristics judged to be necessary by Franco-Santos *et al.* (2007), that is, features (performance measures and supporting infrastructure), role (measure performance) and processes (information provision, measure design and selection, data capture). This framework provides an easier access to PMIS as they actually manifest themselves in organisations, notably for those who develop their own system. SMEs are of particular interest in this regard as not all have the means to acquire a pre-packaged PMIS (or a system labelled as such), yet as "world-class" enterprises confronted with global competition, many require a multidimensional, efficient and effective measurement of their performance (St-Pierre and Raymond, 2004).

Given the previously expressed need for PMIS research in the particular context of SMEs (Garengo *et al.*, 2005), comparative field studies using the proposed classification framework could provide answers to research questions such as:

RQ1. How do these firms measure their performance?

RQ2. What do PMIS look like in SMEs?

RQ3. Are there PMIS characteristics that are specific to SMEs?

Conclusion

In clarifying research questions through a better characterisation of the PMS artefact, the IS perspective can generate new hypotheses on the effects of PMS by its structured consideration of the system attributes that can affect the PMS use-impacts chain. Attributes such as technological sophistication can be called upon to better understand how PMS achieve enhanced efficiency and effectiveness by using IT, i.e. their capacity to provide timely and relevant information at reasonable cost. The IS perspective can also have an impact on the dynamic and evolutionary nature of PMIS by providing appropriate system development methods and insights on system adaptation problems.

It is hoped that PMS researchers from different disciplines will join in an interdisciplinary quest for a deeper understanding of performance management practices on one hand, and of the manner in which PMS support these practices on the other hand. It is only by doing so that such a research effort can eventually provide guidance to managers that must achieve increasingly higher levels of excellence and competitiveness for their organisation in the global economy.

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