Are PMS meeting the measurement needs of BPM?
A literature review

Kwee Keong Choong
School of Accounting, La Trobe University, Melbourne, Australia

Abstract
Purpose – The purpose of this paper is to identify the fundamentals of a performance measurement system (PMS), in order to ascertain if they satisfy the measurement requirements of business process management (BPM) by means of a systematic review of the literature.

Design/methodology/approach – The paper uses meta-analysis to systematically review and examine existing BPM and PMS from the business, non-business and public sectors. A specific methodology using categorization concept was used to select the appropriate articles. In total, 42 relevant articles are selected and later analyzed. A subsequent content analysis of the information obtained is applied to identify the gaps in the current literature.

Findings – The growing interest in PMS has produced an extraordinarily large numbers of papers on the topic. This paper found that, by and large, the PMS as advocated by various authors for over 20 years (since 1990) failed to fulfill the measurement requirements of BPM. This is alarming, considering that past critics of PMS have indicated that the weaknesses of PMS in relation to BPM applied only in isolated or specific situations such as information technology (IT). These findings dispel the notion that a PMS is a prerequisite to the introduction of an effective BP in organizations.

Practical implications – This paper has identified the gaps (weaknesses) of current PMS in meeting the measurement requirements of BPM. This paper proposes a theoretical integrated framework which encompasses a management system, that combines with a measurement system and business processes, and which can be implemented using the popular value-chain methodology to measure and compare performance within BP organizations.

Originality/value – The results presented contribute towards providing an updated overview of the current state of research into PMS and its relevance to BPM, in order to identify existing research gaps, issues and concerns upon which ongoing and future research efforts on this topic can be built.

Keywords Business process, Process management, Research work, Journals, Business process management, Performance measurement, Performance measurement system

Paper type Conceptual paper

1. Introduction
Performance measurement system (PMS) is now multi-disciplinary, and they can be found in the business sector (Fitzgerald, 1988; Eccles, 1991; Dumond, 1994; Neely et al., 1995, 2005; Kueng, 2000; Kanji, 2002; Bourne et al., 2005; Franco-Santos et al., 2007; Hubbard, 2009); governments and nonbusiness sectors (Australian Government Process Interoperability Framework, 2012; Singapore Housing and Development Board Business Process (BP) initiatives, 2012; US DOE, 2012); international agencies (Serrat, 2010; United Nations, 2012 “UMOJA” BP); and IT (Kueng et al., 2001; Jacks et al., 2011).

The coverage of PMS in such a wide spectrum of disciplines suggests that there is considerable interest in PMS, and the extraordinarily large numbers of papers on the topic is testimony of this growing interest. The growing number of PMS in the academic and in practice suggests that the current traditional accounting (financial) measuring
The functional approach or Taylorism has certain limitations as it is too heavily reliant on mass-production, activities based on specialization (function), and the accounting measurement system that treats measurement of actual economic transactions (historical), and where the measures and metrics used are backward-looking and largely financial. The Taylorism approach is not useful in measuring activities (things) that focus on customers, product quality, and value creation (Neely et al., 1996; Kueng and Krah, 1999; Kueng, 2000; Ghalayini and Noble, 2002; Najmi et al., 2005; Glavan, 2011). These critics considered that a BP approach is the one that can assist organizations in measuring activities focusing on customers, product quality, and value creation. As a result, several BP methodologies have been discussed and proposed over the years, which culminated in a discipline called business process management (BPM).

Unfortunately the BPM discipline, and in particular business process reengineering (BPR) — the forerunner of BPM, was not so successful in revolutionizing business rethinking, and the adaptation of BPR has met with various difficulties (Zairi, 1996; Kueng, 2000; Al-Mashari et al., 2001; Kueng et al., 2001; Cardoso, 2005; Yen, 2009; Gonzalez et al., 2010; Glykas, 2011). Kueng (2000) and Kueng et al. (2001) indicated that the current PMS was not focused upon BPs but rather on the traditional approach of measurements that rely on financial metrics. Cardoso (2005) indicated that given that BP is a new topic and process measurement is an even newer phenomenon, without an adequate measurement system, BP activities cannot be measured, proposed measures cannot be validated, and hence, efforts should be made in the quantification of specific activities of BPM. Yen (2009) cited many key reasons for the lack of BPR/BPM success, and one of these is that there is no one single measurement approach within an organization that satisfies all stakeholders within the BP, and hence, the support of a credible measurement for BP...
effectiveness is not forthcoming. Gonzalez et al. (2010) found that while the call for measurement in BPM is needed in order to improve the organization, but there is a lack of measurement validation, and hence there is no way to verify the usefulness of performance measurement in terms of BP. Glykas (2011) indicated that most of the PMS used in the BPM perspective are based on theories and techniques used in other disciplines or research fields, and hence, in the majority of cases the proposed theories and techniques prove to be inadequate to measure performance holistically or integrate organizational, human resource management, process management and workflow management concepts.

All of these authors have cited inadequate measurement to be the key contributing factor for the misgivings of BPM. These criticisms, however, applied only in isolated or specific situations, for example, Kueng (2000) and Kueng et al. (2001) criticized the weakness of PMS in terms of measuring IT processes, while Cardoso (2005) was critical of the effectiveness of PMS in measuring production process activities. The objective of this paper is to examine whether PMS has failed the BPM in isolated cases or wantonly. This paper considers that a solid understanding of measurement criteria, and practical measurement techniques as applied to the analysis and design of BPs is essential to BP success. The remainder of this paper is organized as follows. Section 2 discusses the methodology used for this paper. Section 3 is concerned with BPM and the needs for measurement. Section 4 critically examines the fundamentals and its relevance to BPM, and Section 5 discusses the results of findings concerning PMS and its relevance to BPM, and a proposal for an integrated BP measurement and management system (IBPMM). Section 6 concludes the discussion.

2. Methodology
To investigate the PMS within organizations that have relevance to BP, an extensive literature survey of PMS and related subjects have been conducted. This section is organized into:

- meta-analysis in the review of the literature;
- review using synthesis analysis; and
- journal search criteria and search procedure.

2.1 Meta-analysis and systemic review of the literature
This paper uses the meta-analysis approach in conducting a systematic review of the literature in seeking all the relevant articles of PMS that have fundamental elements of measurement. This approach is particularly suited for the systematic selection of a large number of articles for review (Glass, 1976; Cooper, 1989; Gill and Johnson, 1991; Rosenthal and Dimatteo, 2001; Kitchenham and Charters, 2007; Cooper et al., 2009), and it has been used in many measurement and BP literature surveys (Neely et al., 1995; Kohli and Devaraj, 2003; Orlitzky et al., 2003; Gonzalez et al., 2010; Jacks et al., 2011). According to Glass (1976, p. 3): meta-analysis is defined as:

\[
\text{[...]} \text{the statistical analysis of a large collection of analysis results from individual studies for purposes of integrating the findings.}
\]

Thus, unlike the traditional literature review, a meta-analysis adopts the path of science by analysing differences and areas of similarities, and by integrating results from different studies, in order to derive an objective conclusion in the context of multiple studies.
2.2 Review using synthesizing research

The field of PMS has not formally been defined. Considering its normative approach in the discussion of various topics and issues, and its close link with the fields of management, economics and accounting, the study of PMS can be considered a branch of social science (Trochim, 2006; Bohrnstedt, 2010; Cartwright and Bradburn, 2010). As social science is not as coherent a discipline as science; nonetheless, we still need to conduct social science research as objective as possible, and this means that we will need trustworthy, orderly and systematic research synthesis (Cooper, 1989, p. 1). Therefore, this review adopts the research synthesis path as it is most suited to social science because, unlike other forms of the review of literature, a research synthesis requires us to provide unambiguous definition in conceptual form of the area of research. A research synthesis also directs us to review articles by following a list of specific steps to ensure that we can obtain the most relevant information with regards to a specific topic (subject), obtained in an unbiased manner. Eventually, this ensures the fidelity, completeness and rigorous nature of the review (Gonzalez et al., 2010, p. 116). The research synthesis requires the following steps/criteria.

First, the investigator needs to be clear of his/her research question (RQ) – problem formulation, data collection (if any), data evaluation (if any), analysis and interpretation and public presentation of the result of the research. It is essential that any social science research is given a conceptual definition pertaining to the area of research (Cooper, 1989, p. 13), and that the RQ (research concept) not be too narrow, as that would make the conclusion of the review less definitive and less robust (Cooper, 1989, p. 7). This conceptual definition is the prerequisite for synthesizing conceptual (theoretical) research. For empirical research, we require a priori specification of operations with an empirical realization in mind, and the investigator must have knowledge of the kind of measurement used to measure the data (Cooper, 1989, p. 14). For any research synthesis, it is imperative for us to take care to differentiate concepts and theories that predict similar and different results from the same set of investigations.

Second, the primary function in a review is the construction of a definition that distinguishes relevant studies from irrelevant studies. Good judgment is essential to select the relevant studies in a literature search, and this requires open-mindedness and expertise in the area of study. While expertise is a tacit attribute of the investigator, Cooper (1989, p. 20) recommends that one way of relating to open-mindedness is to use the broadest conceptual definition pertaining to the RQ.

Third, caution with regards to procedural differences that may create variation in the review process is crucial, as this may affect the conclusion of the review.

Fourth, the investigator should ensure that there should be no sources of potential invalidity in the review conclusion. It is vital for the investigator to describe the qualities of the variable that are independent of time and space but can be distinguishable from relevance and irrelevance to the concept in question.

2.3 Journal and text search criteria and search procedure

All literature searches were conducted using major journal databases such as ABI/Inform ProQuest, Emerald full text, and EBSCO. The literature review was based on the research synthesis methodology of Cooper (1989) where he advocates an open-mindedness approach in using the broadest conceptual definition pertaining to the RQ.
The RQ is specified as: the fundamentals of PMS with measurement focus. This means that PMS should be searched in a wide range of journals rather than in the disciplines of the journals (e.g. performance measurement, or production). The search criterion for the publication period is from 1980 to 2011 (32 years). The starting year is chosen due to data availability as most search engines are not able to locate articles prior to 1980. The search procedure is executed using a four-point approach, and the journal search process and the results of the number of relevant articles selected are depicted in Table I.

First, the author specified the keys for the literature search. The search keys are based on the terms “measurement system”, “measuring system”, “PMS”, “BP”, and “business process measurement”. By combining the search keys with Boolean logic, a wider search of the PMS and related literature was conducted. The restriction for the literature survey is confined to:

- full-text documents;
- scholarly journals; and
- business, accounting, management and economics.

The initial search results reveals a total of 7,432 articles. However, the figures are not mutually exclusive because an article found under “measurement system” may appear again under “performance measurement” or an article found under ProQuest may appear again under EBSCO, thus the total of 7,432 articles is exaggerated. Hence, an analysis is conducted to reduce duplication and irrelevancy. Since content analysis reveals that “measurement system”, “measuring system” and “PMS” are largely semantic, these terms are amalgated as “PMS”. As a result, the number of relevant non-duplicate articles was reduced to 3,102. Most of the PMS articles come from ten journals[1] that account for nearly 97 percent of all publications relating to PMS. Franco-Santos et al. (2007) found 2,240 references related to PMS and related terms from the early 1980s to around 2005. In 1999, Neely found 3,615 articles on performance measurement were published between 1994 and 1996.

Second, to reduce the overload of information (i.e. discussion of PMS and related topics with no particular focus), it is necessary to flush out the smokescreen of “apparent” knowledge so that the number of articles can be reduced to ensure that they relate to PMS and that they have relevance to BPM. Thus, this paper focuses on articles

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<th>Source</th>
<th>Raw</th>
<th>First Non-duplicates</th>
<th>Second Fundamentals</th>
<th>Third Internet (additional)</th>
<th>Fourth Final</th>
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<td>3,102</td>
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Notes: <sup>a</sup>Since “measurement system”, “measuring system” and “performance measurement system” are largely semantic, these terms are amalgated as “performance measurement system”; <sup>b</sup>out of these 30 were substantially devoted to fundamentals of measurement

Table I. Journal search process
that have substantially discussed the fundamentals of PMS. In the absence of a theory for PMS, this paper considers that articles that have provided definitions/indications or reviews of PMS ought to provide good coverage of the essential elements of PMS in relation to BPM. Definitions and terms are essential for any systematic pursuit of knowledge (Oxford Dictionaries Online, 2012). In the absence of definitions, indications can be useful in explaining the basics of things (Levey, 1990; Locatelli et al., 2005). Articles that perform reviews of a subject (field) are also useful in providing a wide range of information for us in researching the fundamentals of the subject (field) (Gill and Johnson, 1991). After discarding articles that contained no/little fundamentals of PMS, the number of articles was reduced to 101.

Third, to be very certain that no relevant articles were omitted from the literature search, a search for PMS, BPM and related topics was conducted on the Internet and selected websites using “Google Scholar” using the same search keys and Boolean logic from 1980 to 2011. 14 additional articles were found to be relevant to this research, thus the number of articles increased to 115. This excludes articles that are solely devoted to the search methodology (Glass, 1976; Cooper, 1989; Levey, 1990; Gill and Johnson, 1991; Rosenthal and Dimatteo, 2001; Orlitzky et al., 2003; Kitchenham and Charters, 2007; Locatelli et al., 2005; Pino et al., 2008; Cooper et al., 2009; Cartwright and Bradburn, 2010; Oxford Dictionaries Online, 2012), articles that are devoted solely on categorization theory (Rudner, 1966), and articles centered on measurement (Stevens, 1946; Cardoso, 2005; Trochim, 2006; Stanford Encyclopedia of Philosophy, 2007; Bohrnstedt, 2010). The full bibliography of the selected articles appears in the reference section.

Fourth, these articles were content analyzed, assessed for their appropriateness to PMS, and for those relevant to measurement. Hence, in this respect, information was analyzed in helping to improve knowledge rather than on what was written. Finally, a total of 30 PMS articles were found to have the most substantial coverage of the fundamentals of PMS with a focus on measurement.

The use of such an extensive number of articles and journals allows for an effective meta-analysis of the issues concerning the topic of PMS. While this procedure did not guarantee an exhaustive collection of all relevant PMS articles, the author believes that a large majority of relevant papers were found, and the resultant findings from this research suffice to provide a strong conclusion in the fundamental aspects of PMS.

3. BPM and the needs for measurement

BP, BPR, workflow management systems (WfM), and BPM are sometimes treated synonymously and at times differently in the literature. However, these four terms are distinct and hence it is necessary to explain their differences.

3.1 BP management

The origin and the exact philosophy (concept) of BPM remain unclear. First, there are suggestions that BPM has its roots in the early work of Taylor (1967) and Doebeli et al. (2011), while some believe that BPM arises due to the unfulfilled promises of BPR (Dooley and Johnson, 2001; Spanyi, 2003; Ko, 2009; Ko et al., 2009; Yen, 2009). Second, the term BPM still lacks clarity (Harmon and Wolf, 2008; DeBruin and Doebeli, 2008, 2009a, b; Doebeli et al., 2011). This is because, as of today, the field is largely prescriptive and there is little theory in the academic area to assist businesses in embedding BPM across organizations (DeBruin and Doebeli, 2008). Nevertheless, this literature review finds that
the common ground for a BPM is: a holistic management philosophy that uses a systematic approach and IT to improve processes that focus on aligning all aspects of an organization with the wants and needs of customers (Elzinga et al., 1995; DeToro and McCabe, 1997; Zairi, 1997; Lee and Dale, 1998; Armistead and Pritchard, 1999; Kueng and Krahn, 1999; Al-Mashari and Zairi, 2000; Kueng, 2000; Jeston and Nelis, 2008; de Bruin and Doebeli, 2008, 2009a, b; Yen, 2009; Gonzalez et al., 2010; Kohlbacher, 2010; Doebeli et al., 2011; Glavan, 2011; Jacks et al., 2011). More importantly, the central notion of BPM is the requirement for managers to undertake the creation/addition of value for customers and for the organization.

With the publications of critiques of BPR from the mid-1990s, coupled with abuses and failures of BPR projects, and with BPM gaining major attention in the corporate world, BPM can be considered as a successor to the BPR (Ko, 2009; Ko et al., 2009; Yen, 2009; Hammer, 2010). It can be construed that BPM focuses on the managing or “run the business” while BPR is posited to institute a radical change of the entire organization or process or “change the business” as Winter (2010) puts it. Both BPR and BPM involve substantial organizational change, and hence require a long-period of time for both to materialize, and since BPR focuses on the reengineering it needs to implement activities/plans to initiate change at the highest level. By structuring BPR with BPM it will then be possible to monitor and ensure the change initiated by the BPR is successful (Winter, 2010). It is obvious that BPM is an extension of BP as the former is all the management activities of a given process which work towards reaching the objectives allocated for this process (Thiault, 2012).

However, the differences are not clear between BPM and WfM. There are different viewpoints between these two terms: BPM as a management discipline with WfM supporting it as a technology or the technical aspect of a BP (Bendraou and Marrie-Pierre, 2007; Hill et al., 2008); WfM as a subset of BPM (Georgakopoulos et al., 1995; Van der Aalst et al., 2003; Bendraou and Marrie-Pierre, 2007); and BPM as the matured version of WfM (Ko, 2009; Ko et al., 2009). More specifically, WfM is about the managing the flow of work through automation (usually with the use of software packages) of procedures where documents, information or tasks are passed between participants according to a defined set of rules to achieve, or contribute to, an overall business goal (WfMC, 1993). The tasks of organizations generally mean the processing of business transactions. Ko (2009) and Ko et al. (2009) observed that many publications and BP software vendors prefer the term BPM rather than WfM as the former indicates sophistication and hence appears more marketable, and in their view this may have influenced why WfM is on the wane as a terminology while BPM is gaining popularity. The view of Ko (2009) and Ko et al. (2009) on the preference to use the term BPM over WfM may be a marketing ploy; however, technically there are differences between BPM and WfM. An important distinction between BPM and WfM is that the former is about optimizing BP while the latter is concerned with the effective management of the information or tasks associated with workflows in an enterprise but it does not optimize a process. Following the articulation of these authors, most appropriately the WfM is a subject/technical (subset) part of BPM; where we may, for illustration, view WfM as book-keeping and BPM as accounting; or WfM as nursing and BPM as doctoring.

3.2 BP reengineering

BPR can be defined as “[…] the fundamental rethinking and radical redesign of BPs to achieve dramatic improvements in critical modern measures of performance, such as
cost, quality, service, and speed.” (Hammer and Champy, 1993, p. 32), and “encompasses the envisioning of new work strategies, the actual process design activity, and the implementation of the change in all its complex technological, human, and organizational dimensions.” (Davenport, 1993, p. 2). Al-Mashari and Zairi (2000, p. 36) define holistic BPR as “[…] a continuum of change initiatives with varying degrees of radicalness supported by IT means, at the heart of which is to deliver superior performance standards through establishing process sustainable capability”.

BPR is a strategic management approach for redesigning the way work is done to better support the organization’s goals and reduce costs. To achieve these, BPR is more than just business improvising or continuous improvement – it is the seeking for, the change of structural organizational variables, and other ways of managing and performing work that is considered as being insufficient. In short, BPR is about radical rather than mere change in catering for customer needs and avoiding inefficient and unnecessary work. The concept of BPR is extremely attractive to organizations as proper design and implementation of BPR can result in enviable success for a firm, and due to this, re-engineering is the basis for many recent developments in management.

Despite its many merits, many organizations are reluctant to embark on BPR as reengineering involves a great deal of risk (Covert, 1997). Galliers (1998) reported that only 30 percent of reengineering projects were regarded as successful, mainly due to problems attributed to staff, layoff and redundancy. Dooley and Johnson (2001) found that the lack of any successful transformation effort was due to a lack of recognition of the need to change. More recently, Yen (2009) reported that the BPR movements were not successful largely due to organizations being unable to revolutionize business rethinking.

3.3 Business process
According to Davenport and Short (1990, p. 12) a BP is a set of logically related tasks performed to achieve a defined business outcome. However, this definition is not particularly clear and, three years later, Davenport (1993, p. 3) defined a (business) process as:

[…] a structured, measured set of activities designed to produce a specific output for a particular customer or market. It implies a strong emphasis on how work is done within an organization, in contrast to a product focus’s emphasis on what. A process is thus a specific ordering of work activities across time and space, with a beginning and an end, and clearly defined inputs and outputs: a structure for action. […] Taking a process approach implies adopting the customer’s point of view. Processes are the structure by which an organization does what is necessary to produce value for its customers.

This definition is consistent with those of Hammer and Champy (1993), Johansson et al. (1993) and Rummel and Brache (1995). The important point of BP as advocated by these authors is that the process as a whole is designed and periodically reviewed, improved, or substituted by another task, with a view to continuous improvement in four major areas:

1. process effectiveness;
2. process efficiency;
3. support internal control; and
4. compliance to various statutes and policies.
The articulations of these authors contain certain characteristics a BP must possess. They are:

- while BP has many parts or sub-processes, overall, the purpose is to achieve goal congruence;
- focus on how work is done instead of focusing on what is done (product perspective);
- a process must have clearly defined boundaries: input and output;
- activities within the organization must be measured reliably with a focus on value creation; and
- customer focus.

In short, BPs are designed to add value for customers (increase effectiveness) and should not include unnecessary (non-value-added) activities (increase efficiency and internal control) with high degree of compliance to various statutes and policies.

To summarize, BPM, BPR, and WfM are all subsets of BP with BPR and WfM as subsets of BPM. The relation between BP, BPM, BPR, and WfM is shown in Figure 1.

Figure 1 shows that BPM is considered a more holistic view of BPR in that the former includes the execution, measurement and control of processes, in addition to the

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<th>Business process</th>
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<th>BPM</th>
<th>WfM</th>
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<td>• Radical change</td>
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<td>• Strategic management approach</td>
<td>• Strategic management approach</td>
<td>• Operational &amp; managerial management</td>
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<td>• No defined mode of change: change can be structural, change of</td>
<td>• Change is focus on business process &amp;</td>
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<td>employees or methods of processing business process</td>
<td>organizational goals</td>
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<td>• Requires managers to add/create value to</td>
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Are PMS meeting needs of BPM?
modelling, improvement, and redesign of activities, while WfM is a component of a comprehensive BPM strategy but does not encompass the strategic or change management activities associated with BPM (Bendraou and Marrie-Pierre, 2007).

3.4 BPM and measurement framework
BP itself is of limited use because process-oriented organizations need a process management which is able to measure the current level of process performance (Kueng and Krahn, 1999, p 6), and therefore, a measurement system is needed which is focus upon processes, and not on organizational units or departments. Gonzalez et al. (2010) took management in the BPM context a step further. They argued that measurement is fundamental in many disciplines, and the application of measures improves BP so that the organization can be more effectively and efficiently managed. In an attempt to affirm these authors’ views, a systematic review of the BPM measurement initiatives was conducted, and the information captured was then systematically classified into seven categories pertaining to BPM measurement:

1. systems and components;
2. goals;
3. features;
4. processes;
5. information and communication;
6. customer focus; and
7. management.

Categorization enables us to put in order the systematic organization of a magnitude of possibilities into a set of classes (groups) consisting of a coherent number of items (Rudner, 1966). According to Stevens (1946, p. 677), one of the authorities of the Representative of mathematical measurement, and founder of the “scales of measurement”, classification is the most basic form of measurement. The relation between BPM and measurement is summarized in Table II.

Table II indicates that the activities of BPM are interrelated within an organization, and management of measurement is vital to improve processes continuously in satisfying customers so that the creation of value is possible. McCarthy (1982), Berretta (2002), Alfaro et al. (2007), Alter (2010) and Pöppelbuß and Röglinger (2011) discussed the systems and component aspects of BPM that have been substantially devoted to measurement and performance. McCarthy (1982) was critical of the accounting system as it lacks measurement attributes, over-focuses on monetary values, and is too overly aggregated, etc. and as a result, went on to develop a REA Accounting Model that caters for BP for both accounting and non-accounting users. The work of Alter (2010) is interesting as he called for a change in the paradigm in the understanding of a system: a system should be viewed as a service rather than as a form of technology that facilitates communication. This change in the paradigm is necessary as a service system precludes to the conceptualization of a work system, which provides a framework for BPM. However, a framework for BPM is not that straightforward because BPs are varied, requiring various measurements that suit the circumstances and goals of different organizations. Furthermore, if BP are systems then different components and sub-systems will require different measurements. One approach that
### Characteristics of BPM

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<th>Characteristics</th>
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<tr>
<td>Systems and components</td>
<td>REA accounting model is a generalized accounting framework designed to be used in a shared data environment (centralized database) where data comprising of various economic resources and economic events are schematically structured to relate to various business transactions such as sales, purchase, employee, inventory and others that are used by accounting and non-accounting users. The model requires that, in a coordinated effort, releases the functionality demanded by customers through an efficient use of resources; and (2) management of the complex interactions linking all the organizational units that work on the process.</td>
<td>McCarthy (1982)</td>
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<td>BP</td>
<td>BP provides a natural bridge linking strategies of a value generation to concrete decisions and actions. Value generation requires (1) design of a BP system that, in a coordinated effort, releases the functionality demanded by customers through an efficient use of resources; and (2) management of the complex interactions linking all the organizational units that work on the process.</td>
<td>Beretta (2002, p. 261)</td>
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<td>BP is viewed as a system that is used to measure performance through the integrated management of the different components of processes. A system should be viewed as a service rather than as a form of technology that facilitates communication. Viewing systems as services is beneficial in a number of ways: e.g. it helps in focusing on the business value of IT; most internally directed systems within organizations basically perform services for other parts of the organization as though the customers' needs. The definition of systems as a service system precludes to the definition of a work system. A work system is an IT-based system in which human participants and/or machines perform work to procure materials from suppliers, produce products, deliver products/services to customers, find customers, create financial reports, hire employees, coordinate work across departments and perform many other functions.</td>
<td>Alfaro et al. (2007, p. 642)</td>
</tr>
<tr>
<td></td>
<td>The Cynefin framework (CF) draws on research into complex adaptive systems theory, cognitive science, anthropology and narrative patterns, and evolutionary psychology to examine the relationship between man, experience and context (O'Neill, 2004) and proposes new approaches and strategies in interrelated and complex social environments by providing a typology of contexts that guides what sort of explanations and/or solutions may apply (Snowden, 2000).</td>
<td>Alter (2010, pp. 196, 201-202)</td>
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<td></td>
<td></td>
<td>Snowden (2000); Kurtz and Snowden (2003, pp. 462-463, 468, 471) and O'Neil (2004, p. 149)</td>
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</table>

(continued)
CF provides an orderly way to evaluate the interaction of organizational various sub-systems, their environments and the myriad of management methods and tools available to decision makers by:

1. moving away from many of the available management philosophies/approaches that have been designed to succeed in simple and complicated but not complex domains (i.e. there is order – a definable relationship between cause and effect in human interactions and markets, which are capable of discovery and empirical verification); (2) instilling a sense-making framework that enables managers to make sense of a wide range of unspecified problems, and helps them to break out of oldways of thinking and to consider intractable problems in new ways; (3) acknowledging and incorporating diversity and change whereby enables enterprises of different systems domain and different stages of life cycles to adapt to changes and new systems more appropriately; and (4) integrating a measurement system that can cater for business processes.

BPM maturity models refer to a company’s BPM capabilities such as governance, methods and tools, IT, and culture that are subjected to evolution and change, and posit how organizational capabilities evolve in a stage-by-stage manner along an anticipated, desired, or logical maturation path; thus it is also termed as stages-of-growth model, stage model, or stage theory. There are many BPM maturity model (BPMMM) and all these models intend to assess and improve an organization’s business processes where all of them are supposed to support descriptive purposes (applied for as-is assessments where the current capabilities of the entity under investigation are assessed with respect to given criteria), prescriptive purposes of use (how to identify desirable maturity levels and provides guidelines on improvement measures), and comparative purpose of use (allows for internal or external benchmarking where information can be compared). All models comprise a sequence of four or five stages through which organizations proceed to BPM or process maturity.

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**Table II.**

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<thead>
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<th>Characteristics</th>
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<th>Selected authors</th>
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<tr>
<td>CF</td>
<td>CF provides an orderly way to evaluate the interaction of organizational various sub-systems, their environments and the myriad of management methods and tools available to decision makers by: (1) moving away from many of the available management philosophies/approaches that have been designed to succeed in simple and complicated but not complex domains (i.e. there is order – a definable relationship between cause and effect in human interactions and markets, which are capable of discovery and empirical verification); (2) instilling a sense-making framework that enables managers to make sense of a wide range of unspecified problems, and helps them to break out of oldways of thinking and to consider intractable problems in new ways; (3) acknowledging and incorporating diversity and change whereby enables enterprises of different systems domain and different stages of life cycles to adapt to changes and new systems more appropriately; and (4) integrating a measurement system that can cater for business processes.</td>
<td>Poppelbuß and Roglinger (2011, pp. 2, 8-10)</td>
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<tr>
<td>Goals</td>
<td>Measuring BP is to ensure business goals are met. A BP is a complete, dynamically coordinated set of activities or logically related tasks that must be performed to deliver value to customers or to fulfill other strategic goals. In a work system, the initial step is vision and operational goals require a BP organization to define business problems and goals, priorities, constraints and success criteria. Goal setting and measurement with maturity levels are required to be defined for each level of process and stage of maturity.</td>
<td>Kueng and Kuhn (1999, p. 10)</td>
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<td>Strnadl (2006, p. 70)</td>
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<td>Alter (2010, p. 215)</td>
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<tr>
<td>Poppelbuß and Roglinger (2011, p. 7)</td>
<td></td>
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<tr>
<td>Features</td>
<td>The features of a measurement system consist of data (variables), measuring (measurement) system, and the methods used for measurement. Without data nothing can be measured and the measuring system with its measures and metrics are required to implement measurement.</td>
<td>Franco-Santos et al. (2007)</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Description</td>
<td>Selected authors</td>
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<tr>
<td><strong>Processes</strong></td>
<td>Performance indicators are required to possess the attributes required in BP. Performance measures are needed to quantify the organization achievement in terms of (1) quality; (2) time (throughput); (3) cost; and (4) flexibility. Companies should adopt time-based metrics which could be use as diagnostic tools throughout the organization for (1) developing new products; (2) decision making; (3) processing and production; and (4) customer service. BPM is based on a process architecture that captures the interrelationships between key BP together with enabling support processes and their alignments with the strategies, goals and policies of an organization. Process roles are defined to determine how people are assigned to process roles; the visibility of process roles; evidence of process career-paths and the treatment of process; and functional responsibilities.</td>
<td>Kitchenham (1996, p. 103) Neely <em>et al.</em> (2005, pp. 1231-1239) Stalk and Hout (1990, p. 180) Armistead and Pritchard (1999, p. 97) Rosemann and de Bruin (2005)</td>
</tr>
<tr>
<td><strong>Information and communication</strong></td>
<td>The centralized database and its relational schemata of REA Accounting model ensures data for use by various users are available, information is generated and communicated to accounting and non-accounting users. PMS can be seen as an IS which supports processor and their colleague to improve the competitiveness of BP sustainably. Main objective of PMS is to provide comprehensive and timely information on the performance of BP. An IS is a work system whose processes and activities are devoted to processing information, i.e. capturing, transmitting, storing, retrieving, manipulating, and displaying information.</td>
<td>McCarthy (1982, pp. 556-557) Kueng and Krahn (1999, p. 8) Kueng (2000, p. 72) Alter (2010, p. 202)</td>
</tr>
<tr>
<td><strong>Customer focus</strong></td>
<td>BP has to be competitive in the sense that the market with its customers and its suppliers is satisfied. BP strongly influences the quality of the products and customer satisfaction, both of which are of fundamental importance in the marketplace.</td>
<td>Keung and Krahn (1999, p. 12) Powell <em>et al.</em> (2001, p. 64)</td>
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<tr>
<td><strong>Management</strong></td>
<td>Any well-engineered BP is one in which management establishes the measurements of process performance and influences process performance in a desired direction by using these measurements to control the process. Measurement is fundamental in BP and the application of measures improves BP so that the organization can be more effectively and efficiently managed. BPM is a management discipline that requires organizations to shift to process-centric thinking in terms of organization and measurement. Workflow management is also important as it (1) provides more efficient processing of documents, information and tasks; and (2) reduces cost of manpower as routine workflows can be automated.</td>
<td>Gonzalez <em>et al.</em> (2010, p. 115) Doebeli <em>et al.</em> (2011, p. 184) WfMC (1993)</td>
</tr>
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</table>

| Table II. | Are PMS meeting needs of BPM? | 547 |
can help visualize and understand how systems operate within a variety of domains is the Cynefin framework (CF)[2]. Drawing from the synthesizing concepts developed by Boisot (1995) and Cilliers (1998) and others, Cynthia Kurtz and Dave Snowden developed the CF (Kurtz and Snowden, 2003) in which BP can be conceptualized as systems and their external environments can be classified as complex, complicated, and chaotic, and each requires different responses by the organization (Figure 2).

The goals of BP were discussed in Kueng and Krahn (1999), Strnadl (2006), Alter (2010) and Pöppelbüß and Röglinger (2011). They discussed that BP and measurement of BP must be consistent to business (organizational) goals. For organizations with different maturity levels, measurement goals are required to be set with the right maturity level (Pöppelbüß and Röglinger, 2011).

The features of a measurement system are vital as without data, a measuring system and methods of measurement, measurement cannot be implemented. Franco-Santos et al. (2007) consider that features are the characteristics that are seen as necessary and/or sufficient for the existence of a measurement system.

It is obvious that processes and customer focus are the two fundamental aspects of BP/BPM. Stalk and Hout (1990), Armistead and Pritchard (1999) and Rosemann and de Bruin (2005) indicated that companies should use metrics and measures to capture various BP activities that ensure customers are satisfied, and that the products produced are of high quality. These assertions are consistent to the precursors of BPR (Hammer and Champy, 1993; Davenport, 1993; Rummler and Brache, 1995).

Information and communication are also vital to BPM. These form parts of Workflow. Many authors (McCarthy, 1982; Kueng and Krahn, 1999; Kueng, 2000; Alter, 2010)
consider that an information system (IS) is part of BPM. Information and communication are required to capture results of performance of activities/things measured in order to ascertain whether or not past performance meet business goals. An important aspect of IS is the organization’s ability to utilize IT and data to be shared among users (McCarthy, 1982).

Obviously, management is considered a vital function for BPM and performance measurement for:

- controlling and evaluating BP;
- management of workflows; and
- provides more efficient management of resources, people and information (Powell et al., 2001; Gonzalez et al., 2010; Doebeli et al., 2011).

4. Fundamentals of PMS and its relevance to BPM
4.1 Fundamentals of PMS identified
The information in which this paper is interested was extracted from sources of the literature of the business, non-business and public sectors. The literature extraction reveals that there are 30 articles that provide substantial coverage of the fundamentals of PMS. Four of these articles provide fundamental coverage of both performance measurement (PM) as well as PMS, thus making a total of 34 identified articles with fundamental coverage of PMS. 17 of these articles come from Franco-Santos et al. (2007). Many of the definitions/indications are broad, and there are too many interrelated terms that mean more or less the same thing – for example, measures and metrics are used indiscriminately and interchangeably. Therefore, modifications of the definitions/indications were made if the words/terms/phrases are either ambiguous or unclear. The modified definitions/indications selected from the literature and the results of the content analysis, sorted by publication date in chronological order are presented in Table III – Columns 1 and 2.

The fundamental coverage, which comprises of definitions/indications and reviews of PMS extracted from the reviewed literature exhibit the diversity of the subject content with no coherent explanation of the purpose, function and use of PMS. Hence, there is a need to analyse the content of the various articles systematically.

4.2 Results of the fundamentals of PMS reviewed
When analyzing the fundamentals of PMS that has relevance to BPM, this paper uses the same seven categories of grouping which BPM authors visualize would capture the essence of measurement in terms of BPM perspective (see previous section). The seven categories are:

1. systems and components (Sys);
2. goals (Goal);
3. features (Feat);
4. processes (Proc.);
5. information and communication (Com.);
6. customer focus (Cust.); and
7. management (Man.).
Table III. PMS, its fundamentals and relation with the measurement needs of BPM

<table>
<thead>
<tr>
<th>Authors</th>
<th>Fundamental expression</th>
<th>Sys</th>
<th>Goal</th>
<th>Feat</th>
<th>Proc</th>
<th>Com</th>
<th>Cust</th>
<th>Man</th>
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<tbody>
<tr>
<td>(Rogers 1990) in Smith and Goddard (2002, p. 248)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>BPMS provides a set of planning and review procedures for individual units and ensuring that they align with the overall strategy of the organization&lt;sup&gt;a&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Lynch and Cross (1991)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>A SPMS is IS, management and accounting based system that provide and help interpret information&lt;sup&gt;a&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Eccles and Pyburn (1992)</td>
<td>SPMS comprises of integrated sets of performance indicators in quantitative and qualitative forms that represent a particular business performance model</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>McGee (1992, pp. B6-1-B6-3)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>SPM is managerial that consists of components: (1) performance metrics (old and new) and measures used to measure performance and reporting of business activities and stakeholders relationship&lt;sup&gt;a&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Lebas (1995, p. 35)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>PM is a MS consists of various measures: key success factors, detection of variance, check the validity of the cause-and-effect relationships among the measures&lt;sup&gt;a&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Neely et al. (1995, pp. 80-81)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>PM is the process of quantifying the efficiency and effectiveness of action</td>
<td>✓</td>
<td>✓</td>
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<td>PMS is the set of metrics used to quantify both the efficiency and effectiveness of actions at three different levels: (1) individual performance measures, (2) entity level performance measures (financial and nonfinancial reporting) (3) relationship between PMS and environment within which it operates (e.g. customer satisfaction)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>✓</td>
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<tr>
<td>Kaplan and Norton (1996, p. 59)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>A strategic performance measures from four measurement perspectives: financial, customer, internal and learning, and growth&lt;sup&gt;a&lt;/sup&gt;</td>
<td>✓</td>
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<tr>
<td>Bititci et al. (1997, p. 533)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>PMS is a IS that is essential for effective and efficient functioning of the management process&lt;sup&gt;a&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>Harbour (1997, p. 8)</td>
<td>PM is the process of measuring work accomplishments, output and in-process parameters that affect work output and accomplishments&lt;sup&gt;a&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Nadzam and Nelson (1997, p. 546)</td>
<td>The use of both outcomes and process measures to understand organizational performance and effect positive change to improve care.&quot;</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Atkinson et al. (1997)</td>
<td>PMS refers to contractual relationship between stakeholders and the organization where it focuses on strategic roles. PMS is the tool used to monitor organizational-stakeholder relationship.</td>
<td>S</td>
<td></td>
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<tr>
<td>Atkinson (1998)</td>
<td>SPM is contractual relationship between (1) owners and organization in which it undertakes strategic and management accounting activities for owners; and (2) activities that the organization’s employees use to promote success. The SPM process includes measuring activities, monitoring achievement and revising objectives, facilitates leaning and tie incentive pay to performance measurement results.</td>
<td>S, A</td>
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<td>Neely (1998, pp. 5-6)</td>
<td>PMS is a IS that measure, provide feedback and control mechanism to the firm.</td>
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<td>Marshall et al. (1999, p. 13)</td>
<td>PM means the development of indicators and collection of data to describe, report on and analyze performance of a government services or community or both.</td>
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<td>Otley (1999, pp. 346, 364)</td>
<td>PMS has many components: (1) objectives, (2) strategy, (3) targets, (4) rewards, (5) information flows (feedback and feed-forward). They are used as an IS in assisting managers in evaluating performance.</td>
<td>S, IS, MO</td>
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<td>Gates (1999, p. 4)</td>
<td>SPMS consists of financial, strategic and operating measures to gauge performance.</td>
<td>S, A</td>
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<td>Forza and Salvador (2000, p. 359)</td>
<td>PMS is a IS that support management: (1) enabling and provision of communication; (2) collecting, processing and delivering information on the performance of people and non-people activities.</td>
<td>IS, O</td>
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<td>UK CAG (2000, p. 2)</td>
<td>“PM and reporting are intrinsic to the whole process of public management, including planning, monitoring, evaluation and public accountability.”</td>
<td>S, M, O</td>
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<td>Maisel (2001, p. 12)</td>
<td>BFMS is strategic and operating mechanism that enables an enterprise to plan, measure and control its business and people performance to ensure they are aligned with business strategies and create shareholder value.</td>
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<tr>
<td>Kueng et al. (2001, p. 6)</td>
<td>PMS is a system that consists of five basic elements: people, procedures, data, software and hardware and is aimed to evaluate the success of a system’s implementation and continuously to improve the performance of the system measured.</td>
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<td>Neely (2002)</td>
<td>“PMS is a balanced and dynamic system that is able to support the decision-making process by gathering, elaborating and analyzing information.”</td>
<td>IS, M</td>
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<tr>
<td>Kanji (2002, p. 718)</td>
<td>The requisites for a good PMS are: (1) based on the Critical Success Factors (CSF) or performance drivers; (2) provides performance from a multi- and interrelated perspectives and enables comparisons to be made, highlights and suggest improvement (strategies) and progress to be monitored; (3) linked to the organization’s values and strategy, rewards’ system and encourages the appropriate behaviours; (4) valid, reliable and easy to use(^a)</td>
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<tr>
<td>Kerssens-van Drongelen and</td>
<td>PM is measurement and reporting for external, internal stakeholders and auditors(^a)</td>
<td>✓</td>
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<td>Fisscher (2003, p. 52)</td>
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<tr>
<td>Bourne et al. (2003, p. 4)</td>
<td>BPMS consists of measures used to measure planning and management of business(^b)</td>
<td>✓</td>
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<tr>
<td>Ittner et al. (2003, p. 715)</td>
<td>SPMS provides (1) information; (2) aligns management processes to evaluate performance with strategy(^c)</td>
<td>✓</td>
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<td>Julnes (2007, p. 1450)</td>
<td>PM is ongoing and refers to the production of information about an organization’s performance (e.g. inputs, outputs, outcomes, efficiency) with regard to services and program(^a)</td>
<td>✓</td>
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<td>Marchand and Raymond (2008, p. 665)</td>
<td>The basic notions that underlie PMS have also evolved over time in which these systems are conceptualized, designed, and implemented in organizations. These notions include: (1) the focus of PMS, namely the notion of performance itself and its dimensions; (2) the performance logic that guides the design of PMS (architecture and performance measurement framework); and (3) the system characteristics of PMS (definition, organizational role and information output)</td>
<td>✓</td>
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<tr>
<td>Serrat (2010, pp. 1-2)</td>
<td>Performance measurement is the process of gauging achievements against stated goals. Performance is an amalgam of dimensions – relevance, efficiency, effectiveness, sustainability and impact (some of which may conflict) and therefore, measuring it requires an appropriate basket of benchmarks(^a)</td>
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<td>US DOE (2012) Appendix E</td>
<td>“Performance measurement is the process of measuring the performance of an organization, a program, a function, or a process.” “PMS is the organized means of defining, collecting, analyzing, reporting, and making decisions regarding all performance measures within a process.”</td>
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|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|------|------|------|
| US GAO (2012), Appendix A | “PM is the ongoing monitoring and reporting of program accomplishments, particularly progress towards preestablished goals. It is typically conducted by program or agency management.”
“A system of performance measurement is a strategic one that is needed to evaluate performance so that the continuous improvement process can be judged by the use of appropriate performance indicators, or performance measures.” | S    |      |      |       |      |      |      |

This is contained in Table III – Columns 3-9:

1) Systems and components: some authors (Lebas, 1995; Neely et al., 1995; Atkinson, 1998; Otley, 1999; Kueng et al., 2001; Neely, 2002; Marchand and Raymond, 2008; US GAO, 2012) defined the PMS in terms of a system. No doubt these authors prescribed that a PMS has many components, but they are not based on the systems approach or scientific methods (Franco-Santos et al., 2007), or that the modern PMS is not based on systems theory because of cognitive managerial limitation (Taticchi, 2010). These authors implied that a PMS itself has no meaning as it requires various components to establish measurement criteria that provide the infrastructure of the measurement system. These and a few other authors indicated that measurement of activities/things is not only confined within the organization but it also requires a constant interaction with the environment (Lebas, 1995; Neely et al., 1995; Atkinson, 1998; Harbour, 1997; Nadzam and Nelson, 1997; Kerssens-Van Drongelen and Fisscher, 2003). The PMS and its components as articulated by these authors were described generally and are largely prescriptive.

2) The goals of PMS were discussed as measurement goal(s) and performance goal(s), but they appeared to be used interchangeably (Neely et al., 1995; Kaplan and Norton, 1996; Kanji, 2002; Julnes, 2007; Serrat, 2010; US GAO, 2012), and they include strategic, managerial and operational goals; however many authors (Gates, 1999; Maisel, 2001; Ittner et al., 2003; US DOE, 2012) stated that PMS goals are strategic. Measurement/performance goals were commonly used for measurement, planning, contractual obligations and comply with stakeholders’ requirements. The goals of measurement are to:
   • ensure the alignment with business strategy (Rogers, 1990; Maisel, 2001; Ittner et al., 2003);
   • achieve desired performance levels consists of measures to gauge performance (Harbour, 1997; Gates, 1999; Serrat, 2010; US DOE, 2012); and
   • provide performance from a multi- and interrelated perspectives and enables comparison to be made (Kanji, 2002).

Only three selected articles have provided discussions of measurement/performance goals in relation to BP Lebas (1995); and Harbour (1997) indicated that PMS is the process in measuring work accomplishments; and to Nadzam and Nelson (1997), the use of process measures is to provide us with an understanding of organizational performance and effect positive change for improvement:

   • The features of a PMS consist of data (variables), measuring (measurement) system, and the method(s) used for measurement (Franco-Santos et al., 2007). Data (variables) can be quantitative or qualitative (Rogers, 1990; Nadzan and Nelson, 1997; Otley, 1999; Gates, 1999; UK CAG, 2000; Serrat, 2010); however most data as used by organizations are commonly cited to be financial. The measuring system consists of measuring attributes (measurers), and methods used to measure activities/things within an organization. Many authors of the selected articles indicate that the PMS itself is useless as the implementation of measurement can only be effected through its attributes such as performance measures or measures of performance (Lynch and Cross, 1991; Eccles and Pyburn, 1992; Neely et al., 1995; Kaplan and Norton, 1996; Gates, 1999;
Maisel, 2001; Bourne et al., 2000). The PMS and its likely attributes are contained in Table IV. Table IV shows that the four attributes commonly mentioned by authors of the selected articles are measures, metrics, indicators and drivers. Only three articles use the term “driver” when discussing PMS, but these authors are not explicitly clear in what they described as the term could refer to business drivers (which is actually an input in cost form) (in the case of Ittner et al., 2003) or performance indicators (in the case of Kaplan and Norton, 1996). Business drivers are not measurers of performance (Fitz-Gibbon, 1990) since their meaning can be construed to be “input” or “indicators” rather than as attributes for PMS.

The implementation of the attributes is corroborated with the use of measurement methods (Nadzan and Nelson, 1997). Most commonly, in a business organization, the measuring method is the assignment of monetary value to a transaction based on the double-entry book-keeping system.

- The processes function of PMS cited by the authors of the selected articles consists of various activities: measures, design/selection, data capture, measurement, information, monitoring and performance evaluation, interpretation,

<table>
<thead>
<tr>
<th>Authors</th>
<th>Measure</th>
<th>Metric</th>
<th>Indicator</th>
<th>Driver</th>
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<tr>
<td>Rogers, 1990</td>
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<td>Lynch and Cross (1991)</td>
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<td>Eccles and Pyburn (1992)</td>
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<td>McGee (1992)</td>
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<td>Lebas (1995)</td>
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<td>Marchand and Raymond (2008)</td>
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<td>US GAO (2012)</td>
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Note: The article devotes substantial discussion (not just passing reference) of these four attributes
and review procedures. When describing performance measurement as a process, most authors of the selected articles (McGee, 1992; Lebas, 1995; Neely et al., 1995; Harbour, 1997; Forza and Salvador, 2000; Kerssens-Van Drongelen and Fisscher, 2003; Serrat, 2010; US DOE, 2012) described it as a conversion of input to output that must adhere to stated objectives or goals, which is a long-term task needed to evaluate and report performance, rather than focusing on how the conversion is effected in terms of production or BP.

- Information and communication. Communication is commonly discussed by the authors of the selected articles: the communication function of a PMS includes an IS or a management information system (MIS), reporting, feed-forward and feedback mechanisms (Harbour, 1997, p. 8); PMS is an IS that supports management by enabling and the provision of communication on the performance of people and non-people activities (Forza and Salvador, 2000, p. 359); performance measures assist organizations to communicate objectives and priorities (UK CAG, 2000, p. 10); measurement is to provide information, motivation and accountability to aid decision-making (Kanji, 2002); measured activities are communicated to stakeholders (McGee, 1992, p. 2; Atkinson et al., 1997, p. 31; Maisel, 2001; Kerssens-Van Drongelen and Fisscher, 2003, p. 55); performance measurement and monitoring ensure that the program (project) is attuned to its objectives in a sustainable basis (Otley, 1999; p. 346; Julnes, 2007, p. 1450; US GAO, 2012, Appendix A). It appears that there is no consensus to whom and for what purpose measured activities/things ought to be communicated.

- Customer focus is cited by only a few authors of the selected articles (Neely et al., 1995; Kaplan and Norton, 1996; Atkinson et al., 1997; Atkinson, 1998; Kerssens-Van Drongelen and Fisscher, 2003). These authors described customers as vital stakeholders entitled to receive information on performance measurement. In particular, Kaplan and Norton (1996) stressed the need for the use of multi-dimensional measures to cater for customer satisfaction so that the organization’s business activities can be sustained in an ongoing process. Other than these, there is no articulation as to how performance measurement is needed to evaluate quality of products, production, or value creation.

- Management: Nearly half of the authors of the selected articles (McGee, 1992; Neely et al., 1995, 2005; Lebas, 1995; Bititci et al., 1997; Atkinson, 1998; Otley, 1999; Forza and Salvador, 2000; UK CAG, 2000; Neely, 2002; Kanji, 2002; Bourne et al., 2003; Ittner et al., 2003; US DOE, 2012; US GAO, 2012) have indicated that performance measurement is aimed towards more effective management, and that the PMS and management system (MS) together should provide a balanced and dynamic system that enables support of decision-making processes by gathering, elaborating and analyzing information.

In addition, another five authors of the selected articles (Rogers, 1990; Lynch and Cross, 1991; Eccles and Pyburn, 1992; Gates, 1999; UK CAG 2000) (Table III) also indicated that measurement roles are linked to managerial roles; although their emphasis of the managerial impact on performance measuring is less significant to the authors who have propagated a direct link between measurement and management. Nevertheless, these two groups of PMS authors account for nearly three-quarters of the authors of the selected articles.
The analysis of the results of the fundamentals of PMS identified revealed that there is no consensus in the ways in which PMS were discussed and promoted in the literature. In particular, it was found that the PMS fundamental characteristics have not focused on BPM, but instead PMS were described to be more inclined in measuring workflow.

5. Discussion

5.1 Analysis and discussion of PMS fundamentals reviewed

The measurement needs of BPM, the results of the fundamentals of PMS reviewed in the literature survey, and this paper’s proposed actions are summarized in Table V.

Table V is organized as follows: the horizontal columns are the seven key measurement fundamentals based on BPM philosophy (as discussed in Section 3.3); and the vertical rows are organized in three modes:

1. BPM requirements (as discussed in Section 3.3);
2. results of PMS fundamentals reviewed (as discussed in Section 4.2); and
3. the author’s proposed actions.

Analysis of the discussions by various authors in the PMS and BPM literature indicates that, by and large, the PMS as advocated by various authors for over 20 years (since 1990) failed to fulfill the measurement requirements of BPM. This is alarming considering that critics of PMS have criticized that the PMS are ill-equipped to provide measurement for BPM only in isolated or specific cases such as IT (Kueng et al., 2001; Jacks et al., 2011). These findings revealed that Kuwaiti and Kay’s (2000, p. 1416) notion stating that a PMS is a prerequisite to the introduction of an effective BP in organizations cannot hold. The discussion of each of the key measurement fundamentals pertaining to PMS and BPM are as follows.

While the precursors and key authors of BPM consider that BPM is a holistic management structure where many PMS authors have defined/indicated PMS to be a system or consisting of various components. By definition, a holistic structure is any set or group of interdependent or temporally interacting parts – that are generally systems themselves (Dettmer, 2011, p. 8). Although the PMS has been defined/indicated as a system, the PMS as discussed in the literature is a normative “totality” (whole) concept that is based on the traditional analytical approach to measurement and management. Dettmer (2011, p. 8-9) argued that the traditional analytical approach to management is counter-productive, and a holistic, or system approach is considerably better suited to the kinds of complex organizations we usually encounter today. This is because the systems approach represents synthesis-thinking with an integrated perspective about the whole enterprise. To Dettmer (2011), analysis tells us how the individual parts function whereas synthesis tells us how the various parts work together. Dettmer’s (2011) preference of the synthesis-thinking over the analytical approach indicates strongly that the CF would be an appropriate proposition for use in BPM measurement since the CF is largely based on the synthesizing concepts. Goals of PMS were discussed in terms of measurement or performance goals and they were often used interchangeably (Rogers, 1990; Gates, 1999; UK CAG, 2000), thus causing confusion as to their appropriateness. Measurement goals and performance goals are distinct. A measurement goal, as discussed in the literature, relates to the measurement of activities/things such as the measuring of time taken of document processing in the form Are PMS meeting needs of BPM?
<table>
<thead>
<tr>
<th>Modes</th>
<th>Systems and components</th>
<th>Goals</th>
<th>Features</th>
<th>Processes</th>
<th>Information and communication</th>
<th>Customer focus</th>
<th>Management</th>
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<tr>
<td>Measurement needs of BPM</td>
<td>BP consists of components and management is needed to manage and measure the complex interactions of activities within the organization. As BP are varied, requiring various measurements that suit different circumstances and goals of different organizations, the CF is suitable for use in integrating a measurement system that can cater for BP. BPM consists of components but not based on systems approach (theory).</td>
<td>Measuring BP is to ensure business goals are met and the key goal is to measure value to organizations and customers. Performance indicators and measures are required to possess the attributes required in BP to measure (quantify) the organization achievement in terms of (1) quality; (2) time (throughput); (3) cost; and (4) flexibility.</td>
<td>BPM is based on a process architecture that captures the interrelationships between key BP together with enabling support processes (people and non-people functional roles) and their alignment with the strategies, goals and policies of an organization.</td>
<td>Main objective of PMS is to provide comprehensive and timely information and document processing on the performance of BP in order to improve the competitiveness of BP sustainably. This function is part of workflow.</td>
<td>Preferrably time-based metrics be used in measuring BP. PMS processes are varied but focus on the conversion of input data to output information that relates more to workflow than BP.</td>
<td>BP needs to focus on quality of products and customer satisfaction in order to be competitive in the market.</td>
<td>BPM is a management discipline that requires organizations to shift to process-centric thinking in terms of organization and measurement. Measurement is fundamental in BP and the application of measures improves BP so that the organization can be more effectively and efficiently managed.</td>
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<td>Results of fundamentals of PMS reviewed</td>
<td>PMS goals are unclear as measurement and performance goals are used interchangeably. BP goals not widely discussed. Data used by organizations can be qualitative or quantitative but are usually financial (accounting). PMS authors consider three valid measuring attributes: metrics, measures and indicators.</td>
<td>PMS goals are unclear as measurement and performance goals are used interchangeably. BP goals not widely discussed. Data used by organizations can be qualitative or quantitative but are usually financial (accounting). PMS authors consider three valid measuring attributes: metrics, measures and indicators.</td>
<td>PMS information is largely workflow and there is no consensus to whom and for what purpose measured information ought to be communicated.</td>
<td>Customer focus is largely ignored by PMS authors and lack of articulation on how performance measurement is needed to evaluate quality of products, production and value creation.</td>
<td>Nearly three-quarter of PMS authors consider that performance management is aimed towards more effective management and IS be combined with PMS for better support of decision-making processes.</td>
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<td>Proposed actions needed to address deficient measurement needs of BPM</td>
<td>To structure PMS to align with BPM in terms of systems theory (approach) and base on CF. Needs to differentiate between measurement and performance goals. BP goals should be incorporated as part of measurement and performance goals.</td>
<td>Needs for qualitative and nonfinancial attributes such as in today's knowledge economy many activities (esp. customer) are qualitative and nonfinancial. Research and practitioners should adopt the three valid measuring attributes: measures, metrics and indicators for measuring BP.</td>
<td>While processes relating to workflow are relevant and useful to an organization, BP should be given prominent.</td>
<td>Ensure stakeholders are clearly defined so that measured information can be determined and communicated properly for both workflows and BP purposes.</td>
<td>Emphasis on customer focus by measuring BP to evaluate quality of products and level of customer satisfaction.</td>
<td>This is perhaps, the only area where PMS is attuned with BPM.</td>
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Notes: BP – business process, BPM – business process management, PMS – performance measurement system
of purchase orders. Measurement, as discussed in the literature, refers to the assignment of numbers. A performance goal is often viewed by PMS authors as an accomplishment that meets a particular target. For instance, a performance goal is defined “as the targeted level of accomplishment expressed as a tangible and measurable objective against which actual achievement is compared” (Harbour, 1997, p. 8). While measurement and performance goals were often discussed by authors of the selected articles, they were largely confined to workflows, only three selected articles (Lebas, 1995; Harbour, 1997; Nadzam and Nelson, 1997) have discussed the goals in relation to BP. However, both of them did not go far enough to articulate the importance of BP goals in relation to measurement, for example, how BP goals ensure processes are measured promptly and accurately so that an evaluation can be made to ascertain whether the organizational goals in term of revenues and costs can be achieved.

The features of PMS were largely financial (accounting) and, due to these, today’s PMS still lack effective measurement of nonfinancial aspects, and they are not focused upon BPs (Kueng and Krahn, 1999, p. 15). While accounting data and information cannot be substituted, some authors (Eccles and Pyburn, 1992; Kaplan and Norton, 1996; Kanji, 2002; Ittner et al., 2003) consider accounting measures are lagging indicators, backward looking or historical and do little (or are even useless) to predict future performance. Since a driver cannot be considered as a measuring attribute (Fitz-Gibbon, 1990) the three remaining attributes as cited by PMS authors are measures, metrics and indicators. Analysis of these terms is difficult as these attributes were simply described as quantitative or qualitative criteria, or financial and nonfinancial forms. To clarify this ambiguity, reference is made to William Trochim, an authority on social science measurement. According to Trochim (2006), a measure, metric and indicator are the three valid measuring attributes, and each of these play different roles.

To BPM, a key item is the ability to identify and/or develop predictive performance measures for a range of activities, and, preferably, firms should supplement non-financial performance information with more relevant nonfinancial information (Eccles and Pyburn, 1992; Neely et al., 1995, 2005; Kanji, 2002; Ittner et al., 2003; Šškrinja et al., 2008; Taticchi et al., 2010; Serrat, 2010; Gonzalez et al., 2010; Jacks et al., 2011). The non-financial information can be captured via an indicator. Suppose an organization wants to measure profitability, the values that are assigned to the attributes are shown in Figure 3.

![Figure 3. The relationship among the data (variables), and the values that are assigned to the attributes](source: Adapted from Trochim (2006))
That variable has a certain attribute in which it will be operationalized by either a measure, metric or indicator, i.e. each of these measuring attributes measures different thing, say Value 1 is in the form of net profit, Value 2 is net profit percentage, and Value 3 indicates increase/decrease of net profit from previous year. Researchers and practitioners should adopt these three valid measuring attributes when measuring BP.

While the PMS authors of the selected articles did discuss processes; their descriptions were purely about measurement process, i.e. measurement is the transformation of input to output in various activities such as performance process linking to strategies, the provision of information and communication (McGee, 1992), process of creating income (Lebas, 1995), costs associated with the processing of customer complaints, customer returns, field services, warranties, process quality control, and order processing lead time (Neely et al., 1995). Process refers to the transformation and blending of a set of inputs into a (hopefully) more valuable set of outputs (products, services, tasks, and even “improved” people) (Harbour, 1997), processes must support managers and typical processes are data collection and the processing of information, strategy formulation and revision, process quality control, monitoring and performance evaluation of production process, and evaluation of people performance (Forza and Salvador, 2000), processes involve various activities such as target-setting process, budgeting process, reward process, process of responsibility and authority assignment, acceptance, facilitation and accountability; all of which are needed for external reporting and evaluation process (Kerssens-Van Drongelen and Fisscher, 2003). The purpose of performance measurement is to measure outcomes, combined with input, output, and process measures that appreciate the effects of exogenous factors (Serrat, 2010). Performance measurement goal is to arrive at sound decisions about actions affecting the product or process and its output, and it is concerned with process optimization through increased efficiency and effectiveness of the process or product (US DOE, 2012). These authors discussed processes mainly consisting of workflows and functional aspects of business activities rather than a focus on production or BPs. These findings are consistent with Franco-Santos et al. (2007) in which they found that the processes of a business PMS are the series of actions that combine together to constitute the business PMS, and a majority (53 percent of the authors of the papers reviewed) cited that information provision as the key BP.

Although the works of these authors of the reviewed articles are useful, however, a majority of them adopt the view of process as a simple, cause and effect workflow that has prevailed for the last 50 years or so, despite an acknowledgement by a minority of these authors, and other authors in the management, operations research and IS fields that PMS are systems, suggesting that measurement should be devised for BP rather than on workflow or on business functions. No doubt a process can be cross-functional (Davenport, 1993; Sethi et al., 2001; Troy et al., 2008); however, the important aspect is how one measures a production or BP where we can see the transformation that occurs in the process, and determine should we add value to the input and create an output that is more useful and effective to the recipient either upstream or downstream (Johansson et al., 1993). The process criterion also emphasizes the links between activities and the transformation that takes place within the process or function. Within an organization, a process constitutes many stages of inputs and outputs. For example, the production of cellular phones may consists of 22 stages (which means there will be 22 sets of inputs and outputs. The output of stage one will be the input of stage two and so on. The extensive literature survey has not picked up any article that has extensively articulated on this aspect.
For any organization, measurement is implemented at every level although some PMS authors of the selected articles (Rogers, 1990; Lynch and Cross, 1991; Eccles and Pyburn, 1992; McGee, 1992; Kaplan and Norton, 1996; Atkinson et al., 1997; Atkinson, 1998; Otley, 1999; Gates, 1999; Maisel, 2001; Ittner et al., 2003) regarded the PMS as strategic. However, the philosophy of BP also requires attention for measurement at the operational level in order to capture performance of input and low-level process activities. Andersen (1995) and Rigby (2007) indicated that performance measurement at the operational level can be carried out effectively using benchmarking. These authors posit that to measure performance, a standard requires a benchmark (criterion) to gauge activities (things) measured against which individuals are compared and evaluated. Measuring performance using benchmarking is a new paradigm of measuring productivity as it provides a “softer” approach in measuring performance more effectively and efficiency; for instance using a qualitative metric to measure intangibles (Andersen, 1995).

While the emphasis of management and IS be combined with PMS should provide for better support of decision-making processes that are consistent with BPM, most authors of the reviewed articles were of the opinion that information and communication relating to measurement such as enabling, provisioning, motivating and accountability purposes that are used to support decision-making by managers are largely workflow activities. Moreover, there is no consensus as to whom the various kinds of information ought to be communicated; suggesting that the communication channel, stakeholders, and goals of information and managerial aspect of measurement are not specific enough for use in BPM.

Most PMS discussed by the authors of the selected articles either ignore customer focus, customer satisfaction, value creation or only make passing comments of customer needs. While a few authors of the selected articles (McGee, 1992; Neely et al., 1995; Atkinson et al., 1997; Atkinson, 1998; Kerssens-Van Drongelen and Fisscher, 2003) have discussed the importance of customers as stakeholders, however, they neglected to discuss the influence of customer value in a BP, and how customer value may drive improvements of product and process quality. The exception is Kaplan and Norton (1996) who dealt with customers elaborately.

Lastly, BPM is a managerial discipline and PMS is found to be a managerial discipline (albeit in this literature review); thus, this suggests that both disciplines are in unison on the need for management in measurement.

5.2 Proposal for an IBPMMSS
The analysis and discussion of Section 5.1 reveals that the current PMS as expounded by various authors of these selected articles have largely failed to meet the measurement needs of BPM. Therefore, there is a need to develop a measuring framework to improve quality attributes that are valuable for customers, and which addresses both internal and external causes of quality-related problems (Higgins, 1998). Yen (2009) considered that one way out of this predicament is to propose a theoretical integrated framework that encompasses measures (measuring attributes) and BPs that can be implemented to compare performance within BP organizations.

This paper concurs with the approach of Yen, and proposes a theoretical integrated framework that encompasses a MS that combines with a PMS and the popular VC philosophy in order to model, measure and evaluate BP. The theoretical consideration for the framework is based on a systems approach as articulated by Berretta (2002), Alfaro et al. (2007) and Alter (2010), and structured along the CF. Kurtz and Snowden...
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(2003) believe that the inherent characteristics of natural systems that are enshrined in the CF can be addressed to make sense of any business situation for measurement to take place. Thus, a merit of using the CF is that it allows organizations of various complexities, and life cycle to re-structure their subsystems of processes and their domains differently. Given a hypothetical case of an organization having different complexities of their BPs (Table VI), the CF can be applied by taking the suggestion of Kurtz and Snowden (2003).

Table VI shows that four domains can be acted in stages in a clockwise fashion starting from the domain of chaos (unknown) to the order domain of ordering of ideas, formulation and testing of solutions to knowable problems, until those known solutions are implemented as part of everyday ritual with the use of best practice. The inventory process will have to be acted upon immediately in response to the chaotic (unknown) domain. The next domain to be acted upon is the marketing and sales process, where the problems and solutions arise from circumstances, often unpredictably, and employees and managers within the sub-system are able to observe the impact of the problems, learn and adapt accordingly to achieve desired results. The complicated domain will be the next to be examined. In this domain, the cause-and-effect analysis is only as good as the knowledge of system or environment that one has available, but fortunately, in this domain, information is usually available somewhere, and it just a matter of research and time to find it. Finally, the sales process, due to its clear cause-and-effect relationship, which is well understood by everyone in the sub-system, will be structured along the simple (known) domain. The outcome in restructuring the BPs in accordance to the CF is shown in Figure 4.

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<tr>
<th>Business process</th>
<th>Domain</th>
<th>Explanation</th>
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<tr>
<td>Purchases</td>
<td>Simple</td>
<td>Sub-system operates in a stable context characterized by clear and well-defined rules that are easily discernible by everyone in the sub-system</td>
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<tr>
<td>Inventory (supply-chain)</td>
<td>Chaotic</td>
<td>Sub-system is turbulent with 20,000 items of components and raw materials, unaccounted number of work-in-process, and 120 different finished goods products. There is no systematic coding scheme and users are not able to differentiate different items and categories of inventories</td>
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<tr>
<td>Production</td>
<td>Complicated</td>
<td>Sub-system operates in a fairly well-defined variability and relatively uncertainty but stable environment. There are various tools and methods of production that are used (can be used) in transforming raw materials to finished products; however employees and managers do not have the right answer in choosing the best tools and methods for use. There are frequent but solvable issues relating to capacity planning and production scheduling</td>
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<tr>
<td>Marketing Sales</td>
<td>Complex</td>
<td>Due to constant changing external environment such as changing product type, customer taste and competitive advantage, many emerging issues arise that affect adopting the right marketing strategy and knowing how to constantly satisfy customers. However, marketing and sales staff are adaptive and resilient in the face of perturbation. Employees and managers have some latitude to react to those issues and circumstances by changing the work system, though both the system and human resources constrain one another</td>
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</table>

Table VI. A hypothetical case of an organization having different domain complexities (based on CF) in relation to their business processes
This proposed integrated system is termed the IBPMMS. An illustration of the IBPMMS with its various sub-systems is shown in Figure 5.

Figure 5 shows that the BP is well integrated with a measurement system. Obviously, the IBPMMS will be IT-and IS-based to facilitate the exchange of data and information electronically both within and across organizations using distributed network technology. This framework will need to have a centralized database designed to be used in a shared data environment where data comprising of various economic resources and economic
events are schematically structured to relate to various BPs and transactions, similar to the REA. The database and the associated software are schematically structured to relate to various business transactions such as sales, purchase, employee, inventory and others that are used by accounting and non-accounting users. Since many of today’s business activities can be automated, the throughput concept is suitable for use in the measuring of automated operations, as the concept (in the operations management context) is concerned with the speedy movement of inputs and outputs through a process or a sequence of operations, and value-creation/lost can be identified in each stage of the process (Hopp and Spearman, 2000).

To implement the BPM within the confines of the IBPMMS, we need to map the BPM so that the implementation will be attuned to the objectives of BPM. The mapping system is devised to trace a set of sequential processes and sub-processes, and the various alternative paths depending on certain conditions as applicable, performed to achieve a given objective or produce given outputs. These BP are designed to be operated by one or more business functional units, and emphasize the importance of the “process chain” rather than the individual units. Hence, a VC system with its “process chain” architecture would be a suitable candidate in the processing of BP activities, and measure their performances from the various stages of the BP. Using the VC approach has its advantages as it avoids the traditional functional organizational structure and the archaic measurement system. A VC organizational structure has fewer levels of hierarchies (i.e. flatter or more horizontal), and hence there are fewer staff and less communication channel between staff and managers (Anderson, 2007). The traditional measures and metrics have a tendency to be focused on the individuals or the functions, not the processes that are at the core of management, and due to these factors, it encourages a short-term vision (Kanji, 2002). An illustration of a simple VC system, based on Porter (1985) pertaining to the IBPMMS is shown in Figure 6.

Figure 6 shows the VC with the entire BP divided into a series of process activities and tasks pertaining to the production of goods in which each step of the process adheres to a set of stated goals that eventually form the overall goal of the organization. By adhering to the goal congruence, the IBPMMS provides that activities are performed within and across the functions in conjunction with the operations of the system and not as separate entities and so that activities and measurement of activities revolve around the system and its objective, rather than as isolated functions.

**Figure 6. Proposed measurement and evaluation of business process activities based on the VC philosophy and measuring attributes of measures, metrics and indicators**

**Notes:** Per unit = PU; Cur = Current (actual); Fut = Future projected; CS = Customer satisfaction
Thus, adapting the organization to the systems concept places emphasis upon the integration of all activities toward the accomplishment of over-all objectives but also recognizes the importance of efficient sub-system performance so that the various processes can be measured and managed based on continuity.

Notice that in Figure 6 the measurement and evaluation of performance of the various BP is structured in such a way that by using the three valid measuring attributes: measures, metrics and indicators (see earlier discussion and Figure 3), the various BP and its sub-systems can be measured differently to suit the circumstances and goals of their different needs or processes. For instance, in the purchases process (sub-system), the measure is used to measure the total purchase cost (or other bases, e.g. per month basis), the metric is used for measuring the standard unit cost of materials purchased while in the inventory/supply-chain process, the measure measures the cost of raw materials sent to production, the metric is devised to measure the standard (in minutes) delivery rate of materials sent to production, and the indicator is used to measure the deviation of the delivery rate sent to production, and so on. Thus, by basing on BP, the IBPMMMS enables measurement to focus on value-added activities. This is consistent with the measurement methodology of BP of Kueng and Krahn (1999, p. 7). They stated that a measurement system is needed that is focused upon processes and not on organization units, since effective process supported by effective management ensures business success. In essence, it is BPM that provides for managing, measuring and evaluation of performance through BPs which help to improve the company’s performance in a more and more complex and ever-changing environment (Thiault, 2012).

6. Conclusion
This paper examined the fundamentals of PMS in an effort to determine, whether or not, PMS are suitable for BPM. By conducting an extensive literature survey on the fundamentals of PMS from the business, public and non-profit sectors, this paper found that, by and large, the PMS as discussed by various authors for over 20 years (since 1990) failed to fulfill the measurement requirements of BPM. This is alarming considering that past critics of PMS have indicated that the weaknesses of PMS in providing adequate measurement for BPM applied only in isolated or specific situations such as IT (Kueng et al., 2001; Jacks et al., 2011). This paper also finds that the lack of BPM measurement focus pertaining to PMS is consistent to past studies (Kueng and Krahn, 1999; Kueng, 2000; Kueng et al., 2001; Gardoso et al., 2004; Yen, 2009; Gonzalez et al., 2010; Glykas, 2011; Jacks et al., 2011). These findings dispel the notion (advocated by Kuwaiti and Kay, 2000) that a PMS is a prerequisite to the introduction of an effective BP in organizations. This paper identified five major weaknesses concerning measurement in BPM perspectives:

1. While PMS authors did discuss processes; their descriptions are purely on measurement process, and the focus of measurement is in terms of functional or workflow aspects rather than a focus on production or BPs.

2. The goals of PMS as articulated by PMS authors were unclear (measurement and performance goals were used interchangeably), and while measurement is implemented at every level, some PMS authors regarded PMS as strategic. Nevertheless, BPM authors have articulated that measurement of performance can be efficiently and effectively carried out at the operational level using
benchmarking to capture the “softer” element of business activities such as intangibles.

(3) Customer focus is not given a heavy emphasis by PMS authors, and hence, measurement is seen as “what is done” rather than based on “how work is done”. Due to this, product or service quality are not properly matched, and neither is customer satisfaction.

(4) Despite the criticisms by PMS authors that financial (accounting) measures are lagging indicators that lack predictive powers, and that many performances cannot be measured qualitatively or in non-financial terms (e.g. customer satisfaction), the performance information criteria as discussed in the PMS literature are still largely financial (accounting).

(5) As there is no consensus on what constitutes PMS goals and key stakeholders, the question: to whom, and for what purpose, measured information ought to be communicated remains elusive.

As BPM is gaining interest from the business and academic perspectives, and from many writers, BPM is now considered a critical component of effective organizational management, and it is imperative for us to address these questions in an attempt to consider a theoretical integrated framework that encompasses a MS combined with a measurement system. Thus, the outcome of this review, this paper proposes an IBPMMS that encompasses measurement and management to ensure that BPs can be implemented using the best of IT and IS, the concept of throughput, and the popular VC methodology to measure and compare performance within BP organizations.

Notes

2. The author acknowledges and appreciates one referee who provides this valuable suggestion.

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Corresponding author
Kwee Keong Choong can be contacted at: k.choong@latrobe.edu.au

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