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Performance Measurement Systems Must Be Engineered

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METHODOLOGY;
TUTORIAL

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ABSTRACT

The aim of this paper, which puts special emphasis on IT-related aspects, is threefold.

- First, it defines requirements a modern Performance Measurements System (PMS) should meet. The list of requirements generated can be used both to assess a current PMS, and to identify ways to improve an existing PMS.
- Second, it reports the findings of an empirical study, which seeks to identify the shortcomings of existing PMSs.
- Third, a life cycle for PMSs is suggested.

Keywords: performance measurement systems, design and maintenance, performance measurement, process model, requirements

I. INTRODUCTION

The importance of performance measurement is increasing for two seemingly different reasons:

1. globalisation
2. managerial compensation.

Globalisation. Customers living in industrialized regions are no longer forced to buy the products and services they need from suppliers in their own region. The Internet makes it possible for the buyer to choose among many sources, and – more importantly – at least for relatively simple products, to compare prices and conditions. These changes led to increased competition, and make it vital that business performance is tracked and improved on a regular basis.

Managerial Compensation. More and more companies use a salary scheme consisting of a fixed and a variable part. A manager's variable compensation is partially based on performance. This approach requires measuring the performance the manager is accountable for; e.g. a business unit or a business process.

II. LITERATURE REVIEW: WHAT IS COMMON GROUND?

The shortcomings of traditional performance measurement are documented extensively (e.g. Kaplan (1989), Eccles (1991), Neely et al. (1995)). The weaknesses of traditional PMSs shall not be re-iterated here. Instead, the literature was analyzed to identify a set of widely accepted principles. Based on this analysis, a 'common ground' can be characterised as follows:

- *When measuring performance, various aspects, dimensions, or perspectives must be taken into account.* Fitzgerald et al. (1991), for example, suggested that the following six dimensions should be measured:

-financial performance	-competitiveness	-resource utilisation
-quality of service	-innovation	-flexibility

Kaplan and Norton in their article on the balanced scorecard (1992) see the relevant perspectives as:

-financial	-internal business
-innovation and learning	-customer perspective

.

- *Leading indicators must be considered*. It is important that not only the results of yesterday's decisions (i.e. the financial results), but also the indicators of tomorrow's performance are measured. That is, the performance drivers (leading indicators) must be identified and measured to obtain early warning signals. Bititci (1995) and others state that PMSs should facilitate understanding of the structures and relationships among various measures.
- *Performance has to be measured at different levels*. McNair et al. (1990) proposed measuring performance at three different levels, such as the business unit level, the business operating system level and the work centre level. Fitzgerald et al. (1991) believe that performance measurement should be focused primarily on strategic business units, and secondarily it should take place at the corporate level. Kueng (2000) suggests that performance should be measured at the business process level – and not at the level of business functions.

ASPECTS THAT GENERATED SOME DEGREE OF CONSENSUS

- *Monitoring external changes.* Performance measurement systems should monitor changes in the organization's environment. If the changes in the environment are significant, the business objectives and eventually the business strategy must be changed. Consequently, changes in the environment may determine the performance indicators to be measured. Some authors, (e.g. Simons (1999)) suggest, that a PMS should include an external monitor component.

- *Considering IT capabilities*. Only a few papers discuss the contribution of Information Technology (IT) to support performance measurement (e.g. Bititci (1997)).

- *Real time information about performance*. Several authors address the problem of delay; i.e. the time that passes from the occurrence (of good or bad performance) until the communication of these facts. It is argued that the delay in reporting should be as short as possible.

Overall, the many performance measurement frameworks suggested during the last decade stressed the dimensions and the performance measures (performance indicators) that should be taken into consideration. In contrast, implementation-related aspects and questions that deal with Information Technology to support performance measurement (such as efficient data collection processes, storage and management of the performance data, and dissemination of the performance results) were neglected to a large degree.

III. 'PERFORMANCE MEASUREMENT SYSTEM' VS. 'IT SYSTEM FOR PERFORMANCE MEASUREMENT': AN ATTEMPT AT A DEFINITION

What is a Performance Measurement System? Is it a management process? Is it a collection of tools whose aim is to control business performance? Is it a modern Management Information System? Is it an IT-based Information System? Or is it a piece of software?

Neely et al. (1995) define a PMS as follows: "A performance measurement system can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions" (p. 81). Other authors emphasize the relevance of IT when describing the term PMS. Bititci (1997) states: "At the heart of the performance management process (i.e. the process by which the company manages its performance), there is an information system which enables the closed loop deployment and feedback system. *This information system is the performance measurement system* which should integrate all relevant information from relevant systems." (p. 47).

In the next two subsections, a distinction is made between

1. Performance Measurement System (PMS) and
2. IT system for performance measurement.

PERFORMANCE MEASUREMENT SYSTEM

A PMS performs the following functions:

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

In more general terms, the aim of a PMS is to evaluate the success of a system's implementation and continuously to improve the performance of the system (e.g. an organization) measured. A PMS does not necessarily include Information Technology. However, for a PMS to be effective, the use of IT is required (Bitici(1997)). Thus, a PMS is a system (i.e. interdependent group of items forming a unified whole) that consists of five basic elements:

- people
- procedures
- data
- software
- hardware

IT SYSTEM FOR PERFORMANCE MEASUREMENT

An IT system for performance measurement contains hardware, software, and those procedures that can be supported by IT. That is, it includes those parts of a PMS that are related to IT. The aim of an IT system for performance measurement is to facilitate the tasks of a PMS through effective use of Information Technology. One major role of an IT system for performance measurement is that of a central platform for storing and communicating performance-relevant data.

The difference between a PMS and a 'IT system for performance measurement' is illustrated in Figure 1.

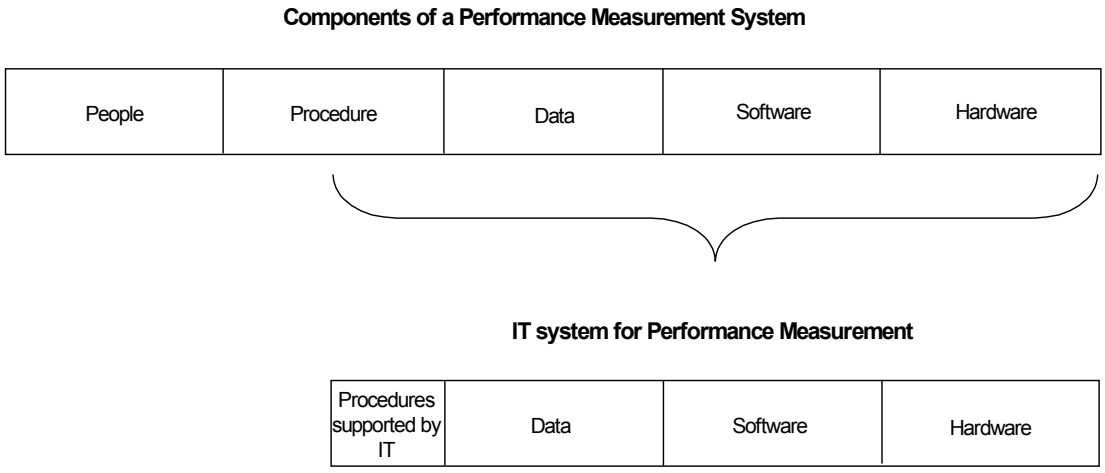

Figure 1. IT System as Part of a Performance Measurement System

As shown in Figure 1, the proportion of procedures that are part of the IT system cannot be defined exactly. Consequently, an IT system for performance measurement can be quite rudimentary. For example, it could consist of a PC, database management software, and aggregated performance values that are keyed-in manually. In such a system, most procedures (from data collection to dissemination of results) would be carried out by humans. On the other hand, an IT system for performance measurement could be very sophisticated. In this case most procedures (e.g., definition of performance indicators, collection of performance-relevant data, data analysis, data communication, generation of possible actions, prioritizing alternatives) would be supported by IT. Consequently, such a system would require powerful pieces of hardware, different software packages, an extensive communication infrastructure, and a high-volume database. Such a sophisticated IT system for performance measurement would offer many benefits, but would result in considerable investment and operating costs.

Table 1 shows the five components (people, procedures, data, software, hardware) of a PMS.

Table 1. Components of a Performance Measurement System

People	Procedures	Data	Software	Hardware
• Owner of PMS • People accountable for the units measured • People who set-up and maintain the PMS • Data suppliers • Internal and external users of the PMS • Internal and external stakeholders	• Procedures and rules for definition of performance indicators • Rules for data management • Rules for data communication • Rules for use of performance results	• Performance-relevant Data (as-is values) • To-be values of performance indicators • Performance results (calculated data) • Meta-data: description of performance indicators	• Software for extraction, transformation and loading of data • Database Mgmt software / Data Warehouse software • Data analysis software • Presentation and communication software	• Personal Computer or other visual display unit • Server • Communication infrastructure • Storage system

IV. PERFORMANCE MEASUREMENT: STATE-OF-PRACTICE

Although many performance measurement models were suggested in the past, little is known about the status and the usage of current implementations. The principal aim of the empirical study described in this section was to find out whether, and to what extent, companies adopted the published ideas and suggestions. A second aim of the study was to detect the strengths and limitations of the implemented PMSs.

SURVEY DESIGN

In the empirical study, data was gathered from eight Swiss companies. The companies were selected according the following criteria:

- they belong to one of these four industries: (1) finance, (2) insurance, (3) transport or (4) information technology
- each industry was to be represented by two companies
- the participating companies are ISO 9000 certified

Company size (i.e. the number of employees) was the main selection criterion. Seven out of eight companies operate internationally and they represent, by Swiss standards, the largest ISO 9000-certified firms in their industry. Data was gathered in face-to-face interviews and recorded by hand. The number of people that participated in the interviews varied from one to three. Each of the eight interviews lasted approximately two hours.

SHORTCOMINGS OF THE ANALYZED PERFORMANCE MEASUREMENT SYSTEMS

Every system is composed of four distinct elements as shown in Figure 2 (Leavitt, 1965):

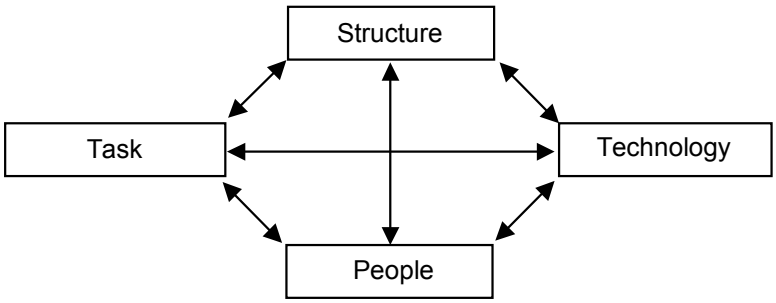

Figure 2. The Four Basic Elements of an Organizational System
Source: Leavitt (1965)

For the system to operate effectively, the four components must be balanced. Since these four components interact with one another, the alteration of one component requires an alteration of the other three as well. The weaknesses and shortcomings of the analyzed PMSs are described below according to the four basic units in Figure 1.

SHORTCOMINGS RELATED TO TASK

What tasks should the performance measurement system accomplish? When asked about the tasks and goals of the system in place, quite often interviewees could not give a clear answer. In fact, a PMS may be used for different reasons.

However, the main goals of a PMS should be clear. If this is not the case, many questions arise, e.g.,

- To whom should the performance results be communicated?
- Which level of aggregation is useful?
- Should the performance data be disseminated as a management report?
- What should the recipients do with the information they get?
- Should someone take action if the target values (to-be values) are not met?
- Is the aim of the PMS to check whether the given targets are met or to collect information in order to improve the underlying business processes?

If the rationale of the PMS is not defined, ideal design/architecture of the PMS cannot be determined.

The empirical analysis showed that the aim of the PMSs in place was often not clear. As a consequence, many processes from data collection to data dissemination and use of data were poorly defined.

SHORTCOMINGS RELATED TO STRUCTURE

- Non-financial aspects are clearly under-represented; in particular, employee-related performance aspects are not measured systematically. In addition, innovation-related aspects (is the company going to be successful in the future?) are measured poorly.
- The concept of leading indicators was suggested at least a decade ago, but has not been implemented to a substantial degree. Most companies measure a few non-financial performance indicators, but do not regard them as the precursors of financial results.
- The following organizational levels that are tracked (i.e. the units of analysis): (1) corporate level, (2) business units, and (3) functions (such as production

or sales & marketing). The performance of business processes is rarely tracked.

- Most companies analyzed argue that business processes were established. Indeed, the main business processes are documented (all of the analyzed companies were ISO 9000 certified). However, most companies did not implement the process management concept properly. For example, the so-called process managers did not have the competencies and resources needed to design, measure, and change their business processes.

SHORTCOMINGS RELATED TO TECHNOLOGY

- The cost for collecting performance-relevant data is considerable since the technology in use is, in some instances, rather basic. In one case, performance-relevant data was extracted from one IT system, then converted (partially manually), and finally the converted data were keyed into another IT system. Due to manual intervention and inappropriate IT systems, several desirable and meaningful performance indicators were not tracked; their measurement would have been too costly.
- Some performance results are stored only on paper because the aspects selected (e.g. customer and employee satisfaction) are measured and assessed by third parties. It is not uncommon for these third-party companies deliver their results only on paper.
- Most performance data is collected company-internal and is stored electronically. However, the data are stored in different organizational units, and in various formats such as spreadsheets, non-relational databases, and relational databases. As a result, it is difficult and time-consuming to:
    1. obtain an integrated view in terms of overall business performance,
    2. produce time series to get a long-term view.
- When performance results become available they are (to some degree) outdated. For example, in one company it took six weeks to produce the

monthly performance report. Better support through IT could shorten the delay significantly.

SHORTCOMINGS RELATED TO PEOPLE

For a PMS to be effective, two people-related requirements must be met:

- People must be well educated and must possess the skills to use the performance data effectively. If people cannot interpret the performance indicators in place, if they do not understand the proper meaning of the indicators, they cannot act upon them. Moreover, if people are not aware of the relationships that exist between performance indicators, they may initiate actions that lead to unintended side effects.
- Companies using a PMS must have a 'measurement culture'. If performance measurement has a negative connotation in the firm and if measurement is perceived as a constant threat, managerial and non-managerial staff becomes demotivated. Consequently, the primary goal of a PMS – continuous improvement of business performance – is not going to be attained.

Skills. In the companies analyzed, we found that managers believe that the skills of their staff are satisfactory. However, some interviewees mentioned that awareness of the 'big picture' and of the relationships between the performance-relevant factors was sometimes lacking.

Measurement culture. Several interviewees mentioned that a real measurement culture has not emerged until now. In some companies, performance measurement is still regarded as an instrument of control (are the targets met?) and not as a management and a performance improvement instrument. In one company, the attitude regarding performance measurement was particularly negative. As results the middle management refused to collect the necessary performance data.

V. REQUIREMENTS OF MODERN PERFORMANCE MEASUREMENT SYSTEMS

Based on the literature review (Section II), the opportunities offered by Information Technology (Section III), and the shortcomings of the PMSs in place, we developed the main requirements modern PMSs should meet. These requirements are listed in Table 2. This list may be used to assess current PMSs and to identify ways to enhance a running PMS.

VI. ENGINEERING PERFORMANCE MEASUREMENT SYSTEMS

Today's PMSs are of mediocre quality (Section II). One underlying reason is that many of the PMSs in place were not developed systematically. They were not engineered; they grew over a long period of time.

In mechanical or civil engineering it is self-evident that systems have to be planned and designed carefully. In these disciplines it is common to consider four distinct phases:

- the design phase,
- the build and implementation phase,
- the run phase when the system is operational,
- the decommissioning phase when the system is uninstalled.

In Figure 3, two cycles are distinguished:

- Cycle 1, called 'Creation of PMS', addresses the design and building steps.
- Cycle 2, called 'Use of PMS', addresses the activities once the PMS is operational, i.e. when the system is in the run phase.

Aspects	Requirements
Definition of Performance Indicators to be Measured	• Financial as well as non-financial performance indicators are measured. • The performance indicators in place reflect the stakeholders' interests; each individual performance indicator is part of an integrated system. • Performance is evaluated at different organizational levels. A set of performance indicators is defined for all organizational units and core processes.
Identification of Data Sources	• Company-internal data sources are exploited. Operational IT systems get special attention in respect of providing useful performance-relevant data. • Company-external data are integrated into the PMS. • The need for performance data determines the data sources – and not the inverse.
Procedures for Data Gathering	• Collection of financial and non-financial performance data stemming from operational IT systems is automated. • Gathering of performance-relevant data that is not available from operational IT systems is supported by IT. • The various systems that deliver performance-relevant data are integrated. Manual intervention (for extraction, verification, conversion, loading of data) is not required.
Creation of Database	• All performance data is stored in an integrated database system. Pre-defined reports can be stored. • Performance data can be stored over a long period of time. • The database can store and manage processes that describe how the measurement processes are carried out
Analysis of Performance Data	• Performance data can be aggregated (using weights) across various levels, and performance indices can be calculated. • Performance data can be dis-aggregated (drill-down) across various levels. • Gap analyses can be carried out and trends can be identified. • Cause and effect relationships (among performance indicators) can be identified and verified on a statistical basis.
Procedures for Communication of Performance Results	• Performance results can be disseminated electronically. The IT system supports the push principle. • The IT system supports the pull principle; authorized users may browse the performance database and they may formulate and execute ad-hoc queries. • Company-external stakeholders can access the performance results in a user-friendly manner. • The PMS shows the tree (or web) of active performance indicators and their interdependencies.
Procedures for Using Performance Results	• Performance results are used (1) as a central managerial and planning instrument, and (2) to support company-internal and external communication. These processes are supported by IT. • The PMS can manage suggestions on how to improve performance and it can store descriptions of actions taken.
Quality of the Processes needed to Use the PMS	• The performance measurement processes carried out when the PMS is operational (i.e. definition of to-be values, data collection, communication of results) are documented; the execution of the processes is compliant to the description. • Feedback about the performance measurement processes is collected. • Continuous improvement of the measurement processes takes place; new technologies and practices are identified and tested.

Table 2. Requirements of a Modern Performance Measurement System

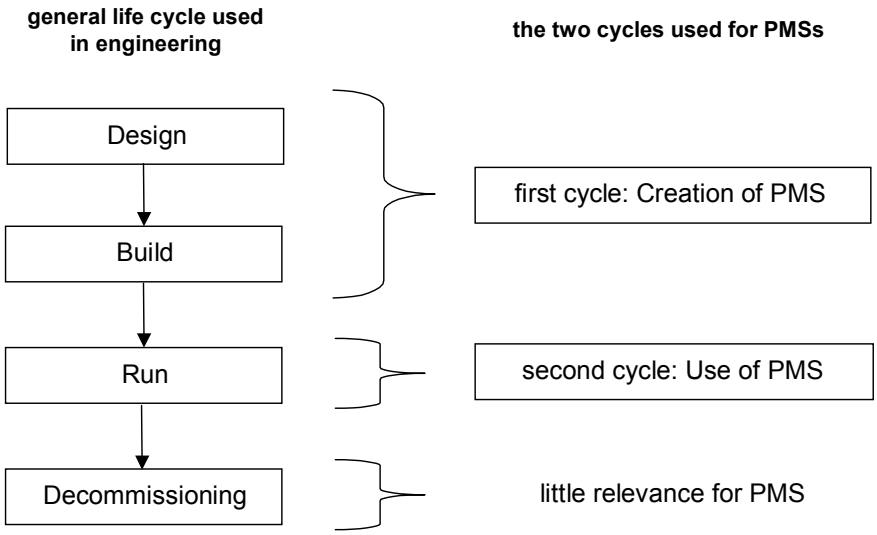

Figure 3. The Four Common Phases in Engineering

By using these two cycles, the various steps that are needed to engineer and operate a PMS are shown in Figure 4. The upper cycle of Figure 4 starts with a step called 'Definition of performance indicators'. To carry out this step, business strategy and business goals are taken into account. Once the needed performance indicators are selected, the data sources are identified. Special attention is given to operational IT systems, since data collection from these systems can be automated. However, to obtain a balanced view, external data (such as data gathered from current and potential customers) are also considered. Next, procedures for collecting the needed performance-relevant data are defined. Some of these procedures can be translated into software; other procedures are carried out by human actors. It is important that collected data is stored centrally in a database that is easily accessible to the stakeholders. The data store may be a traditional relational database or a Data Warehouse. Inmon (1996) defines a Data Warehouse as "a *subject-oriented*, *integrated*, *non-volatile*, and *time-variant* collection of data in support of management's decisions" (p. 33). To use the gathered and stored performance-

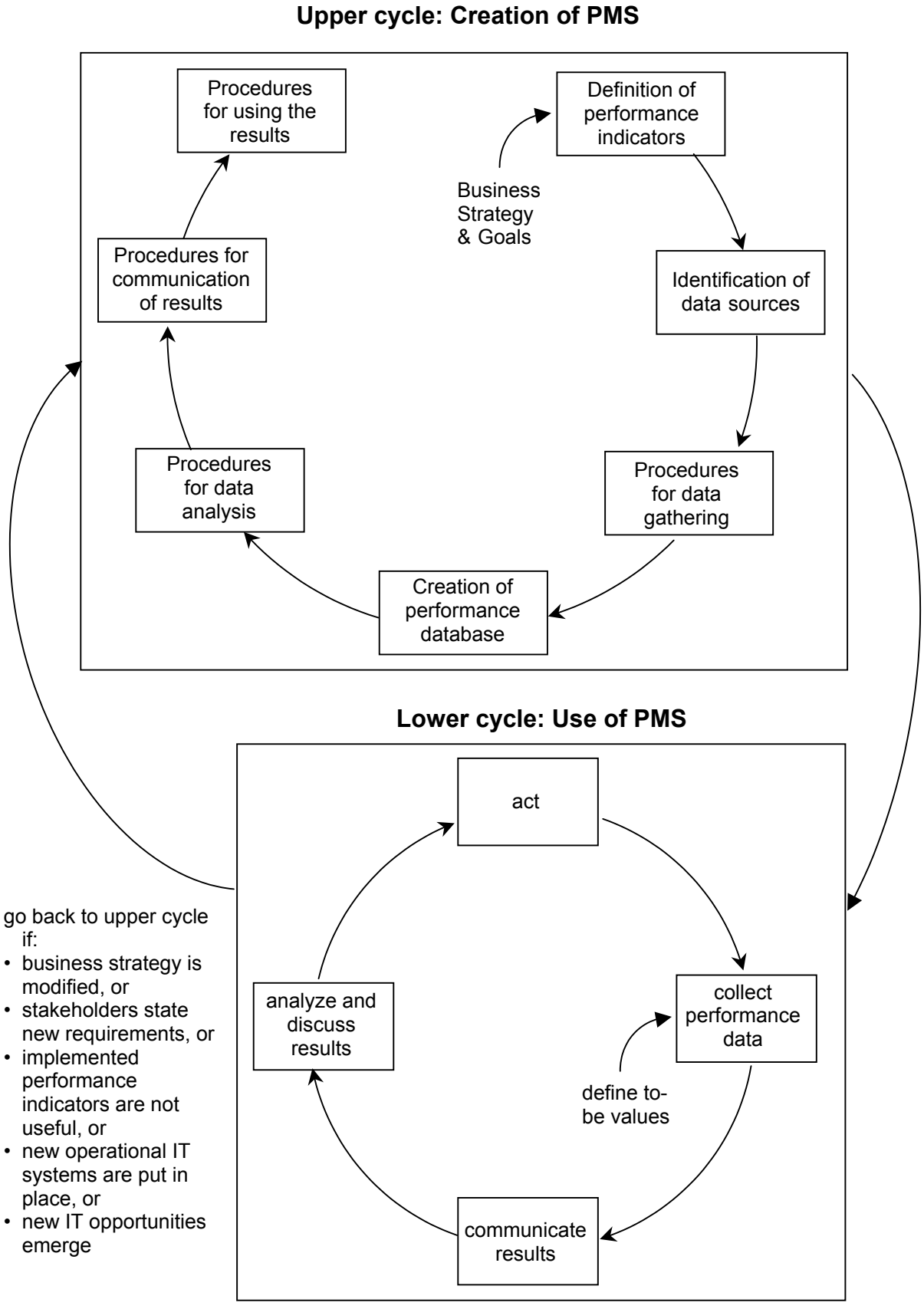

Figure 4. The PMS Cycle

relevant data efficiently, data analysis procedures must be defined. Of course, different users can analyze performance data in an ad-hoc manner but such analysis is time-consuming and risks using inappropriate algorithms.

Communication of the performance results is the second most important step. To support communication, IT may offer different mechanisms and facilities. For example, different user profiles can be defined; selected data can be sent as Email to managers; data can be accessed via an Intranet; and performance results can be discussed via a computer-supported forum. Most important is that performance results are *used*. Therefore, it would not be wise to leave this step up to the users. The designer must define what the results are to be used for. If no rules are defined regarding result usage, it is likely that the power of a PMS is not fully exploited.

Once the upper cycle in Figure 4 is defined, the PMS can be taken into the operational mode (Use of PMS). While the upper cycle is not carried out very often (e.g., once a year), the lower cycle has a shorter period. Depending on the performance indicators in place, its period is usually a week or a month. Before the lower cycle can start its turn for the first time, the to-be values must be defined for each indicator. Afterwards, data collection starts, performance results are calculated and communicated (according to the procedures defined by the upper cycle), results are analyzed and discussed (eventually mediated by it) and, finally, options are prioritized (what do we need to tackle first?) and action is initiated. Then, the lower cycle repeats again and again.

A switch to the upper cycle may be needed at certain points. For example, the CIO or the manager of a functional unit wants to modify the business strategy; or it turns out that some of the implemented performance indicators are not considered useful. Another event that requires a modification of the PMS is the emergence of new IT opportunities which could offer new data collection or data dissemination procedures.

VII. RESEARCH AGENDA FROM AN ENGINEERING POINT OF VIEW

If the PMS research reported during the last decade is evaluated in terms of the life cycle shown in Figure 4, it becomes clear that only a few of the steps shown have yet been addressed. Most effort was invested in the very first step – 'definition of the performance indicators to be measured'. A large body of published literature discusses the perspectives and dimensions to take into account when performance is measured. Other aspects, such as the use of the right data sources, the management of the performance data, or the communication procedures that allow effective use of the performance data were addressed to a much smaller extent.

Based on the shortcomings of existing performance measurement systems (Section IV), and on the requirements of modern performance measurement systems (Section V), a number of research question are proposed. They are divided into:

- research questions that need substantial empirical work, and
- research questions that deal primarily with the design and creation of performance measurement systems.

The questions are indicative of what needs to be done, rather than being comprehensive.

EMPIRICAL WORK

- *The cost of measuring non-financial aspects.* An integrated PMS takes into account both financial and non-financial performance indicators. Financial indicators have been tracked for a long time. The systematic tracking of non-financial indicators emerged about a decade ago and culminated in the creation of integrated PMSs.

  One argument against the introduction of PMSs is cost. In particular, companies floated on the stock market argue that the costs for the required extensive financial reporting are considerable. The introduction of an even

broader performance measurement would be too costly they say. Based on the available body of knowledge, it is difficult to decide whether this rather intuitive judgment is correct. To be able to make a well-founded decision, it would be useful to evaluate the costs for the measurement of non-financial performance. Therefore, the cost of setting-up and running integrated PMSs (consisting of both a financial and a non-financial part) should be assessed. Then the costs related to the non-financial part should be weighed against the overall costs generated by a PMS. Knowing the costs that are incurred by the measurement of non-financial aspects helps to decide whether the introduction of an integrated PMS is justified.

- *What are the benefits of PMSs***?** The history of the so-called 'IT paradox' shows that it is extremely difficult to identify whether investment in IT leads to higher profit. Based on this experience it would not be an effective approach to initiate a project aimed at calculating the costs and benefits (in Euros or Dollars) generated by a PMS. A more indirect approach should be favored. One option could be to find out how PMSs are used when managers have to take decisions. For example: Which non-financial performance indicators do they analyze prior to taking decisions? What does the flow of information for decision-making look like? In addition, one could identify the decisions taken by over a certain period of time (e.g. one month). With this data, one could analyze how much the PMS implemented by the firm was used, and identify to what degree an integral, appropriate PMS could have been used.

- *Leading indicators*. The empirical study presented in Section IV indicated that the concept of leading indicators is not yet being used effectively. The concept of leading and lagging indicators was introduced in academia more than a decade ago. Despite the publicity surrounding the balanced scorecard (Kaplan and Norton, 1992) and similar approaches, the activities of management consultancies and rising interest from managers, the

concept of leading indicators often does not find its way to implementation and proper use. By proper use, we mean:

- that companies identify their leading indicators not only ex-ante, but also ex-post (i.e. based on performance data), and
- that companies evaluate the actual values of their leading indicators to estimate future performance.

A question that should be addressed is: "What are the barriers to the proper application of the concept of leading indicators?"

RESEARCH QUESTIONS RELATED TO SYSTEM DESIGN

Integration of traditional measurement tools. Most medium-sized and large companies use a number of tools, systems and instruments to measure and assess performance. For example, most businesses use financial accounting information systems, business planning systems, project management and reporting systems, and personnel information systems. Adding a separate IT system to measure performance introduces an additional system that must be operated and maintained. Inevitably, this system will store some data redundantly and may introduce inconsistent data. The following are three approaches to resolving redundancy:

1. Create a comprehensive performance measurement systems that makes some of the more traditional measurement tools become obsolete.

2. Design the performance measurement system as lean as possible.

3. Integrate the functionalities of a PMS into a traditional IT systems such as an ERP system (Kueng et al. 2000).

- The research task is to define and evaluate alternative information system architectures for performance measurement in terms of technical feasibility and economic justification.

Integration of EMS. In Europe, an increasing number of companies are implementing the 'Eco-Management and Audit Scheme' (EMAS) which was

launched in 1993. EMAS seeks to encourage industries to adopt a site-specific, proactive approach to environmental management, and to improve their performance (Barrow, 1999, p. 69). Because the implementation costs of an Environmental Management System (EMS) are substantial, it would be worth analyzing whether an EMS can be incorporated into a PMS. It appears that the structure of the data stored in an EMS does not differ radically from that stored in a PMS, and the stakeholders of an EMS appear to a large extent to be the same as those for a PMS. However, to answer this question scientifically, the usage pattern of EMSs must be analyzed, and the requirements of an EMS must be compared with those of a PMS.

Advanced Information Technology. In the last decade, many new IT tools emerged (e.g., Internet, Intranet, Personal Digital Assistants, mobile phones, electronic books, miniaturised tools for voice recording). The potential of applying each of these technologies in PMSs should to be examined.

Education and training. The analysis of existing PMSs (Section III) showed that performance results are poorly communicated and often not used to bring the business a step forward or to identify the relationships between different parts of the business. Performance is rarely used to obtain a broader, stakeholder-oriented view.

One approach to solving these problems may be to improve education and training. However, research is required to determine whether education and training can improve managerial understanding and use of PMSs. The following are typical research questions:

- What should management be taught prior the introduction of a PMS?
- How can management be taught how to use a PMS effectively?
- How can performance data collected and calculated by a running PMS be used in teaching management?
- What does operational staff need to know about performance measurement?

- *Performance measurement for team-based structures*. Performance measurement is often regarded as an instrument for translating vision and strategy into operational terms. Performance measurement is therefore deployed top-down. High-level strategic measures are decomposed into specific performance indicators at operational level. PMSs and performance indicators in particular are designed to align people's work with the enterprise's objectives. This is the theory. Yet many organizations are organized around teamwork. Research is needed on the impact of team-based structures on the deployment and use of performance measurement systems. Typical questions are:
    - Does it make a difference whether performance indicators are developed for traditional, hierarchical organizational structures or for flatter team-based structures?
    - How should performance data be aggregated and disseminated to support team-based structures?
    - Should a centralized information system for performance measurement be separated into smaller units to better fit the team's purposes?

VIII. CONCLUSION

What is the vision of where Performance Measurement Systems should be? The primary aim of a PMS is to support the concept of 'continuous improvement'. PMSs are formal systems to maintain or alter patterns in organizational activities. The purpose of a PMS is to convey information (financial and non-financial information) that influences decision-making and managerial action (Simons, 1999, p.4). Ideally conveyance of information (information gathering, storage, consolidation, distribution) is strongly supported by information technology. In addition, both the operation of a PMS and the process to create and maintain a PMS is automated. In summary, our vision is that the ideal PMS must meet all the requirements listed Table 2.

This article shows that existing Performance Measurement Systems suffer from different shortcomings such as:

- performance measurement is focused too strongly on financial performance indicators,
- business processes are not measured systematically,
- the concept of leading indicators has not been implemented,
- performance data becomes available with a considerable time lag,
- access to performance data is complicated, and
- the performance measurement processes are poorly defined.

Evaluating the research activities of the last decade, the question addressed most intensively was the following: “What dimensions and perspectives must Performance Measurement take into consideration?” Other aspects such as the suggestion of different organizational or technical architectures, or the evaluation of alternative implementations are not discussed intensively. Moreover, the processes needed to run and use a performance measurement system have not been addressed substantially. Finally, questions related to education and training in the efficient use of performance measurement systems need to be addressed. Overall, there is still a long way to go, until Performance Measurement Systems can be described as ‘mature’.

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[1] http://www2-iiuf.unifr.ch/is/peter/COPPA.htm

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