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A decision framework for the consolidation of performance measurement systems

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ABSTRACT

Numerous performance measurement systems have been expanding over the years. Therefore, they often contain more information than needed as well as irrelevant information. The consequences are high complexity in cognitively processing the enclosed measures and unnecessary costs for operating and maintaining the supporting infrastructure. Against this backdrop, we propose a decision framework that supports the consolidation of existing performance measurement systems such that information processing complexity and costs are balanced with the extent to which decision makers' information requirements are met and alignment with corporate objectives is achieved. We also report on the results of an evaluation based on feature comparison, prototype construction, and a real-world application.

1. Introduction

Whether for the implementation of corporate strategy, the continuous monitoring of corporate objectives, or the management of business units, performance measurement systems (PMS) are an accepted instrument for providing decision makers with information that enables them to take effective actions [63]. Nevertheless, numerous PMS users indicate that they suffer from information overload [38,66]. This is surprising because performance measures and PMS actually are intended to reduce complexity by abstracting from the real world [48]. In particular, PMS that have been subject to uncontrolled growth (i.e., the number of measures they enclose has been increasing over the years) are likely to contain more information than needed as well as irrelevant information. This phenomenon entails challenges for the information provision of decision makers that require intervention.

From an *informational perspective*, one has to consider the limitations of human information processing capabilities [17,60,73]. Cognitively overstrained decision makers suffer from stress and loss of clarity [6], which in turn reduces decision quality [2,20]. As early as 1967, Ackoff recognized that misinformation is grounded not only in too much information, but also in irrelevant, redundant, and heterogeneous information—a problem that has intensified over the last decades [1,21,28,49]. Thus, the central challenge from an informational perspective is to answer the question of which measures enclosed in an existing PMS are sufficient to manage the fields of action under investigation at an adequate level of information processing complexity.

From an *economic perspective*, one has to consider that information provision is not free. The costs of information provision are all too often neglected in the context of PMS [3,41]. A 1999 Hackett Group benchmarking study reported that companies spend an average of more than 25,000 person-days a year per billion dollars of revenue on measuring and reporting performance [34]. This figure may have decreased due to a more extensive automation of extraction, transformation, and loading (ETL) procedures, but it nonetheless corroborates the need to investigate PMS from an economic perspective. In doing so, the central challenge is to answer the question of which existing measures and parts of the supporting infrastructure are worth their costs.

While there is an elaborate body of knowledge that deals with the initial design of PMS, very few approaches address the systematic consolidation of PMS (see Section 2.3). In the context at hand, consolidation refers to the decision about which measures enclosed in an existing PMS and which parts of the supporting infrastructure should be kept in order to provide sufficient information while at the same time reducing negative informational and economic effects. Against this backdrop, the paper addresses the following research question: *How can an existing PMS be consolidated considering the informational and economic challenges of information provision?*

To answer the research question, we adopt a design science research approach and propose a decision framework for PMS consolidation as artifact. As the decision framework is a model that enables the comparison of different consolidated PMS and shows characteristics of a method for guiding the process of PMS consolidation, the decision framework is a valid artifact type [55]. In line with existing reference processes for

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design science research [68], the present work covers the following phases: identification of and motivation for the research problem, objectives of a solution, design and development, and evaluation.

The remainder of this paper is structured as follows: In Section 2, we introduce the foundations of PMS to delineate the problem context and unit of analysis. We also extract requirements for useful PMS from the literature that embody the objectives a solution to the problem of PMS consolidation should achieve (*objectives of a solution*). Using these requirements as an analytical lens, we discuss existing approaches to PMS design and consolidation to identify the research gap. In Section 3, we sketch the principles of multi-criteria decision analysis, which serves as the research method for constructing the decision framework presented in Section 4 (*design and development*). Section 5 reports on the results of feature comparison, prototype construction, and a real-world application (*evaluation*). The paper concludes in Section 6 with a summary, implications, and limitations.

2. Domain background and related work

2.1. Foundations of performance measurement systems

Although PMS have been discussed extensively in the international literature on management accounting, operations management, and performance measurement for decades, no common definition has been established so far [25]. Nevertheless, there is a consensus that PMS are an essential instrument of corporate performance measurement, which in turn is a component of performance management at large [27,67]. Performance measurement aims to provide decision makers with information that enables them to take effective actions and evaluate whether a company is progressing in line with its strategy. Neely defines performance measurement as "the process of quantifying the efficiency and effectiveness of action" [63].

With respect to what characterizes a PMS, Franco-Santos et al. classified existing definitions into different groups [25]. From an operations perspective, a PMS is a set of interdependent (performance) measures, also known as metrics, figures, or indicators [64]. A PMS also includes the reporting process that gives feedback to employees on the outcome of actions [8]. From a strategic control perspective, PMS include the procedures to translate strategies into measures as well as the systems that provide the necessary information to challenge the content and validity of strategies [39]. From a management accounting perspective, PMS correspond to traditional management planning and budgeting [67]. Franco-Santos et al. concluded that two major features make up a PMS: measures and the supporting infrastructure [25].

Each *measure* enclosed in a PMS quantifies the efficiency and/or effectiveness of the entity under investigation from a distinct perspective and serves as indicator of overall performance [10,44,62]. A comprehensive discussion about the prerequisites for and the drawbacks of using measures as well as about the epistemic underpinnings of measures can be found in Strecker et al. [78]. It is common to distinguish between different, though not necessarily disjoint types of measures, such as financial and non-financial measures, leading and lagging measures, measures relating to different perspectives (e.g., financials, customer, business processes, or learning and growth), measures relating to different levels of abstraction (e.g., department-wide, company-wide, or industry-wide), or measures relating to phenomena from inside or outside the company [18,42]. It is important to note that measures in general do not exhaustively cover decision makers' information requirements. They typically have to be complemented by qualitative information such as rumors, press releases, or external reports of competitors. Throughout this paper, we focus on those parts of the information requirements that refer to quantitative information provided by measures.

The performance measurement literature distinguishes between logical, empirical, and hierarchical interdependencies among measures [47,53,65]. Logical interdependencies result from definitions (e.g., profit = revenue − expenses) or mathematical transformation (e.g., return on investment = capital turnover / profit margin). Empirical interdependencies result from observing reality. They are either deterministic or stochastic (e.g., higher prices probably lead to lower sales volume). Hierarchical interdependencies define ranked orders, which can be objective (e.g., annual profit = sum of monthly profits) or subjective (e.g., liquidity is more important than profitability). It is a widespread perception that PMS conform to a tree- or pyramid-like topology where a top measure (e.g., return on investment or economic value added) is decomposed by means of mathematical transformation into an objective hierarchy of lower-level measures. The DuPont System of Financial Control is probably the most popular example. A tree- or pyramid-like topology is feasible if mainly financial and lagging measures are used, and if performance is analyzed at a high level of abstraction. In business practice, however, financial and non-financial measures are used jointly in many cases, as are leading and lagging measures. Moreover, the lower the level of abstraction on which performance is analyzed, the more ambiguous logical and hierarchical interdependencies become. This results in a network-like topology where empirical interdependencies predominate. In practice, empirical interdependencies typically do not meet the requirements of causal relationships and cannot be derived from theoretically valid explanation models [65]. Rather, they have to be interpreted as "is assumed to indicate" relationships and are stochastic in nature [78]. They can be revealed by analyzing historical data and have to be justified by consulting subject matter experts. Their strength can be quantified by means of measures of coherence as auxiliary quantities (e.g., correlation coefficients or coefficients of determination).

As for the *supporting infrastructure* of a PMS, there is no common understanding either. It can vary from very simplistic manual methods of recording data to sophisticated information systems and procedures of information provision that involve "data to be acquired, collated, sorted, analyzed, interpreted, and disseminated" [44], including the required human resources [45]. Some authors put the supporting infrastructure and the PMS on the same level (i.e., PMS are interpreted as dedicated information systems with reporting and analysis functionality). Other authors regard the supporting infrastructure as technical and organizational means for implementing the conceptual parts of PMS and facilitating information provision [13,37,56]. Independent of the concrete interpretation, it holds true that changes in the measures imply changes in the supporting infrastructure.

With these foundations in mind, we can narrow down how PMS are understood throughout this paper and what consolidation is about. We primarily focus on the conceptual parts of PMS, i.e., the enclosed measures and the interdependencies among them, because it is the measures that convey information to decision makers, not the supporting infrastructure. Without useful content, the infrastructure does not create added value, no matter how sophisticated the IT-based reporting and analysis functionality or the procedures of information provision are. Consequently, the measures enclosed in a PMS should be the starting point for consolidation. We also consider PMS with a network-like topology. This is because such PMS are closer to reality. *Consolidation* then means that existing PMS come under scrutiny with respect to which of the measures they enclose should be kept. If one intends to incorporate the informational and economic perspectives of PMS consolidation, the effects of changing the measures of a PMS on the supporting infrastructure have to be considered as well. Throughout this paper, we interpret the supporting infrastructure as comprising sophisticated information systems and supporting procedures of information provision used for performance measurement. In the course of consolidation, it may happen that parts of the supporting infrastructure can be shut down or need not be executed anymore.