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Classification of articles and journals on project control and earned value management

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Abstract

This paper presents an overview of the existing literature on project control and earned value management (EVM), aiming at fulfilling three ambitions. First, the journal selection procedure allows to discern between high-quality journals and more popular business magazines. Second, the collected papers on project control and EVM, published in the selected journals, are classified based on a framework consisting of six distinct classes. Third, the classification framework indicates current trends and potential areas for future research, which can be summarized as follows: (i) increased attention to the stochastic nature of projects, (ii) enhanced validation of the proposed methodology using a large historical dataset or a simulation experiment, (iii) expansion of integrated control models, focusing on time and cost as well as other factors such as quality and sustainability, and (iv) development and validation of corrective action procedures.

Keywords: Project management; Classification; Project control; Earned value management

1. Introduction

Project control aims at measuring and evaluating the actual progress of projects by applying techniques such as earned value management (EVM) in order to finish the project on time and within budget. Focusing on time and cost control, the baseline schedule or planned value (PV) serves as a starting point to evaluate the actual performance of the project. Typically, the development of planned and actual values is assumed to follow an S-curve pattern. This implies that more work is done in the middle stage of a project compared to the early and late stages. At the project start, a preliminary estimate of the planned duration and cost is made. While the focus of EVM was initially mainly on cost, it gradually shifted from cost control to time control, partly initiated by the article by Lipke (2003), which introduced the earned schedule (ES) concept. In order to track project progress during execution, the planned value (PV), earned value (EV) and actual cost (AC) curves are plotted in the time–cost space. To detect deviations from the schedule, the cost performance index (CPI), schedule performance index (SPI) and its ES-variant SPI(t) are calculated and evaluated. For a concise overview of the EVM metrics we refer the reader to the paper by Anbari (2003). Incorporating this new information, the time and cost estimates at completion are updated. When deviations occur, the project manager should decide whether corrective actions should be taken to bring the project back on schedule.

These concepts have been brought to attention by books on project management and control in general (Archibald and Villoria, 1967; Cleland and King, 1988; Kerzner, 2013) and EVM in particular (Fleming and Koppelman, 2005; Vanhoucke, 2010a). Moreover, a comprehensive bibliography on the earned value literature has been constructed by Christensen (2015). In

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2008, the first comparison between various time control methods using EVM has been published in the International Journal of Project Management (Vandevoorde and Vanhoucke, 2006) and resulted in an IPMA awarded research study by Vanhoucke (2010a). Besides cost and time, some research effort has been done to incorporate quality as a performance objective. However, most research has focused on managing quality in projects (Atkinson, 1999; Basu, 2014; Gardiner and Stewart, 2000), and integrating time, cost and quality in the scheduling phase (Babu and Suresh, 1996; Khang and Myint, 1999; Kim et al., 2012). Only few studies explicitly monitor and control quality during project execution.

The contributions of this paper are threefold. Our first ambition is to collect the academic work on time and cost control, focusing only on papers published in well-recognized and high-ranked journals. Selection of the relevant papers entails a clear definition of the scope, which will be provided in Section 2.1. Subsequently, Section 2.2 will address the journal selection procedure, applied to discriminate between high-quality journals and the more popular business magazines. Second, the collected papers will be classified according to a framework consisting of six classes, all representing a typical and fundamental aspect of a research paper. In particular, Section 3 will elaborate on the research problem, contribution, methodology, analysis, validation and application of the papers. The third and final objective of this paper is to identify trends in current research and to determine gaps in the literature that exhibit room for improvement. These trends and gaps should motivate researchers to make contributions to this interesting research field where its added value would be the highest. The main findings of this literature review and directions for future research are highlighted in Section 4.

2. Article and journal selection methodology

This study was initiated by an explorative search on EVM using the databases Web of Science, ScienceDirect and Google Scholar. The search terms mainly consisted of combinations of the keywords: earned, value, project and control. We used the topic of the paper (Section 2.1) and the journal in which it was published (Section 2.2) to delineate the scope of this review paper. The latter constraint cleared approximately 20% of the papers listed in Christensen's bibliography for inclusion in the classification framework. The literature search finally resulted in a collection of 187 academic research papers on EVM and project control, which will be classified along the following classes: (i) research problem, (ii) contribution, (iii) methodology, (iv) analysis, (v) validation and (vi) application. The specifics of this classification framework will be addressed in Section 3, followed by a discussion of the current research trends and possible areas for future research in Section 4. Fig. 1 presents a graphical summary overview of the upcoming sections.

2.1. Article selection

The literature on integrated project management and control (IPM&C) (Vanhoucke, 2014) can be broken down into three broad categories, that is, baseline scheduling, risk analysis and project control (Fig. 1). The focus of this review paper lies on the latter, and more precisely on the quantitative mechanisms used to monitor a project in progress, to measure its time and cost performance and to generate warning signals that act as triggers for action when the project tends to run out of control. In order to restrict the scope of this review paper, only articles on time and cost control will be included. Although a range of other objective functions, such as quality, safety and sustainability exist, they are only added when combined with time and/or cost control.

The earned value management methodology is undoubtedly one of the most straightforward and most widely disseminated techniques for monitoring and controlling projects, and we have therefore used this technique as a general theme. However, this does not mean that all papers in our review explicitly mention EVM as a project control tool. Instead, some of the papers that have been incorporated into the classification rely on a very similar quantitative approach without explicitly mentioning EVM as a technique. Thus, papers on time and/or cost forecasting methods, performance evaluation techniques and measuring systems applied to trigger corrective actions are included. Regarding cost and time forecasting, however, only papers explicitly dealing with forecasts during project progress were withheld. Furthermore, papers that do not cover any of the above-mentioned topics but exclusively deal with factors affecting cost, time, performance, success or failure are neglected in this overview paper since they have no direct link to the project control theme.

2.2. Journal selection

The literature on project control and EVM is rich and diverse, and is spread over various journals. Most of the academic journals are ranked in the Journal Citation Reports (JCR) of the Web of Science and are able to report an impact factor. This index reflects the relative importance of a journal, measured by the number of citations to recent articles in the journal. On the other hand, numerous articles on EVM are published in journals that provide a reliable source of information for a wide audience and report relevant results or ideas that are interesting and of public concern. Quite often, however, these articles lack a methodological ground and test of logic and can therefore not always be readily used for research purposes. Despite the relevance and necessity of both classes of journals, it is hard to draw the lines between these types of journals when it comes to judging the quality of the articles from an academic point of view and their relevance for future (academic) research purposes. Nevertheless, we believe we have followed an approach that objectively ranks all journals that published at least one article on the topic of this paper.

2.2.1. Minimum threshold

During the search process, we kept track of all journals and magazines in which the relevant articles that we encountered were published. This resulted in a collection of 663 items, such as articles, books, technical reports and dissertations. A first condition for an article to be accepted in the classification