

Data Mining to Identify Project Management Strategies in Learning Environments

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INTRODUCTION

One of the most important organizational developments in recent years has been the significant growth of project work in different economic sectors and industries (Winter, Smith, Morris, & Cicmil, 2006). Thus, projects have become a key strategic working form. Further, it has been shown that all industries can benefit from project-based working (OPSR, 2003).

No longer just a sub-discipline of engineering, the management of projects -including program management and portfolio management- is now the dominant model in many organizations for strategy implementation, business transformation, continuous improvement and new product development (Winter et al., 2006). However, there is growing recognition that different types of projects require different approaches to their management (Müller & Turner, 2007). Furthermore, the increasing globalization of projects and project management adds intercultural challenges for project managers (Müller & Turner, 2004).

There is no doubt that management's configuration of projects affects the project's evolution. There are also factors like virtual teamwork and team building processes that are relevant to that evolution. Since effectiveness in managing projects depends on these factors, the authors

conducted this research to determine whether project performance varies according to project management and other factors. Thus, with a view to complementing other research to link project management to project success (Din, Abd-Hamid, & Bryde, 2011; Mir & Pinnington, 2014), this work considers factors such as virtual team configuration, team composition, knowledge competence, policy and strategy, project life monitoring and the level of detail implemented in managing projects that are undertaken in the learning process.

The data for this research was provided by an educational framework that was specifically designed to facilitate the learning experience of project management engineering students. The main purpose of this learning experience was to highlight how to move from simply learning content by rote to understanding, discussing and sharing (Alba-Elías, González-Marcos, & Ordieres-Meré, 2014). In this case, practitioners learned and applied by means of an experimental learning approach, a defined project management methodology that enables them to manage projects better.

Data mining and data analytics were used in this work to identify and understand the relationships between project performance and the analyzed factors. Data mining is widely applied in the educational area to predict students' performance

(Romero & Ventura, 2010; Shahiri, Husain, & Rashid, 2015). In the present research, we are much more interested in the project effectiveness that unexperienced project teams achieve, depending on specific factors. Thus, this study concentrates on using data mining for discovering patterns in project success, i.e., the performance of students as a team, instead of the performance of individual students.

The conclusions of our study can help higher education course designers, as well as teachers and students, by making clear the influence of smarter strategies in the learning process. In fact, the same benefits will help practitioners too, as they can improve their continuous learning procedures and adjust their own project management policies and strategies. Thus, the proposed research can be used as a specific decision tool of benefit in organizing projects according to specific parameters.

BACKGROUND

Project management is the application of knowledge, skills, tools and techniques to project activities to meet project requirements (PMI, 2008). The literature concerning project management includes many studies of critical success factors as can be seen in Wi & Jung (2010) or Alias, Zawawi, Yusof & Aris (2014). It is often agreed that project performance must achieve its objective and be aligned with criteria that the project stakeholders establish (Barclay, 2008). The usual metrics that are considered are cost, schedule and quality (ur Rehman Toor & Ogunlana, 2010). Indeed, the currently available standards are basically using these criteria in a process-oriented approach throughout the project's entire life cycle. Despite not being included in the three main strands of project management, sustainability has become a very important qualitative and quantitative step, particularly in the project's environmental aspects (Marcelino-Sádaba, González-Jaen, & Pérez-Ezcurdia, 2015). Thus, although sustain-

ability and project management traditionally have been tackled separately, the role of environmental management in projects is gaining more and more attention as an increasing number of publications in this field highlight (Marcelino-Sádaba et al., 2015; Økland, 2015).

Project performance has been of great interest to researchers and some authors have defined conceptual frameworks (Hewagamage & Hewagamage, 2011), as well as specific assessment models (González-Marcos, Alba-Elías, & Ordieres-Meré, 2016; Rehman, Usmani, & Al-Ahmari, 2012). Also, different studies have been conducted to investigate the impact of various factors on project performance. For instance, some studies for the Information and Communication Technology (ICT) projects, indicate that both users' knowledge of Information System and developers' knowledge of application domains have a significant impact on project performance (Byrd & Turner, 2001). In addition, insufficient personal knowledge about information system resources is a major reason for the failure of ICT projects (Tesch, Sobol, Klein, & Jiang, 2009).

However, despite the importance of technical factors, organizational and behavioral factors are considered in the literature to be the most relevant (Qureshi, Warraich, & Hijazi, 2009). Thus, all authors in the field recognize the relevance of continuous improvement and learning factors on project performance (Ojiako, Ashleigh, Chipulu, & Maguire, 2011). This applies not only to individuals, but also to the corporation. Therefore, elements such as lessons learned and project management maturity models are considered.

In this work an experiment that permits different layers of management (program and project management) to be reproduced was conducted. Thus, it was possible to study how managerial configuration of project management of virtual teams relates to project success. The main contribution of this work is the identification of quantitative relevance of described factors, as well as considering virtual teams as an additional driving factor.

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