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Reported project management effort, project size, and contract type

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ABSTRACT

Literature based hypotheses on the proportion of project management effort are created and tested with reported effort data from 117 projects by software supplier firms. The results support most of the literature based hypotheses, but some of the hypotheses are not supported. The supported hypotheses are the correlations between project management effort, project size, and team size. The unsupported hypotheses are the necessity of spending at least some project management effort on a project, and the insignificance of contract type. The conflict with previous studies and practical experience may be a result from market pressures and skewed reporting. The analysis implies that there is a pattern of inaccurate reporting of effort data and some possible explanations for the pattern are discussed. The results suggest that we do not properly understand the internal dynamics of supplier firms.

1. Introduction

Two important steps during project planning are the estimation of the effort required for the actual implementation of the project and the creation of the work breakdown structure (WBS). The importance of the WBS has been stressed in standards such as PRINCE2 (OGC, 2009), PMBOK (PMBOK Guide, 2013), and ISO 21500 (ISO, 2012). The importance of the estimation of effort has been noted especially in the software development field (Jørgensen and Shepperd, 2007; Moløkken and Jørgensen, 2003), in which projects are often late due to problems in effort estimation (Jørgensen and Moløkken-Østvold, 2006).

The accuracy of effort estimation is especially important for software supplier firms that operate in the project business. An important part of their business is based on selling projects and associated services to their customers (Artto and Wikström, 2005). Although those firms may not be dependent solely on selling projects, the profitability of individual projects is especially important for them (Savolainen et al., 2012). In order to be able to make a profit on projects sold to customers, the effort required by an individual project has to be estimated during the sales phase of the project marketing cycle (Cooper and Budd, 2007).

Software development projects are especially prone to estimation errors (Jørgensen, 2005; Kocaguneli et al., 2012; Moløkken and Jørgensen, 2003), and those errors may have a significant economic impact on software suppliers. Software suppliers have to be able to estimate the actual costs that a project will impose on them. For that purpose, they can use expert estimation (Jørgensen, 2005) or software effort-estimation techniques. The use of software effort-estimation techniques is based on defining the new project by some of its attributes and comparing those attributes to a historical data set (i.e., a set of past projects) containing the measures of the relevant attributes (i.e., distribution of actual effort, size, programming methodology, programming language, experience of the development team, and others) (Dejaeger et al., 2012).

We are not aware of studies that link contract type to effort estimation or effort reporting. Hence it is assumed that contract type has no impact on effort, although it has been reported to have an impact on project success (Sadeh et al., 2000).

Project management effort is an important part of the effort required for the implementation of a project, and research suggests that any complex activity such as a project or a complex task cannot be started without spending a minimum level of effort. According to Barry et al. (2002), a certain minimum level of effort is required for starting complex activities. In addition, there are cases in which the supplier encounters additional challenges (Savolainen and Ahonen, 2015), which increase the project management effort required during the start of the project. Hence the effort estimation of the project management activities for a project should include at least the effort required for starting the project and its complex tasks determined in the work breakdown structure created for the project.

The creation of a detailed work breakdown structure requires knowledge of the expected amount of project management effort that will be needed for the beginning project. For that reason, the distribution of effort between different tasks in the WBS should be known. For this study, we analyzed 117 software development

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projects in order to find out the relative minimum and maximum levels of project management effort that is required for the management of a software development project. Prior to the analysis, we created five hypotheses based on the literature and our experience.

Analysis of the data did provide support for some of our theoretical hypotheses, but some of the hypotheses turned out to be unsupported. Supported hypotheses are the correlation between project duration and the proportion of project management effort, and the correlation between team size and the proportion of project management effort. Unsupported hypotheses are the minimum amount of project management effort required and the relationship between the type of contract and the proportion of project management effort required — these results are not in accordance with previous literature and our own experience. However, the data provide a glimpse into the actual realities of supplier firms. The realities of the project business may explain the unexpected results, since commercial realities may force the supplier firms to behave in ways that make the historical data less accurate than would be preferred. The results of our study suggest that there is a systematic pattern of inaccurate reporting of project management effort.

The structure of the paper is as follows. In Section 2, we outline our hypotheses and the reasoning behind them. Section 3 briefly outlines the data, and Section 4 presents our analysis. The results of the analysis, some of which are counterintuitive, are discussed in Section 5, and some explanations for the unexpected results are speculated. Section 6 provides a conclusion.

2. Research hypotheses

The most common project management standards are PMBOK (PMBOK Guide, 2013), PRINCE2 (OGC, 2009), and ISO 21500 (ISO, 2012). These standards are fairly comprehensive, and they include several project management processes, which make up the best practice recommendation for project management. This is explicitly stated in ISO 21500, in which it is stated that "*These project management processes are appropriate to projects in all organizations. Project management requires significant coordination and, as such, requires each process used to be appropriately aligned and connected with other processes*". ISO 21500 recommends that the project management processes presented in the standards are tailored to the individual cases in which it is applied. The other standards have similar recommendations.

ISO 21500 has 39 separate project management processes. The other standards do not have the same exact number of processes, but the actions that should be performed by applying the standards have much in common. We will not, however, analyze those standards in detail from this point of view. We are content to note that every standard has a comprehensive set of processes to be applied and customized.

The number of project management processes and the activities included in them are likely to require a considerable amount of effort if performed. In addition to that, it is reasonable to assume that there is a lower level of effort that is required to perform the minimum level of project management activities for a real project. This assumption is supported by Barry et al. (2002), in which it was found that there exists a minimum amount of effort required for starting a complex activity.

Guidelines on the amount of effort that should be reserved for the management of a project would help project planning and resource allocation. However, we are aware of only one study that provides some numbers on project management effort (Haapio, 2011). Haapio's numbers are in line with the industrial "rule of thumb" we are aware of and which recommends reserving 10–15% of the total effort for project management activities. In order to get a better understanding of the required project management effort, we decided to analyze data from a set of projects, especially the timesheets provided by the individual team members. Before starting the analysis, we formulated five hypotheses to guide our analysis.

Our analysis concentrates on the *proportion of project management effort* required for executing projects. By the proportion of project management effort we mean the percentage of total effort that is used for project management activities. In our analysis, *total effort* means every type of effort that has been reported for the project, and *team size* is the number of persons who have reported hours for the project.

The duration of a project is an important factor regarding the project management activities required. The risks with projects with longer duration increase (Cooke-Davies, 2002), which may require additional effort for risk management and replanning. For a project with a longer duration, the importance of change management and replanning increases (Dvir and Lechler, 2004), which is likely to increase the proportion of project management effort. This is supported also by recent results on complex projects (Zhang, 2013).

The first hypothesis is based on the assumption that projects with longer project duration require a greater proportion of project management effort than projects with a shorter duration. Hence we formulate our first hypothesis as follows:

H1. Projects with a long duration require a greater proportion of project management effort than projects with a shorter duration.

Projects may have small teams with a simple communication structure. With a small project team, the project manager may easily have a meeting with all team members in a meeting room and be constantly aware of what is happening. Many project management activities are easy to perform and they will not take much time. The situation is likely to change when the project team gets significantly bigger.

Large project teams may require additional levels of management structure and formal channels of communication. In order to keep track of the project, the project manager may utilize formal reporting structures and other complexity-management solutions. Hence a large project team may require a greater proportion of project management effort than a smaller team. The second hypothesis is based on a similar correlation between the size of the project team and the proportion of project management effort required. Hence we formulate our second hypothesis as follows:

H2. Large project teams require a greater proportion of project management effort than smaller teams.

The results reported by Barry et al. (2002) show that there is a minimum amount of effort required in order to start a complex activity. Support for that can be found from Ahonen and Savolainen (2010) and Savolainen and Ahonen (2015), which suggest that there are necessary project management activities that have to be performed for every project. Hence it is reasonable to assume that every project requires at least that amount of project management effort.

The existence of necessary project management activities and effort required for starting a complex activity suggest that there is an absolute minimum of project management effort that is required for any project. In other words, it is not possible to execute a project without spending at least some effort on project management activities.

We assume that when projects are fairly short and have small project teams they require less project management effort than projects with longer durations and larger teams (this comes from H1 and H2). On the other hand, it has been shown that at least some project management effort is always required (Barry et al., 2002), and therefore we assume that on average there is lower limit of proportional project management effort that is approached when projects get shorter and teams smaller. That lower limit would be more than