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The effects of perceived value and stakeholder satisfaction on software project impact

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ABSTRACT

Context: In this paper we present a multiple case study on the insights of software organizations into stakeholder satisfaction and (perceived) value of their software projects. Our study is based on the notion that quantifying and qualifying project size, cost, duration, defects, and estimation accuracy needs to be done in relation with stakeholder satisfaction and perceived value.
Objectives: We contrast project metrics such as cost, duration, number of defects and estimation accuracy with stakeholder satisfaction and perceived value.
Method: In order to find out whether our approach is practically feasible in an industrial setting, we performed two case studies; one in a Belgian telecom company and the other in a Dutch software company.
Results: In this study we evaluate 22 software projects that were delivered during one release in the Belgian telecom company, and 4 additional large software releases (representing an extension of 174% in project size) that were delivered in a Dutch software company. Eighty-three (83) key stakeholders of two companies provide stakeholder satisfaction and perceived value measurements in 133 completed surveys.
Conclusions: We conclude that a focus on shortening overall project duration, and improving communication and team collaboration on intermediate progress is likely to have a positive impact on stakeholder satisfaction and perceived value. Our study does not provide any evidence that steering on costs helped to improve these. As an answer to our research question - how do stakeholder satisfaction and perceived value relate to cost, duration, defects, size and estimation accuracy of software projects? – we found five take-away-messages.

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1. Introduction

An often cited result of the 1994 Standish CHAOS research [1] is that 70% of all software projects are problematic. Standish defines these as so-called 'challenged projects', meaning they were not delivered on time, within cost, and with all specified functionality [2].

This is in a certain way along the lines of what we found when studying a series of 22 finalized software projects in a Belgian telecom company. We found that the average cost overrun was 28% (ranging from −41% to 248%), and that the average duration overrun was 70% (ranging from 9% to 168%). There was only one single project that performed within a 10% cost and duration overrun boundary. As such, these projects were challenged if we adopt the way Standish defines success and failure; being the extent in which a project conforms to its original plan.

However, did all the other 21 projects fail? Is it fair to say that a project with cost overrun is a failure? Is it reasonable to say that a project that performed completely according to plan, but delivered software that no one uses, is a success?

1.1. Problem statement

Supported by many critical reviews of the Standish criteria [2–4], we define success and failure in this paper from a different angle, trying to include the balance between *value* and *cost* into the equation. In previous research we defined success and failure in terms of cost, duration and number of defects of a software project [5–7]. Looking at the outcomes of this we consider that a project that is late and over budget – and thus in terms of our study bad practice, or in other words unsuccessful – yet returns high value according to its stakeholders, may still be called successful, because of the fact that it delivers high value.

By analyzing project metrics such as *cost, duration, defects*, and *size* of the projects in connection with *stakeholder satisfaction*,

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perceived value and *quality of estimations*, we show that stakeholders define success and failure of a project different from solely measuring cost and duration overrun. Especially in domains where value is more important than predictability, e.g. agile ways of working, a limited view on conformance to planning, seems illogical.

Due to the fact that measuring the real – delivered – value of software deliveries is difficult, we focus in this paper specifically on *perceived* value. The underlying idea is that, since finding evidence in the bottom-line financial administration is hard, if not impossible, the best we can do is involve stakeholders for a qualitative indication of value. However, as this is strongly dependent on the individual and the contextual setting (what is valuable in one setting might not be valuable in another, or what one stakeholder considers to be of no value can be of high value to another stakeholder), we use the term *perceived value*. We understand that this is a way to measure value that is limited in its external and construct validity. However, this approach may help in finding early ways of indicating value [8].

In this paper, we analyze a set of projects conducted at a Belgian telecom company (referred to in this paper as BelTel) and a Dutch software company (referred at in this paper as DutchCo) that provides billing software products and services (also largely to the telecom domain). We propose the following research question:

How do stakeholder satisfaction and perceived value relate to cost, duration, defects, size and estimation accuracy of software projects?

In answering this question, we make the following contributions:

1. We propose a light-weight value measurement technique based on post-release interviews.
2. We provide data on 26 industrial projects for which 83 key stakeholders provide *stakeholder satisfaction* and *perceived value* measurements in 133 completed surveys.
3. We contrast the resulting *perceived value* and *stakeholder satisfaction* statements with collected data on *costs, duration, defects, size* and *estimation accuracy* and look for links between them.

This paper is an extended journal version of an earlier published paper at the 20th International Conference on Evaluation and Assessment in Software Engineering (EASE 2016) [6]. Compared to the original paper the new contributions can be summarized as follows:

- We replicated the research performed in our original study in another company: DutchCo, a Dutch software company, specialized in delivering billing solutions to European telecom operators.
- Within DutchCo, we examined four (4) large software releases, representing an extension of 174% in project size. We collected detailed size, cost, time, and defects data from all releases. We performed electronic surveys on stakeholder satisfaction and perceived value among thirty (30) stakeholders within the DutchCo organization and InVend, its provider of India-based development teams.

The remainder of this paper is structured as follows. In Section 2 related work and the background of the model that we use for analysis purposes are described. Section 3 outlines the research design. The results of the study are described in Section 4. We discuss the results in Section 5, and finally, in Section 6 we make conclusions and outline future work.

2. Background and related work

Many studies include critical reviews of the Standish Chaos Report [2–4,9–13]. The Standish Group reported in their 1994 CHAOS report that the average cost overrun of software projects was as high as 189%. Jørgensen and Moløkken-Østvold [2] conclude that this figure is probably much too high to represent typical software projects in the 1990s and that a continued use of that figure as a reference point for estimation accuracy may lead to poor decision making and hinder progress in estimation practices [2] Glass [3] states that objective research study findings do not, in general, support those Standish conclusions [3].

Where in our research we measure value as perceived by stakeholders on four business related subjects, many different measures are used to identify value, and a clear and uniform definition is no question yet. Pekki [14] defines stakeholder value as the "usefulness of offering SPI to its key beneficiaries, so they are fully involved into SPI activities which increases the success of those activities". Beck [15] indicates that value is about money and time, by saying we "need to make our software economically more valuable by spending money more slowly, earning revenue more quickly and increasing the probably productive lifespan of our project". Dingsøyr and Lassenius [16] answer the question "What is value"? by saying that "the improvement trends are not specific on how they define value". They come up with the argument that," proponents of agile development would argue that a development team needs to learn what external stakeholders value during a development project". In a way this matches our idea that besides internal stakeholders, especially external stakeholders should be involved in the value discussion.

Atkinson [17] argues that besides time, cost and quality, often referred at as *the iron triangle*, also stakeholder benefits should be taken into the equation. Besides that, he mentions the effect that quality is "an emergent property of people's different attitudes and beliefs, which often change over the development life-cycle of a project".

Estimate the value of software is probably as challenging as predicting the cost of software [18]. Strand and Karlsen [19] suggested to estimate value in the form of "benefit points", as a kind of equivalent to story points. Cheng et al. [20] describe an architecture-based approach to discover value of software engineering by using big data techniques. Although quite some research has been performed in the area of value estimation [21–23], and success criteria for software projects [24,25], most of these approaches seem poorly adopted in industrial software project management settings. A good sign however, is that an increased focus on value in improvement is seen in software development, mainly driven by agile development approaches [16].

Jørgensen [26] performed a survey among software professionals in Norway on the characteristics of projects with success in delivering client benefits. He mentions that a focus on client benefits as a success criterion is particularly important, because only weak correlations are found on other dimensions, such as "being on time" and "being on budget". Besides that, he mentions that the traditional success factor "having the specified functionality" may even be in conflict with success in delivering client benefits.

3. Research design

The goal of this study is to understand the underlying reasons of stakeholder satisfaction and value of software projects. To achieve this, we contrast project metrics such as *cost, duration, number of defects* and *estimation accuracy* with *stakeholder satisfaction* and *perceived value*. We argue this will help to better understand the backgrounds of software projects as a guide for building future software portfolios.

As explained in the introduction, the Standish criteria [1] states that success and failure are related to the quality of project estimates. In order to explore alternatives, we test for association between paired samples, using Pearson's product moment correlation coefficient and resulting *p*-values in case our data is normally

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