Could Social Factors Influence the Effort Software Estimation?

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ABSTRACT

Effort estimation is often influenced by several factors, including social. This study aims at understanding the interactions between social factors and effort during effort estimation. I want to analyze the dynamics that occur when a developer estimates the effort for a specific task and the influence of the work team and the work conditions.

I conducted a semi-structured interview among three different projects with different developers working in Agile and Scrum processes, asking them which factors and social aspects they take in to account when they estimate the effort during the development processes.

Results show an important influence of social factors during the effort estimation phase, and call for future works for a large scale Survey for a more accurate identification.

Categories and Subject Descriptors

D.2.9 [**Management**]: *Cost estimation, Life cycle*

General Terms

Effort Estimation, Measurement, Experimentation, Human Factors.

Keywords

Effort estimation, Agile process, Scrum process, social factors.

1. INTRODUCTION

Effort estimation is one of the most important activities in any domain, especially in software engineering where still a big number of projects fails because of effort estimation errors[1].

Several effort estimation models have been defined based on user experience or on historical data. In both cases the evaluation is based on factors that are difficult to identify. Those factors are usually related to the project to be developed, the context, the knowledge of domain and last, but not least, social factors such as the interaction in the development team.

In my work, I want to investigate which are the social factors that influence the effort estimation process. I analyze the personal

mechanism that occurs when a developer estimates the effort for a specific task and the influence of the work team and the work conditions.

I conduct a semi-structured interview for collecting which factors the developers take in to account during the effort estimation and I analyze three different projects with different team composed by experts and students.

Results show that most of the interviewed developers consider communication and work pressure as very important social factors while other factors such as familiarity with the project and managerial skills are not considered as relevant social factors during the effort estimation phase.

The remainder of this paper is organized as follows: Section 2 describes related work. Section 3 describes the study carried out. Section 4 shows the results. Section 5 concludes.

2. RELATED WORKS

Software effort estimation is a complex and critical [2] task. Generally the project's effort is estimated based on the effort of projects developed in the past. A big set of information should be also taken into account to estimate the effort, such as the project size, the domain, and many other factors such as law constrains, standard and others that may significantly influence the estimation. The parameters identification and measurement is very complex, since software products are less tangible than the classical engineering ones and the requirement volatility increasing the complexity of the effort estimation negatively influencing the estimation accuracy. [3]

Several estimation models have been defined in the past, mainly based on developers' experience [4] or statistical techniques on historical data [5, 6, 7].

Expert-based estimation models are based on people's experience where the estimation is commonly carried out by analogy, comparing the project to be developed to similar past projects [3] Data-driven models are based on statistical or machine-learning techniques with the goal of reducing the subjectivity of the expert evaluation and automating the effort estimation as much as possible. [5, 6, 7]

Here I report on existing work that analyze the information taken into account by developers during the effort estimation process.

Molokken [8] conducted a systematic literature review of effort estimation identifing several cost factors related to the subjective such as work pressure and communication process. Lamersdorf et al [12] identified as social factor language and cultural differences, communication process and competence level while Kroll et al [13] identified the communication, the team structure

and the work pressure. Also Da Silva et al [14] recognized language and cultural differences but considered in addition the work dispersion and the team size. Finally Nurdiani et al [15] highlighted language and cultural differences and communication issues.

Another set of factors has been identified by Popli and Chauhan [10]. They call "People-Related" factors working time and experience of previous project.

In order to improve the estimation accuracy Menzies et al. [9] and Jørgensen [11] defined some best practices for expert based effort estimation models particularly for personnel.

Another studies, carried out by Taibi et Al, also confirm language and cultural differences, communication and working time as main social influencing factors during the effort estimation [16, 17, 18, 19].

In Table 1, I summarize the most important factors identified here.

Table 1. social effort estimation factors

Factors	Study id.
Language and Cultural Differences	[8] [12] [14] [15] [16] [17] [18]
Communication	[8] [10] [13] [15] [16] [17] [18]
Communication Process	[8] [12] [16][17][18]
Team structure	[8] [13]
Work Pressure	[8] [9] [11] [13]
Work Dispersion	[8] [14]
Team Size	[8] [14]
Competence Level	[8] [12]
Familiarity in Team	[10]
Managerial Skill	[10]
Working Time	[10] [16] [17] [18] [19]
Experience of Previous Project	[10]
Technical ability	[9] [10] [11]

3. THE INTERVIEW

In order to understand if any social factors could influence the effort estimation I conducted three set of semi-structured interviews, among the developers of three different projects developed with Agile methodologies. In this section, I present the goal and the research question. Then I describe the study design, the study preparation and the procedure.

3.1 Study goal and Research Question

Accordingly to our expectation I formulated the goal as following:

Analyze social factors
for the purpose of evaluating the influence of Social factors
from the viewpoint of developers
in the context of effort estimation

This leads to our research question:
RQ: which social factor influence the effort estimation?

3.2 Study design

The study was designed as semi-structured interviews with students and researcher as participants and I carried it out by means of a Questionnaire. The Questionnaire is defined in collaboration with experts in empirical software engineering from the University of Kaiserlautern and University of Bolzano/Bozen.

The questionnaire is composed by three sections. In the first section I profile the interviewees, so as to gather information on their profile. In the second section I ask to rate each factors listed in Table 1 with a likert scale ranging from 1 to 5, where 1 means not important and 5 very important. In the third section, I ask to list any additional factor that could influence the effort estimation.

The study has been designed to be replicated several time, with the same settings, in different projects.

3.2.1 Study preparation

All participants were master students and expert developers. In the first round of interviews the team was a distributed teams in several projects with part-time developers working during non-overlapping hours. In addition, at the University of Kaiserslautern, the development is often gave to students with part-time contracts and they work for a small number of hours per week, in their spare time.

In the second and third set of interviews, the team was always students but they worked for a minimum of six hours per week and mostly during the lectures.

3.2.2 Study Execution

Here I report on the three projects considered in the study.

The first project (GROUP 1) was developed in the context of a web application developed by six developers at the University of Kaiserslautern (Germany) [20]. The project has been developed following the Moonlight Scrum [16, 17, 18, 19] process, by Master Students. The experience level was the same for the team, even if nobody had any experience with agile methodologies. They worked part-time, with weekly working hours between four and ten, with a total effort spent of 39 hours per week. The development started in February 2013 until the end of May 2013.

The second (GROUP2) and the third (GROUP 3) project were conducted in the context of the development of two Master projects, during the course of "Software Factory" in the Computer Science department of the Free University of Bolzano/Bozen (Italy). Both groups developed a web application but, while one group developed in Java /JSP the second developed the application in Asp.Net/C#. Both groups are composed by three developers, working for 10 hours a week, from March 2015 until the end of May 2015.

4. RESULTS ANALYSIS

Here I report the results for all groups and the aggregated results.

Analyzing the results presented in Table 2, users considered very important communication (4.25 out of 5) and work dispersion (4.42 out of 5) while eight factors are considered moderately important or of little importance with likert-scale values that range from 3 to 4 (Domain Knowledge, Communication Process, Experience of Previous Project, Working Time, Language and Cultural Differences, Work Dispersion, and Work Pressure).

Managerial skills, familiaries with the team and competence level are only considered of little importance while only the familiarity with the project is considered unimportant.

Table 2. Results analysis

Factors	ALL GROUPS			GROUP1			GROUP2			GROUP3		
	Mean	*Median*	*Std.dev*	*Mean*	*Median*	*Std.dev*	*Mean*	*Median*	*Std.dev*	*Mean*	*Median*	*Std.dev*
Work Pressure	4,42	4	0,51	4,67	4	0,52	4,67	4	0,52	4,42	4	0,51
Communication	4,25	4	0,62	4,33	4	0,75	4,33	4	0,75	4,25	4	0,62
Work Dispersion	3,58	4	1	3	4	0,75	3	4	0,75	3,58	4	1
Language and Cultural Differences	3,5	3	1,24	3,33	4,5	1,26	3,33	4,5	1,26	3,5	3	1,24
Communication Process	3,42	4	1,31	2,67	4	0,75	2,67	4	0,75	3,42	4	1,31
Experience of Previous Project	3,42	3,5	1,16	2,67	4	0,75	2,67	4	0,75	3,42	3,5	1,16
Working Time	3,42	3,5	1,08	3,33	4	0,63	3,33	4	0,63	3,42	3,5	1,08
Domain Knowledge	3,33	3,5	1,07	2,67	4	0,75	2,67	4	0,75	3,33	3,5	1,07
Team Structure	3,33	3	1,07	3,67	3	1,17	3,67	3	1,17	3,33	3	1,07
Technical ability	3,17	3	0,72	3	3	0,63	3	3	0,63	3,17	3	0,72
Competence Level	2,92	3	0,79	3,67	2,5	0,55	3,67	2,5	0,55	2,92	3	0,79
Familiarity in Team	2,83	3	1,11	3,67	2	0,75	3,67	2	0,75	2,83	3	1,11
Managerial Skill	2,08	2	0,9	1,33	3	0,52	1,33	3	0,52	2,08	2	0,9
Familiarity with the project	1,83	2	0,72	1,33	2	0,63	1,33	2	0,63	1,83	2	0,72
5-point ordinal Likert scale: 1=not important, 2=Of little importance, 3=moderately important, 4=important, 5=very important												

5. CONCLUSION AND FUTURE WORK

In this paper, I highlight the problem of social factors during the effort estimation phase, providing first a literature review to understand the social factors commonly considered important during the effort estimation phases. There are several works reporting on different models to estimate the effort but, at the best of our knowledge, no studies analyzed the influence of social factors.

For this reason, I designed and executed a semi-structured interview, I carried out on three projects, asking our developers which social factor they consider during the effort estimation phase.

Results show that most of the interviewed developers consider Communication and work pressure as very important social factors while other factors such as familiarity with the project and managerial skills are not considered as relevant social factors during the effort estimation phase.

As for threats to validity, results are based only on the analysis of three development processes, based on a relatively short timeframe (3-4 months). Developers are master students, with a limited experience (2-3 years) in software development.

Future work include the execution of a large scale survey on senior developers, so as to target a broader population of software engineers and to better understand which factor influence more the effort estimation with the ultimate goal of increasing the estimation accuracy.

Moreover, I am planning to setup a project to understand to which extent social factors influence software effort estimation, so as to better take them into account during the estimation process.

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