

Cost Estimation for Global Software Development

Patrick Keil
Institut für Informatik – I4
Technische Universität München
Garching, Germany
49.89.289.17386
keilp@in.tum.de

Daniel J. Paulish
Siemens Corporate Research, Inc.
755 College Road East
Princeton, NJ, USA
1.609.734.6579
daniel.paulish@siemens.com

Raghvinder S. Sangwan
Engineering Division
The Pennsylvania State University
Malvern, PA, USA
1.610.725.5354
rsangwan@psu.edu

ABSTRACT

Global software development has gathered pace in recent years. Many software projects now involve asynchronous collaboration among geographically distributed teams several time zones apart. Software cost estimation for such projects becomes challenging due to factors such as effort expended in team building and knowledge transfer, creating an architecture of the software product that can be easily distributed and that minimizes cross-site communication, facilitating communication among remote teams collaborating on parts of the architecture that are interrelated and their day-to-day governance.

In this paper we structure the additional cost drivers of distributed development and examine the significance of each of these factors as a contributor to the overall cost of a software development project. We suggest ways in which COCOMO II, the most widely used software development cost estimation model, can be tailored to account for these additional complexities.

Categories and Subject Descriptors

D.2.9 [Software Engineering]: Management – *Cost estimation.*

General Terms

Economics, Human Factors, Management, Measurement

Keywords

Cost Estimation, Global Software Development, COCOMO

1. INTRODUCTION

With an expanding global marketplace, a trend towards developing software in low cost countries, and the growing complexity and size of software systems, the percentage of projects that are globally distributed has been steadily increasing [7]. Siemens Corporate Research, Inc. (SCR) has been doing research aimed at developing a better understanding of the issues and impact of various practices with respect to Global Software Development (GSD) since GSD increases the requirements

regarding development processes, project management practices, architecture, quality, collaboration tools and so forth.

The 1999 Standish Group report shows a significant correlation between project or team size and the project's success [21]. We believe that one major determinant for this correlation is the physical separation of teams which is more often the case the bigger the projects get. This physical separation, especially across several time zones, requires additional activities and effort; e.g. for team building, knowledge transfer for asynchronous collaboration, creating an architecture that is easily distributed and that minimizes cross-site communication, and facilitating communication among teams working on parts of the architecture that are interrelated [4][5][6][11][12][18]. This additional effort translates into a substantial planning, coordination and control overhead in the day-to-day governance of GSD projects.

Yet many corporations are choosing to partner with software development companies in Eastern Europe, South America, and Asia hoping for substantial cost savings, mainly based on lower labor rates offered by these organizations. This can, however, be misleading considering these other factors that play a significant role in offshore sourcing. In this paper, we present an approach to improve the precision of COCOMO cost estimations for GSD. After a short introduction to COCOMO II, a widely used model for software development cost estimation, we analyze the sources of complexities in distributed software development projects and how well they are represented in COCOMO. We then propose some refinements to COCOMO II. Finally, we draw some conclusions pointing out the shortcomings of our approach and avenues for future research.

The results of our analysis can be used for the calculation of trade-offs between the decision to collocate or distribute the development of a software product. The overall goal of our work on these subjects is to provide a decision making framework for managers when faced with such decisions.

2. COST ESTIMATION WITH COCOMO

The Constructive Cost Model (COCOMO) was introduced in 1981 by Barry Boehm [2]. The enhanced version, COCOMO II, was presented in 1985 and has been further adapted since then [3]. COCOMO II is today's most used method for estimating cost of software projects [23]. It is accepted internationally and in organizations of all sizes.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

EDSER'06, May 27, 2006, Shanghai, China.

Copyright 2006 ACM 1-59593-085-X/06/0005...\$5.00.

