Exploring the Perceived End-Product Quality in Software-Developing Organizations

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ABSTRACT

Software projects have four main objectives; produce required functionalities, with acceptable quality, in budget and in schedule. These objectives are all important for software projects to be successful, but how does the end-product quality fit to them? The objective of this study is to explore how organizations understand software quality and identify factors which seem to affect the quality outcome of the development process. The study applies three approaches; a quantitative survey with 31 organizations, qualitative analysis of in-depth interviews with 36 software professionals, and four workshops for identifying and prioritizing quality goals. The study revealed that quality in software organization is not a single, easily definable entity, but a complex, interconnected concept fluctuating between the stakeholders. Overall, it seems that there is no general consensus over the important quality characteristics in software organizations and therefore software organizations could benefit from identifying the quality characteristics they consider important, and actively pursuing quality goals.

Keywords: ISO/IEC 25010, Mixed Method Study, Quality Characteristics, Quality Goals, Software Quality

INTRODUCTION

Software quality is a composition of different characteristics, with the importance of these characteristics varying between different types of software products. For example, the desired or important quality characteristics between a game on a mobile phone and control software of an airplane surely have a big difference. But are the software producers using some form of quality goals or have they identified the quality characteristics they are aiming for? If they are, what are the factors of the software process that affect the perceived end-product quality?

The main objectives of software engineering include reduction of costs and improvement
of the quality of products (Osterweil, 1997). To reach the quality objectives in the product, an organization needs to identify their own quality i.e., those quality characteristics which are important. After identifying their preferred quality, the next action would be to find the factors in development and testing that affect these quality characteristics and ensure they work as intended.

A model that in this sense attempts to specify the different characteristics of quality is the revised software product quality model, as introduced in the ISO/IEC 25010 standard (International Organization for Standardization, 2011). According to the standard, which further elaborates the quality concepts introduced in ISO/IEC 9126 (International Organization for Standardization, 2002), software quality expresses the degree to which the software product satisfies stated and implied needs when used under specified conditions. In the model, quality consists of eight characteristics, which are functional suitability, reliability, performance efficiency, operability, security, compatibility, maintainability, and transferability. These characteristics are further divided into 38 subcharacteristics, such as accuracy or fault tolerance, which aim to define the quality in measurable terms. In addition, in software business the quality is related both to the development and testing. In the ISO/IEC 29119 standard (International Organization for Standardization, 2009), software test process is defined to comprise of layers, such as organizational level, test management level and testing level. In our study, these standards describe the research subject, software product quality and software testing in organizations.

Testing has a big influence on profitability of software business, as it usually is one of the biggest expenses in software development (Kit, 1995). In addition, one estimate (Tassey, 2002) has calculated that the software producers in United States lose annually 21.2 billion dollars because of inadequate end-product quality. Because of the economical importance of software quality, it is important to understand how organizations understand software quality and how organizations decide on quality requirements. The identification of how organizations perceive quality, i.e., which quality characteristics they consider important, and how the quality requirements are catered, helps them to concentrate on essential parts when improving process outcomes from the viewpoint of quality assurance.

However, defining the quality requirements and understanding what parts of the complete software process affect the quality is not easy, as the development and test processes include many concepts that all have the possibility to affect the quality in practice. In addition, there are several process stakeholders, which all have their own viewpoint on the developed software product. In this study we explore these concepts and viewpoints in different types of software organizations to understand what process factors have a major impact on the perceived software quality outcome and how the quality goals in software organization are formulated.

To reach this objective we use a mixed-method approach and apply three different research methods, a statistical survey, a grounded-theory study, and quality workshops (Barbacci et al., 2003). The sub-objectives related to these parts of the study are:

1. How can the important factors for achieving better end-product quality be characterized in the software industry? We use a statistical survey to form a picture of the industry field as a whole.
2. What factors of software development affect the perceived quality in specific software development organizations? This was approached with open-ended interviews and qualitative analysis to reach a deep and contextual understanding.
3. How should the quality goals be set in practical situations? What should the organization consider when deciding about quality? This understanding was accomplished with a series of workshops to collect and analyze specific quality-related considerations of individual organizations.
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