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Software quality across borders: Three case studies on company internal alignment

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ABSTRACT

Context: Software quality issues are commonly reported when offshoring software development. Value-based software engineering addresses this by ensuring key stakeholders have a common understanding of quality.
Objective: This work seeks to understand the levels of alignment between key stakeholder groups within a company on the priority given to aspects of software quality developed as part of an offshoring relationship. Furthermore, the study aims to identify factors impacting the levels of alignment identified.
Method: Three case studies were conducted, with representatives of key stakeholder groups ranking aspects of software quality in a hierarchical cumulative exercise. The results are analysed using Spearman rank correlation coefficients and inertia. The results were discussed with the groups to gain a deeper understanding of the issues impacting alignment.
Results: Various levels of alignment were found between the various groups. The reasons for misalignment were found to include cultural factors, control of quality in the development process, short-term versus long-term orientations, understanding of cost-benefits of quality improvements, communication and coordination.
Conclusions: The factors that negatively affect alignment can vary greatly between different cases. The work emphasises the need for greater support to align company internal success-critical stakeholder groups in their understanding of quality when offshoring software development.

1. Introduction

The rapid rise of global software development (GSD) [24] has brought with it new benefits and challenges. The main drivers for this practice are cost reduction, proximity to markets and making use of different competencies [52], but there are also many challenges. The most commonly cited challenges in GSD contexts concern communication and coordination [43,29,16], both essential elements in creating alignment between the growing number of stakeholders involved in software development.

There is a wide body of evidence showing that organisations that can create alignment through "convergent intentions, shared understanding and coordinated procedures" will outperform organisations that cannot create this alignment [18,19]. Although Chan [18], and Chan and Reich [19] refer to Business-Information Systems and IT alignment in Information Systems departments, the alignment related issues that they addressed in their articles are very relevant to software development in a global context too. Alignment of stakeholders allows them to collaborate more effectively and produce results that support long-term business strategies, while highly misaligned teams can cause conflict and eventually lead to project failure.

Studies of alignment between groups, stakeholders and so forth are not new. It is a well-known challenge. However, GSD creates a number of challenges in relation to alignment. A challenge identified when working with one of our industrial partners was the alignment in terms of the understanding of the importance of different software quality attributes. The company was interested in understanding both whether different roles have the same understanding of the importance of different software quality attributes, and whether or not people at different sites of the company shared this understanding of the importance of different software quality

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attributes. Based on the identified industrial challenge in relation to alignment of the understanding of the importance of different software quality attributes, three case studies are presented seeking to understand alignment in environments employing two different GSD strategies. Thus, the objective is that the case studies should help in (1) understanding the levels of alignment between stakeholder groups in terms of software quality attributes, and (2) identification of reasons for the level of alignment, or potential misalignment. These two items form the basis for two of the research questions formulated.

This paper is an extension of Barney et al. [8]. The method applied to evaluate the alignment in relation to software quality attributes was originally proposed in Barney and Wohlin [5]. The paper that forms the basis for this work, Barney et al. [8], is the first to apply this method to study alignment in a GSD setting, and extends the statistical analysis originally proposed for the method. This paper extends Barney et al. [8] to include an additional case study from the financial services industry with a US-based company undertaking offshore development in Australia and India. The objective was to include an additional company coming from a different application domain and where the GSD context was different (including the companies having different GSD strategies). Furthermore, this article adds an additional scope by introducing a new research question as it applies the Stakeholder Alignment Assessment Method for Software Quality (SAAM-SQ) for a new company in a GSD context. This gives an opportunity to study the usefulness of SAAM-SQ in new context.

The remainder of this paper is structured as follows. Key literature introducing the topic is presented in Section 2. The research questions and methodology are presented in Section 3. Information about the case studies is presented in Section 4. The levels of alignment found in the case studies are presented in Section 5 and the reasons identified for these levels of alignment are presented in Section 6. A reflection on the use of the method is provided in Section 7. A discussion of the results is made in Section 8, with the conclusions in Section 9.

2. Background

This section introduces key concepts and related work.

2.1. Software quality

There have long been many definitions of software quality [36], with the most common in software engineering being 'conformance to specification' and 'fit for purpose'. Here software quality is used to denote the general perception of how good the software is according to the definitions of software quality, while software quality attributes are used to acknowledge that software quality constitutes of many different attributes, for example performance, reliability, usability and security to name a few. The growing body of value-based software engineering (VBSE) literature recognises that perceptions of software quality are individual and shaped by experiences [35]. VBSE suggests that the most successful way to move forward with software development is for the success-critical stakeholder groups to reach mutual consensus. The success-critical stakeholder groups are the groups upon whom the success of the product depends [14].

Software quality does not need to be perfect [54]. The tough question to answer is, 'how much less than perfect is sufficient?' There is no single answer to this question, as any answer must consider the context in which it is being asked. The Quper model helps answer this question by defining a relationship between the level of quality, the benefits and the costs [48]. The model defines a series of quality/benefit levels, in which a software product can be categorised as *useless*, *useful*, *competitive* or *excessive*. It recognises that under-investment leads to an unusable product, but over-investment costs more than the benefits gained.

2.2. Models of software quality

There are many models that describe software quality. The most common representations of software quality present a hierarchy of quality attributes. Examples of such models include the quality models by McCall and his colleagues—often referred to as McCall's model [41], the quality model by Boehm and his colleagues—often referred to as Boehm's model [12,13], and ISO9126 [34]. All of these models are criticised for various deficiencies. The major complaints about ISO 9126 are missing or insufficiently detailed aspects of quality, and insufficient information about measuring the aspect defined.

An alternative approach to defining quality models was undertaken in Dromey's quality model [25]. This work proposes the definition of the actions required to achieve the desired level of quality rather than describing the quality itself. As such this approach provides developers with concrete actions that will achieve the desired quality.

2.3. Key stakeholder alignment

Stakeholder alignment has been defined as "convergent intentions, shared understanding and coordinated procedures" [18], inline with the goals of VBSE. Individuals from different areas in a product development organisation can understand the same aspect of the product differently [15]. This problem is worse in environments where work is handed sequentially from team to team, but it is better in environments with cross-functional teams. Forming cross-functional teams to work on concrete problems has been found an effective way to increase the information flow.

There is overwhelming evidence showing aligned groups outperform those who are not aligned [19]. A shared understanding is a precondition for stakeholders to collaborate more effectively [3], and hence being more aligned will help producing systems that support the long-term business strategies. It is important that all stakeholders are included in the process of goals, planning, defining roles and defining responsibilities [22]. Highly misaligned teams can cause conflict and eventually lead to the failure of a project.

Brown and Eisenhardt [15] present primary and secondary evidence of the importance of communication both within and between groups during product development to achieve alignment. From this work they conclude that effective communication supports successful product development and requires a communication strategy. Communication strategies that frequently employ multiple communication channels with the various groups involved in product development are associated with greater levels of success. There is research that shows that teams that engage in more thorough internal communication have a superior performance as they are more successful at a range of activities, including goal definition. Cramton [22], after examining 45 geographically dispersed teams of students who work on an assignment project for 7 weeks, suggests exploring the advance potential differences in situations for dispersed teams. For example, ideally every member in the team should receive the same information; however the information overload can be a big problem in practice. Hence, it is important that team members communicate the information that makes sense within the parameters of the collaboration and actively seek for information rather than making assumptions.

Shared knowledge helps a team communicate more effectively as they have shared expectations, experiences and vocabulary [26].