Project Quality Management in Virtual Environments: A Primer

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ABSTRACT
The rise of geographically dispersed project teams enabled by technology has made project quality management a significant challenge for organizations. This paper uses findings from a project on geographically dispersed, cooperating SMEs in the building trade, to explore whether concepts and artefacts from the Rational Unified Process® (RUP®) software development approach could be adapted and used to better manage quality in virtual projects. Our future research aims to explore the use of RUP artefacts in a virtual environment and their impact on project management and quality.

INTRODUCTION
Having evolved from unique, capital-intensive, project-based industries such as construction and defense (Bryde, 2003), project management is now moving into the modern era of virtually managed projects. The rise of culturally diverse and geographically dispersed teams facilitated by networking technologies, has given birth to many complexities (Skyrme, 1998), necessitating the development of models. Moreover, emerging project management models recognize the process-oriented philosophy of quality management (Fraunholz, 1995).

In this paper we posit that managing business processes as well as project management themselves is crucial for maintaining project quality, especially in increasingly virtual environments. This view is elicited from a project on SMEs (ref) in the building industry, with geographically dispersed workforces i.e. a virtual environment. We commence with a contextual taxonomy providing definitions related to our focal theme, followed by a short review on current project quality models and the project management processes in the SME study. Then we explore the Rational Unified Process® and propose how its artefacts could be applied to managing project quality in virtual environments, something we will explore in a future study.

MANAGING VIRTUAL PROJECTS
Project Quality Management is the 'process required to ensure that the project will satisfy the needs for which it was undertaken. It includes all activities of the overall management function that determine the quality policy, objectives and responsibility and implements them by means of quality planning, quality assurance, quality control and quality improvement, within the system...’ (PMBOK, 2000: 6).

Refes (2001) refers to Virtual project management as the way in which virtual teams collaborate for a finite period of time towards a specific goal. Kristof et al. (1995) defined a global virtual team to be a temporary, culturally diverse, geographically dispersed, electronically communicating workgroup. Desouza et al. (2003) purports that complexities can be attributed to managing multiple interdependencies across time, space and projects in these environments.

The views of major contributors (Deming 1982; Juran 1986; Crosby 1980; Ishikawa 1985) have laid the foundational models to manage project quality. In an effort to standardise project quality management best practices, the International Organisation for Standardisation (ISO) developed ISO9000 – a system standard that aims at a continuous cycle of planning, controlling and documenting quality in organisations (ISO, 2004). Also prevalent is the use of maturity models or frameworks to help organisations improve their processes such as software function quality deployment (Yilmaz and Chatterjee, 1997) and the Capability Maturity Model (CMM) (Humphrey, 1989). Project Management Institute (PMI) has made substantial progress with Organisational Project Management Maturity model (OPM³) (Schlichter, 2004). OPM³ prescribes excellent business practices focused primarily on two aspects: choosing the right projects to execute organizational strategies, and implementing the processes, structures, and behaviors necessary to deliver projects successfully, consistently and predictably.

The Rational Unified Process® (RUP®) is a framework that emphasizes addressing high-risk areas very early, by rapidly developing frequent executable releases of these parts of the system. The approach does not assume a fixed set of requirements, instead allowing for requirements to be defined as a project process evolves. Moreover, it lends itself to automation of many components but does not focus on documentation (Kuntzmann-Cornelles and Kruchten, 2001).

The Model-based System (MBASE) framework (Boehm et al., 1999) is a set of guidelines that describe software engineering techniques for creation and integration of a development model for a software project. Models to be integrated include process models such as lifecycle and risk, property models such as cost and schedule, and success models such as business case analysis and stakeholder win-win (Boehm et al, 1999). MBASE appears to be compatible with RUP® as they have adopted similar anchor point milestones for ensuring stakeholder commitment.

THE PROJECT MANAGEMENT PROCESS IN SMEs
During a recent project (Fraunholz, 2001) with SMEs in the building trade (working virtually as cooperating partners spread over a hundred kilometres) we identified a need for project quality management as well as knowledge retention in projects. We also identified that there were significant similarities between the nature of general projects and many of the business processes within these project driven organisations. Specifically, projects consist of business processes such as an initial customer inquiry or the production process on a building site. Therefore, it seems appropriate to be looking for approaches that potentially enhance both domains.

To be able to make use of process models for project management, it is necessary to understand the processes crucial for the organisations concerned, which are directly or indirectly related to projects. In order to realize this understanding, we identified business processes between...
cooperating SMEs in the building industry and made them explicit by using the Process Modelling Language (PML) of the Multi perspective Enterprise Modelling Language (MEMO) (Frank, 1999, 2000, 2002). See Figure 1 for a simplified model of the on site production process.

Once all relevant business processes are formalized, it is possible to identify the interfaces between those covered by conventional project management and those of the project driven organization. This formalization opens up relevant knowledge about processes and assists stakeholders in implementing projects. In order to derive a fully integrated approach we also need a comprehensive controlling concept for the whole project. Whilst many can be used or adapted for business processes (Horvath, 2002), they typically do not take the specific organizational and technological aspects into account. In addition to those business processes that can also be described as project processes, there are many which are not directly related to the revenue-creating core competencies that businesses perform. Yet, these processes also represent necessary issues that must be accounted for. Ideally, what is sought is an integrated approach that will allow for the use of traditional project management skills and provide support in organizing and keeping track of other processes necessary for business.

Consideration of these concepts triggered the idea to manage conventional projects by building on the process like nature of projects in this environment, while adapting RUP®. Our research suggests that this approach would enhance quality in the implementation of general projects. Furthermore, we proposed that such an approach could be suited to more effective management of quality in virtual projects.

MANAGING PROJECT QUALITY WITH RUP®

As information systems projects have different priorities, requirements and technologies, a process-oriented approach that takes quality into account is suited to ensure the best outcomes. RUP® is a Software Engineering Process that “provides a disciplined approach to assigning tasks and responsibilities within a development organization” (Kruchten, 2002: 703). Its goal is to produce high-quality software that meets end-user needs and is produced in a predictable schedule and budget (Booch et al., 1999). RUP has four basic concepts: worker, activity, artefact, and workflow (Priestly and Utt, 2000).

As systems are highly sophisticated and complex in nature this (1) limits the ability of clients to define the requirement in all parts and (2) software engineers to design, build, and test a solution. The likelihood of success is improved if an iterative and incremental approach is pursued. RUP® supports such an approach through addressing risk items earlier in the development cycle than other traditional methods (Rational Software Corporation, 1995). Further, the method makes frequent executable releases that demonstrate progress in these areas which makes it positive for both parties. It enables development teams to track and document tradeoffs, decisions made in the development process and to capture and communicate business requirements (Rational Software Corporation, 1995).

Use cases and scenarios, part of the industry standard Unified Modelling Language (UML) (Fowler and Scott, 1997), are utilized in RUP® documentation. These diagrams prescribe meaning as deliverables become visualizable. For example, use cases are good in prototyping phases like user interface design and often result in a high level of success (Scott, 2000; Phillips and Kemp, 2002). As use cases and scenarios are natural language descriptions, they serve as communication tools that can be shown to the customer (Utt and Mathews, 1999) and are good communication vehicles amongst developers.

Managing stakeholders is not a new phenomenon in project management. However, an important lesson from system failures is that it becomes integral and regular during development to enhance outcomes. For example, strong involvement of the customer in planning and assessment meetings where decisions related to features, change requests and bug fixes are resolved (Hirsch, 2002), ensures exposure to aspects of the system and subsequent resolution of problematic issues. Moreover, “fast and useful feedback from the customer” on these iterations ensures timely incorporation of requirements in subsequent iterations, which aids in the management of expectations (Hirsch, 2002). This is important since over inflated and poorly managed expectations can have a significant impact on an assessment of quality (Wilkin, 2001).

In essence, we purport that software comprises components which are non-trivial modules that fulfill some function. RUP® supports componentization in the development process (Rational Software Corporation, 1995). Componentization helps assure quality by the creation of smaller more easily managed modules. These modules are clearly defined making them well understood by the development teams, which in turn mitigates risk. Functionality of these components can be more clearly defined, communicated and understood by the team and stakeholders alike.

UML is a globally recognized and understood modelling language (Booch et al., 1999) which is utilized in RUP® to aid in the design and development of software solutions. Through the provision of a common framework, development efforts amongst virtual teams are easily brought together. RUP® provides a web-enabled searchable knowledge base that provides team members with guidelines, templates, and tool mentors. Hands-on guidance is provided to users through tool mentors. This extensive use of documented tool sets lends itself well to the management of virtual teams and the opportunity for significant time savings when setting up a project.

Given the geographically dispersed nature of organizations (Beise, 2004), teams work on component modules in disparate locations. RUP®’s provision for clearly documented componentized modules allows them to be assigned to individual members of development teams, meaning they can work on them in isolation. RUP® facilitates this working relationship through its incorporation of online collaborative technologies.

CONCLUSION

In this paper, we explored possibilities for an integrated approach that could help in managing project quality by supporting regular project management processes. The project on SMEs in the building trade, composed of geographically dispersed independent cooperating businesses, identified the need for project quality management and knowledge retention. On examining the RUP® approach, we propose that it could be applied to managing project quality, especially in virtual environments.

Since RUP® prescribes how to elicit, organize and document functionality and constraints early in the project life cycle, it enables project tracking while capturing and communicating business requirements on a continued basis. The iterative incremental approach helps manage
stakeholder expectations, which in turn results in better quality in project implementation. RUP® supports componentization in the development process of projects, and also reuse of modules. This aspect aids in capturing ‘knowledge’ which may then be reused for other projects, or processes to be managed.

Based on our research findings, we propose to explore the use of RUP® artefacts in virtual project environments to better understand their applicability and impact on project management and quality. Further we also propose to explore the MBASE framework, which appears to be similar, in the same context.

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