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# Stakeholders' Approach to Requirements Engineering and Management: A Conceptual Analysis

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## ABSTRACT

The ever dynamic nature of business environment, global competition and increasing requests for more quality products by stakeholders have caused organizations to understand that the only way of survival in the market is to deliver better quality products to meet stakeholders' needs. Many organizations, therefore, spend considerable amounts of their funds in activities related to improving products and services. This study in its qualitative nature employs a phenomenological approach to explore how requirements engineering can be successfully and sustainably attained through critical understanding of stakeholders' needs, wants and preferences. The phenomenological approach provides an introductory background on the consequences of poor requirements engineering and management and why its importance cannot be over emphasized for twenty first century business organizations operating in an hyper competitive environment. The review of literature through desk research further provides insights on various definitions of conceptualization of requirements engineering and management. Stakeholder theory was adopted as the underpinning theory since stakeholders are the principal contributors and creators of requirements within the development of a product. The study concludes that stakeholders are the basis for requirements engineering. Hence, the study recommends involvement of stakeholders early on, to elicit desires, information and feedback from them, and to satisfy their information and communication needs. This is to ensure smooth development and efficient requirements engineering process.

**Keywords:** Requirements, Engineering, Management, Stakeholder, Strategy, Products

## Introduction

The business firms operating in the twenty first century regardless of their nature are going to be part of the global business community affecting and being affected by social change and pressures from around the world. This is as a result of the dynamic and complex nature of the business environment. Thus, their success is going to be dependent on numerous and diverse stakeholders (Olanipekun, 2019). The dynamism that characterizes the business environment in the twenty first century comes with several challenges in today's industry like rapid technological changes (Chang, Yan & Chen, 2013), or time to market that has been an issue for several years (Smith & Reinertsen, 1998). Furthermore, business organisations are also bedeviled with the challenge of identifying both quality and cost effective solutions with an appropriate balance (Kossiakoff, Sweet, Seymour, & Biemer, 2011).

Meier, Roy, and Seliger (2010) posit that one consequence of these challenges is that companies do not longer offer their customers products but rather complete solutions. These solutions are commonly integrated systems consisting of a combination of different sub-systems and/or individual elements e.g. software, services or products where the elements have been designed to be integrated and optimized from a life cycle perspective in relation to customer value. Instead of only selling individual products these solutions provide functions, service and performance (Sundin, Lindahl, Öhrwall-Rönnbäck Ölundh-Sandström & Östlin, 2006).

Mont (2012) as well as Vasantha, Roy, Lelah and Brissaud (2012) are of the view that designing these types of solutions creates a complexity with requirements in regard to several different aspects and stakeholders that need to be considered. The integration and collaboration with relevant stakeholders is therefore seen as an important aspect of creating a successful offering. Similarly, understanding the underlying needs throughout the life cycle is germane and critical for overall success (Sage & Rouse, 1999). Therefore, it is essential to have a suitable requirements process that can capture all relevant actors' needs and related requirements

A requirement can be defined as a description of what a product or service should do (Paetsch, Eberlein, & Maurer, 2003). The first step in any design effort is to ask what it is that one intends to create: What objectives does it need to address? What must it be capable of doing? Who will it serve and how? To what constraints must it conform? These questions are fundamental to design in its myriad forms – industrial design, graphic design, instructional design, and business process design, among others.

Design requirements represent a crossroads where several research, business, engineering, and artistic communities converge. Therefore design requirements discussions span a range of research disciplines, including computer science, information systems, new product development, marketing, strategy, organizational theory, and a variety of engineering fields. In addition, a number of social science inquiries, including cognitive psychology, anthropology, sociology, and linguistics are relevant for the issues raised (Nuseibeh & Easterbrook, 2000).
Requirements engineering is concerned with interpreting and understanding stakeholder terminology, concepts, viewpoints and goals (Penzenstadler, Femmer, & Richardson, 2013). Requirement engineering processes makes sure that all business, customer and system requirements are defined, described and communicated. The importance of having an adequate requirements engineering process in place that produces good-enough requirements can be considered as crucial to the successful development of products, whether it be in a bespoke or market driven development effort.

## Statements of the Problem

Requirements-based processes have been a primary source of project distress and product failure. Economic ramifications of poor requirements management were articulated by Boehm (1981) when he observed that the correction of requirements error represents a fraction of the cost incurred when errors go undetected until implementation. Yet, despite three decades of intensive research, the "requirements mess" continues to plague (Lindquist, 2005).

Research has consistently revealed that requirements processes are one of the primary sources of project distress and failure (Aurum & Wohlin 2005; Leffingwell & Widrig 1999; Crowston & Kammerer 1998; Hickey & Davis 2003; Van Lamsweerde 2000). Despite a significant body of research on requirements, unresolved issues continue to haunt designers across the industrial spectrum. In particular, the "requirements mess" remains a challenge (Lindquist, 2005).

Lack of user input, incomplete requirements, and changing specifications are the three leading sources of project difficulty that are directly related to the creation and management of a projects' design requirements (Aurum & Wohlin, 2005; Crowston & Kammerer, 1998; Hickey & Davis, 2003; Leffingwell & Widrig 1999; Van Lamsweerde 2000). Likewise, Keil, Cule, Lyytinen, & Schmidt, (1998) observed that misunderstanding of requirements and the failure to gain user involvement were among the top project risks. In addition, researchers have noted the persistent gap between research and practice, despite the fact that the area of inquiry is ostensibly motivated by the real-world concerns of designers (Berry & Lawrence, 1998; Kaindl, Brinkkemper, Bubenko, Farbey, Greenspan, Heitmeyer, Leite, Mead, Mylopoulos & Siddiqi, 2002; Nuseibeh & Easterbrook 2000; Siddiqi & Shekaran 1996; Zave & Jackson 1997; Zowghi & Coulin 2005).

## 2. Literature Review

### a. Conceptual Clarifications

#### i. Requirements Engineering

Requirements engineering can be described as a discipline that covers all of the activities involved in discovering (sometimes called catching or eliciting), documenting (specifying) and maintaining a set of requirements for a product (Broy, Feilkas, Herrmannsdoerfer, Merenda, & Ratiu, 2010). Requirements engineering is defined in ISO/IEC/IEEE 24765 (2010) as "the science and discipline concerned with analyzing and documenting requirements.

Wiesner, Nilsson and Thoben (2015) suggested that requirements engineering can be divided into two parts: requirements development and requirements management. Requirements development includes activities to set the foundation for what functions the offering that is about to be designed is supposed to fulfill,

e.g. elicitation and documentation. Requirements management, on the other hand, implies activities to maintain the requirements during the other design phases of the offering, e.g. change management and verification of the requirements

Traditionally, requirements engineering is described as "what services a product should provide and under what constraints it should operate (Cheng and Atlee, 2007), and in the bespoke perspective. Requirements engineering consists of the systematic process of eliciting, understanding, analyzing, documenting and managing requirements throughout a product's life cycle (Broy, Feilkas, Herrmannsdoerfer, Merenda & Ratiu, 2010).

Classen, Heymans and Schobbens (2008) opined that market-driven requirements engineering (MDRE) has a continuous flow of requirements and the requirements engineering effort is not limited to a development instance but a part of product management as a whole. In this environment, requirements come from several sources both internal (e.g. developers, marketing, sales, support personnel, bug reports etc) and external (e.g. users, customers and competitors, often gathered via surveys, interviews, focus groups, competitor analysis etc) (Fernandez, Lochmann, Penzenstadler & Wagner, 2011).

### ii. Requirements Management

Requirements Management is the process that involves eliciting, documenting, prioritizing, analyzing, agreeing on requirements, controlling changes and negotiating with involved stakeholders. Requirements Management is concerned with managing the lifecycle of the requirements and the requirements design (Robertson & Robertson, 2006).

Requirements Management is the process of increasing the value of requirements after the requirements elicitation process has taken place. In order for requirements Management to keep a high level of quality in the requirements, changes in requirements need to be meticulously analysed to acquire an understanding of how much effort and resources have been used to make this change.

This is a good method to cope with changes in requirement because it prevents the requirements from deterioration leading to requirements that are little meaningful (Alexander Jonsson & Kebing Hou, 2009).

Requirements Management acts as a collection of systems engineering processes that interfaces with requirements engineering. The RM process keeps track of all requirements changes and configurations. It also follows up requirement fulfillment and V&V (validation and verification) status. Hood, Fichtinger, Pautz, and Wiedermann (2008) defined requirements management as the set of activities which ensures that the requirements information is always up to date and can be accessed by all that may benefit from it. It is concerned with the documentation and continuous management of the elicited requirements.
The requirements manager's main responsibility is the preparation and facilitation of all activities related to discovering, formulating and maintaining requirements in the requirements specification. The requirements manager supports the project manager in making decisions concerning requirements issues (Robertson & Robertson, 2006)

**b. Theoretical Review – Stakeholder Theory**

Stakeholder theory suggests that organizational survival and success is contingent on satisfying both its economic (e.g., profit maximisation) and non-economic (e.g., corporate social performance) objectives by meeting the needs of the company's various stakeholders (Pirsch, Gupta, & Grau, 2007). Donaldson and Preston (1995) see stakeholders as having legitimate interests in the procedural and/or substantive aspects of corporate activity, whose interests must be considered on their own merits. Widely acclaimed as one of the first to define stakeholder theory, Freeman (1984) stated that stakeholders are "groups and individuals who can affect or are affected by, the achievement of an organisation's mission".

According to Freeman, Harrison and Wicks (2007) stakeholder theory begins with the assumption that values are necessarily and explicitly a part of doing business. It asks managers to articulate the shared sense of the value they create, and what brings its core stakeholders together.

It also pushes managers to be clear about how they want to do business, specifically what kinds of relationships they want and need to create with their stakeholders to deliver on their purpose. The stakeholder theory is based on the premise that the stronger the companies' relationships are with other interest parties, the easier it will be to meet its business objectives.

Requirements engineering has a collective social ingredient due to the involvement of a variety of stakeholders in a project, who often have different skills, knowledge and vocabularies. These differences cause the understanding of the problem to be a complex activity. In order to have a successful engineering requirements process, it is vital to have good communication among stakeholders and to understand deeply the context of the system to be built (Leite, Doorn, Kaplan, Hadad & Ridao, 2004)

Stakeholders are the principal contributors and creators of requirements within the development of a system/product. Within every (initial) phase in a project, requirements are subject to change due to the fact that stakeholders often have various needs and goals which, in many cases, might produce conflicts. These conflicts can be interpreted as changes and errors that need measurement. When requirements have many changes over time, they have a tendency to be highly volatile (Loconsole, 2008). According to Sommerville (2004), stakeholders may also have contradicting interests which produce even more volatility in requirements.

As Cheng and Atlee describe (2009), successful requirements engineering involves understanding the needs of users, customers, and other stakeholders; understanding the contexts in which the to-be-developed software will be used; modeling, analyzing, negotiating, and documenting the stakeholders' requirements; validating that the documented requirements match the negotiated requirements; and managing requirements evolution

## 4. Conclusion and Recommendations

The study has unveiled the potential of stakeholder theory to further understand the discourse on requirements engineering and management from theoretical viewpoint**.** Requirements engineering gives life and form to the concepts proposed by the stakeholders. Hence, stakeholders are the basis for requirements engineering. They pursue goals, include the users of the system under development, and issue constraints.

Requirements engineering provides managers with a broader picture and deeper understanding of how requirements in product development projects are engineered, supported, maintained and realized. Hence, requirements management is an indispensable requirements management process for firms. This is because it increases the value of the requirements.

To ensure smooth development, it is crucial for organizations to continually engage in marketing research and other activities that will involve the stakeholders early on, to elicit desires, information and feedback from them, and to satisfy their information and communication needs. Typically, successfully dealing with stakeholders involves identification, classification, analysis and communication management

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