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Applying collaborative process design to user requirements elicitation: A case study

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ABSTRACT

User requirements play a central role in software development processes by bridging the needs of business to the software. In many cases stakeholders who have different perspectives and expectations about the future system need to collaborate to clarify, capture and uncover user requirements in an efficient and effective manner. Many industry experts have admitted that collaboration among stakeholders in a facilitated workshop, aimed at defining and articulating user requirements, is one of the most difficult tasks in software development. The aim of the research described in this paper is to present a process that can address the challenges of collaborative user requirements elicitation workshops. The process contains activities that correspond to a pattern of collaboration. Developed on a pattern-based architecture, the process is reusable and can be applied to similar user requirements elicitation workshops. To achieve this goal, the principles of Collaboration Engineering (CE) are applied to design collaborative processes that consist of *ThinkLets*, a set of facilitation scripts and process-building blocks, bundled together. The process is evaluated in practice by running facilitated workshops as well as by collecting experts' comments and opinions. The results indicate that the approach is usable and useful. The paper concludes with further elaboration and discussions on research contribution and potential future work in the field.

1. Introduction

Requirements Engineering (RE) is a discipline that describes the tasks that define the requirements of a new or re-designed system while taking into account the conflicting requirements of various stakeholders [1]. During the first step of the requirements engineering process, which is referred to as the requirements elicitation phase, system requirements are discussed and agreed by the stakeholders [1].

Requirements engineering is a complex technical, social and cognitive process, which produces requirements for a software-intensive system [2]. Requirements elicitation is an important activity in the requirements engineering process as it involves discovering and formalizing the system requirements. Requirements are the basis for every project, describing the needs of stakeholders in a potential new system and also what the system must do in order to satisfy that need. Requirements are discovered not only in software development projects, but also in any other processes that involves the construction of a new artefact [3–6].

In the last two decades, product design activities such as requirements elicitation have been moving to a collaborative environment across extended enterprises, due to the globalization of markets, the advancement of technologies, the segregation of customer demands, and the competition at home and abroad [67]. Requirements elicitation, is highly collaborative and involves many stakeholders: the organizational decision makers who will decide on the sourcing of the system and negotiate the functional and non-functional requirements together with the price to be paid, the user who interacts with it, the domain expert, sales and marketing representatives and the developers who build it [1,7]. Each stakeholder has different needs, expectations along with their own experience, prejudices and view points [8] that need to be satisfied by the introduction and delivery of the future system. Moreover It is fairly well known that up to 80% of product cost is determined by the decisions made collaboratively by the stakeholders in the early stages of requirements life cycle, therefore, effective management of product design and the ability of stakeholders to understand what they need and what other stakeholders expect from the product play an important role in the entire product lifecycle [67].

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Despite having alternative viewpoints about requirements, collaborating stakeholders aim to reach consensus and agree on the final list of system requirements [9].

Requirements elicitation is achieved through collaboration. However, facilitating collaborative requirements elicitation is often considered as one of the biggest bottlenecks in projects for the collaborative development of different systems [10]. Expert facilitators can draw from a repertoire of skills and knowledge to guide and motivate a group to achieve a specific outcome. Facilitators use a variety of methods and tools to intervene and support groups in achieving their goals [11]. Expert facilitators in teams guide the collaboration process and help stakeholders combine their viewpoints and understandings to finally reach agreement over the case in hand. However, this process is considered to be expensive and can be time-consuming, if the facilitators need to be trained in-house, and therefore many organizations need to decrease their dependency on expert facilitators [12].

Many researchers have studied collaborative requirements elicitation. In addition to a number of facilitated group approaches for requirements elicitation such as Joint Application Design (JAD) [13], Quality Function Deployment (QFD) [14] and Cooperative Requirements Capture (CRC) [16], several techniques and frameworks have been proposed that seek to address the challenges of collaborative requirements elicitation. Laporti et al. [15] present an approach founded on collective knowledge to progressively build the system requirements from a narrative of user stories to the definition of use cases. The approach is a collaborative process to elicit requirements. Mich et al. [17] describe the problem with collaborating stakeholders who need to identify and enhance their viewpoints and are involved with requirements elicitation processes. They propose a creative technique based on a model of the pragmatics of communication. The model defines a creative process that consists of different steps. In each step the problem is analyzed based on an elementary behaviour identified by the model. Finally, Haruhiko et al. [18] discuss the problem of requirements discordances among stakeholders and suggest a collaborative goal-oriented requirements elicitation method to address it. Although some of these approaches describe a detailed procedure on how to discover and elicit requirements they offer limited support on the issue of how to facilitate requirements elicitation workshops without an expert facilitator while the collaborating stakeholders reach consensus over system user requirements.

In this paper, the authors advocate a different approach to collaborative requirements elicitation. This approach describes a step-by-step requirements elicitation collaborative process that:

(a) Supports a group of stakeholders to collaborate in facilitated user requirements elicitation workshops in order to share their various viewpoints and achieve a high-level understanding and consensus of the user requirements of the future system.
(b) Guides non-expert or novice facilitators to achieve successful delivery of facilitation services.

The approach introduced in this paper is suitable for a group of stakeholders who need to reach consensus about user requirements in a collaborative facilitated workshop. The approach can also be adopted in similar situations where requirements are to be collaboratively discovered and agreed by a group of stakeholders.

The paper is organized as follows: Section 2 provides background information about user requirements, Collaboration Engineering (CE) and collaborative requirements elicitation workshops; in Section 3 the principles of Collaboration Engineering are used and applied to the field of collaborative user requirements elicitation workshops. We demonstrate the applicability of this collaborative process using a case-study. Sections 4 and 5 analyze both the evaluation process and the outcome, providing a critical assessment of the key contributions of the proposed approach.

2. Background

Software artefacts are derived from user requirements. User requirements span business and software requirements, thus bridging the gap between business and the software. User requirements define the basis of what should be developed in a software system [19,36].

User requirements have always been difficult to clarify, capture and articulate. Many industry experts have admitted that defining them is the most difficult task in software development. For example, one of the biggest problems is the gap in communication between software and business people, which results in a low level of consensus building between both sides. This problem also exists for both external software development organizations and software groups supporting internal organizations [36].

In this paper the authors focus on facilitated collaborative "user" requirements elicitation workshops. The authors use Collaboration Engineering (CE) to deliver a process that satisfies the recurring need of discovering and capturing the user requirements in organizations.

2.1. Requirements workshops and facilitation

Requirements workshop is a generic term given to a number of different types of group meeting where the emphasis is on developing and discovering requirements for a software system [10]. A requirements workshop is a structured meeting in which a selected group of stakeholders collaborate to define the workshop deliverables that represent user requirements. It is usually a facilitated group meeting. The workshop deliverables can be in the form of requirements models such as diagrams, lists or tables that are used to document users' needs [36].

There are three levels in user requirements elicitation workshops [36]: scoping, high-level and detailed workshops. Over these three levels user requirements are refined, moving from a high level of abstraction towards more detailed requirements. In the scoping workshop a bird's-eye view is taken to determine which user requirements should be included. The deliverables from the scoping workshop clarify the items to be elaborated in the high-level workshop. The outcome of the high-level workshop is further refined in the detailed workshop [36].

Different methods are used within requirements workshops [10], including the cross-functional method, which involves different types of stakeholders from various areas of the business; Co-operative Requirements Capture (CRC) [37] and Creativity [38] which encourage innovative thinking and expression.

Facilitation is the complex skill of enabling a group of people to complete a task. Griffith et al. [47] describe the facilitator's role as one of "improving a group's communication and information flow to enhance the manner in which a group makes decisions without making those decisions for the group". Facilitators help group members to perform their collective task as a team and manage relationships between people, tasks and technology. A facilitator guides the group in reaching an effective decision using appropriate group processes [58]. By helping a group improve its processes, it can increase the quality of its decision-making processes, increase group member commitment to the decisions which are being made, and decrease time for effective implementation [39].

Professional facilitators, however, tend to be expensive to hire, and the services they provide are not available to a large number of groups that could benefit from their interventions. Recently