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Agile Requirements Engineering: A systematic literature review

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Highlights

- Discussion on state of the art of the integrated field of Agile Software Development, Requirements Engineering and Human-Centered Design.
- Building a shared understanding of the user perspective is not very well established.
- Key artifacts: User stories, prototypes, use cases, scenarios and story cards.
- Integrated methodologies in ASD: Human-Centered Design, Design Thinking, Contextual Inquiry and Participatory Design.

Abstract

ys, Agile Software Development (ASD) is used to cope with increasing xity in system development. Hybrid development models, with the integration of

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User-Centered Design (UCD), are applied with the aim to deliver competitive products with a suitable User Experience (UX). Therefore, stakeholder and user involvement during Requirements Engineering (RE) are essential in order to establish a collaborative environment with constant feedback loops. The aim of this study is to capture the current state of the art of the literature related to Agile RE with focus on stakeholder and user involvement. In particular, we investigate what approaches exist to involve stakeholder in the process, which methodologies are commonly used to present the user perspective and how requirements management is been carried out.

We conduct a Systematic Literature Review (SLR) with an extensive quality assessment of the included studies. We identified 27 relevant papers. After analyzing them in detail, we derive deep insights to the following aspects of Agile RE: stakeholder and user involvement, data gathering, user perspective, integrated methodologies, shared understanding, artifacts, documentation and Non-Functional Requirements (NFR). Agile RE is a complex research field with cross-functional influences. This study will contribute to the software development body of knowledge by assessing the involvement of stakeholder and user in Agile RE, providing methodologies that make ASD more human-centric and giving an overview of requirements management in ASD.

Graphical abstract

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Introduction

Nowadays the business world is characterized by complexity, since market requirements are changing quickly. Accordingly, providers are facing the challenge to reduce time to market while delivering innovative products that customer love. Agile software development (ASD) promises benefits such as on-time delivery and customer satisfaction [1], thus it aims to deliver business value in short iterations. Therefore, the development process is carried out incrementally and empirically, which is an advantage because direction of product development can be changed immediately. Humans and interactions are at the center of such methodologies [2].

Agile methodologies (e.g. Scrum [3], Kanban [4] or Extreme Programming [5]) provide a process model to develop products. These models lack in defining the right kind of product, which fulfils user needs and customer expectations. In order to fill in this gap and to develop products with a good *user experience* (UX), hybrid development approaches including *Human-Centered Design* ([6] referred to as User-Centered Design, UCD) are applied. Although there are some challenges reported while integrating ASD and UCD (see 2.1), the integration of both makes development process more human-centered [7]. Stakeholder and user involvement is a critical success factor for a system to succeed [8] and, if compared with traditional approaches, this involvement is not limited to early phases of development, as stakeholder and user are involved throughout the whole development process instead [9].

Requirements are the base of all software products and consequently Requirements Engineering (RE) plays and important role in system development. Compared to traditional RE approaches ([10], [11]), a list of prioritized requirements (Product Backlog [3]) is used instead of a requirements specification document. The main RE activities (*elicitation, documentation, validation, negotiation and management*) are not clearly separated activities in *Agile RE*. They are repeated each iteration and only required information is elaborated before the next iteration starts. For this purpose, RE in Agile environments is carried out just-in-time with a Little Design Up Front [12].

This article reports the findings of a Systematic Literature Review (SLR) in the field of Agile RE with focus on stakeholder and user involvement. In particular, ASD, RE and UCD have one thing in common: stakeholder and user involvement is described as critical success factor for a system to succeed. To this end, this will be an important aspect in this literature review and will be addressed by the following research questions:

- RQ1: What approaches exist, which involve stakeholders in the process of RE and are compatible with ASD?

- RQ2: Which agile methodologies, which are capable of presenting the user perspective to stakeholders, can be found?

  In terms of RE, these research questions lead us to the third research question:

- RQ3: What are the common ways for requirements management in ASD?

The paper is structured as follows: Section 2 gives a brief overview of Agile RE context, including a gap analysis of related work. Section 3 presents our research objectives and research questions and deals with our review method covering a description of the search strategy, selection process, quality assessment, data extraction and analysis. Section 4 summarizes the key findings of our study, therefore it offers an overview of the included studies as well as answers to our three research questions. Finally, Section 5 discusses on the meaning of findings and limitations of this study.

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Section snippets

Background – Agile Requirements Engineering

In the mid-80s, Takeuchi et al. [13] already stated that a sequential phases approach to product development is not well suited due to the lack of flexibility. Since then, new process models have been developed. On one hand, there are iterative process models like *Rational Unified Process*[14], [15]. On the other hand, there are Agile methodologies such as Scrum [16], [3], Extreme Programming (XP) [5], Feature-Driven Development [17] and Kanban. The usage of Kanban for Information Technology …

Review method

Appropriate guidelines have been followed for conducting the systematic review, particularly the guidelines for SLRs in Software Engineering by Kitchenham and Charters [32]. According to these guidelines, our SLR consists of three main phases. Fig. 3 shows the most important stages of each phase.

Due to the high number of retrieved studies, we used the software Mendeley and excel sheets in order to manage information obtained in an efficient manner. …

Results

We included in our work 27 identified relevant studies. Firstly, we describe characteristics of the studies and show quantitative data (e.g. publication channel, research method or quality overall). Secondly, we state our findings related to the RQs. …

Discussion

In sum, we have found 27 relevant studies analyzed according to our research protocol. Next, we will discuss on the findings of our SLR. First, we will refer to the meaning of findings related to our RQs and, secondly we will identify the limitations of our study. …

Conclusions and future work

This paper presents a SLR on Agile RE addressed to stakeholder and user involvement with the aim to capture the current state of the art of the literature related to the integrated field of ASD+RE+UCD. This review was conducted by following appropriate guidelines provided by Kitchenham and Charters [32]. We identified 42,808 papers in our initial search, and 965 further studies through the snowballing technique. Our search process was carried out in different phases in order to reduce the …

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