



Identifying organizational barriers—A case study of usability work when developing software in the automation industry



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ARTICLE INFO

Article history:

Received 10 April 2012

Received in revised form 12 June 2013

Accepted 16 September 2013

Available online 8 October 2013

Keywords:

Usability

KPI

Human computer interaction

User centred design

Wicked problem

ABSTRACT

This study investigates connections between usability efforts and organizational factors. This is an important field of research which so far appears to be insufficiently studied and discussed. It illustrates problems when working with software engineering tasks and usability requirements. It deals with a large company that manufactures industrial robots with an advanced user interface, which wanted to introduce usability KPIs, to improve product quality. The situation in the company makes this difficult, due to a combination of organizational and behavioural factors that led to a “wicked problem” that caused conflicts, breakdowns and barriers. Addressing these problems requires a holistic view that places context in the foreground and technological solutions in the background. Developing the right product requires communication and collaboration between multiple stakeholders. The inclusion of end users, who fully understand their own work context, is vital. Achieving this is dependent on organizational change, and management commitment. One step to beginning this change process may be through studying ways to introduce user-centred design processes.

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1. Introduction

This article provides a discussion of organizational difficulties in implementing solution to a technical challenge. The technical challenge in our case is about implementing usability key metrics.

Usability is one of the important quality factors. However, despite the fact that our study focused on usability, we do not present details concerning the theories and methods of usability work. The idea behind this article is not to discuss the technicalities of usability, even though usability has been the vehicle which we have focused upon. For more information regarding usability, see e.g. Bevan (2001), Dumas and Redish (1999), International Organization for Standardization (1998, 1999) and Nielsen (1993). Furthermore, we see that the situation that we have uncovered is probably not limited to the problems of performing usability work, but is representative of many types of settings, where complex issues are dealt with in complex organizations, and could therefore be of interest in many different situations.

The context of this study is a large multinational industrial company, with roots in a traditional engineering field, and extensive experience of working with industrial machines. One branch of the company produces and markets industrial robots and robot

systems. The company acknowledges the importance of incorporating concepts of usability in their design and development processes, to improve the quality of their product. The entrance point to this study was a desire to find ways of measuring usability on the basis of Key Performance Indicators (KPIs). Given our background in industrial cooperation, and our focus on usability and user experience, we were invited to perform a case study together with the corporate research department. The study was intended to result in new knowledge of how the industrial organization currently works with usability, and should lead to new theories of the problems involved in such work, and ideas that could facilitate this work.

Questions pertaining to the usability of robot systems are important to study. They deal with the changing conditions for traditional engineering organizations, where it becomes necessary to change the way of thinking when designing and developing products, in order to remain competitive in a rapidly changing and competitive global market. For a producer of robot systems in today's market, it is important to design systems that can be used by domain experts but not robotics experts (Scholtz, 2003). To study this field, practical real-world observations are important, as is the inclusion of experts from multiple domains in research efforts (Goodrich and Schultz, 2007).

In this case, we investigate an industrial situation from the perspective of the organization and organizational processes where industrial robots are designed and developed. It is impossible to understand transformations occurring in the nature of work and organising without considering both the technological changes

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and the institutional contexts that reshape organizational activities (Orlikowski and Barley, 2001). Therefore, it is important to focus on the situation within the organization. We must understand how human and organizational factors affect the execution of software development tasks, as many studies show how behavioural factors have a greater impact on software productivity than tools and methods (Curtis et al., 1988). Orlikowski and Barley (2001) stated that “IT researchers have yet to ask how institutions influence the design, use, and consequences of technologies, either within or across organizations”. This study looks more closely at these aspects. The primary intention of the work at hand is thus to study the processes and communication within the organization, with particular focus on the role played by usability. This work has been performed as a case study (Yin, 2003). The data in the case study has been analysed in a grounded theory (GT) approach (Robson, 2002).

The study illustrates a situation where the company successfully produces and sells a complex product that technically is at the front of the market, where adding features has been a strong selling point, and where usability is in line with other products of similar complexity and ability. There is however a growing understanding that usability is important for future sales, where a successful product has a good balance of price and quality, which includes both features and usability. The initial focus of our study concerned the introduction of KPIs, but we did not drive the process as far as finding ways to formulate candidates for these KPIs. However, we do show a number of areas where breakdowns occur in the organization, and see that a combination of different factors means that the company has difficulty in reaching the goal of formulating measurable usability KPIs. The factors involved combine to create what Rittel and Webber (1973) call a “wicked problem”. To address these problems, we find that it is important to take context into account when designing and developing the product, and that a process of user centred design (UCD) may be a way to address the identified situation. However, we also see that in order to reach the stage where UCD is possible, and to address the issues that we have found, would require a shift in perspective within the organization. There must be an expansion of the understanding of the importance of usability, a commitment to making usability a central factor, and incentives for improving usability. There must be an overview of what is important to focus efforts upon. This overview could lead to useful KPIs, and a system of incentives to work with these KPIs, and a situation where the importance of UCD pervades the organization. However, in the situation that exists today it is difficult to create this overview, because of the factors that we detail below.

In the following, we discuss our methods in Section 2, and then in Section 3 present a detailed illustration and summary of the problems that we uncovered during the study. This is followed in Section 4 by a discussion of the causes of these problems, in relation to work from a number of related areas, and we discuss possible solutions to some of the problems. The article ends with Section 5 with conclusions and some ideas for future work.

2. Methods

The study was performed as an interview-based case study. A case study focuses on a particular case, taking the context into account, and involves multiple methods of data collection; the data can be both qualitative and quantitative, although qualitative data are almost always collected (Robson, 2002; s. 178). A case study approach allows the retention of characteristics of real life events, including organizational and managerial processes (Yin, 2003). Although the study has been performed in a limited part of a large organization, and it could therefore be claimed that it lacks relevance in a larger context, it has been informed by an ethnographic approach (Rönkkö, 2010), which provides an analytic focus

that allows a focus on the types of challenges that are common for many software development projects, in complex design and development situations where many stakeholders are involved (Rönkkö et al., 2005).

The material in this study was collected in a series of semi-structured interviews (Robson, 2002), which took place between November 2009 and March 2010. The interviews were both preceded and followed up by a long process of industrial cooperation, including discussions, meetings and workshops. The interviews were performed by Jeff Winter, hereafter referred to as JWI, and Mikko Rissanen, referred to as MRI.

2.1. The industrial organization

The industrial organization, ABB, is a vast group of individual technology companies that operate in almost all of the sub-domains within the power and automation markets, for instance robotics products and supervisory control systems for production plants of all sorts. MRI belongs to ABB Corporate Research which is a research organization within the ABB Group, the umbrella organization. ABB Corporate Research is thus a unit that provides short and long term research support to individual ABB companies (here referred to also as business units) that own the products and businesses, such as the target of this case study. Corporate Research itself does not own products or develop them directly. Rather, it investigates new product and business ideas, technologies, methodologies and acts as the link to academia, with the aim of ensuring the whole company's competitiveness in global markets. Scientists and technology specialists at Corporate Research work closely with the business units in collaboration projects and bind the latest knowledge from universities to ABB-specific demands as needed.

2.2. Meetings and interviews

The project began with an initial meeting at Blekinge Institute of Technology (BTH). Representatives of ABB's Corporate Research unit contacted Kari Rönkkö and subsequently visited the Use-Oriented Design and Development (U-ODD) research group (U-ODD, 2011) headed by Rönkkö at BTH. The purpose of the meeting was to discuss U-ODD's research methods and results, and more specifically to discuss their previous work in the area of usability and usability testing (see e.g. Rönkkö et al., 2009). This first meeting led to a general agreement to find areas for future research cooperation. MRI was our main contact at ABB Corporate Research and specifically its software research program Industrial Software Systems. His background within the company, first as R&D scientist and later as principal scientist and coordinator for usability and human-computer interaction research, meant that he had extensive experience of performing research within the company, targeting various business units, systems and products by investigating various software technologies, product development methodologies and organizational factors, often in collaboration with universities (see e.g. Aleksy et al., 2011; Andersson et al., 2011; Azhar and Rissanen, 2011; Björndal et al., 2011; Kume and Rissanen, 2011). Thus, MRI acted as an important source of knowledge about the company and its development and history.

By September 2009, a specific plan had been formulated, and JWI, together with Rönkkö, travelled to the industrial site for discussions about the background to a potential project, the goals and expectations of the industrial and academic partners, and practical matters about performing a study. This resulted in an agreement to cooperate in performing a case study that would examine problems and possibilities of developing usability Key Performance Indicators (KPIs). In November 2009, plans for the project were finalised, a unit within the company was selected for study, and JWI travelled to the industrial site to prepare for the coming interviews.

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