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The progress of user requirements through a software development project

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Abstract

Many studies indicate that the fulfilment of user requirements is an important prerequisite for the development of successful products. The relevance of formulating well-founded user requirements for the product development process is supported. However, succeeding in eliciting relevant user requirements is not enough to ensure a successful product. The whole development process must be user-oriented if the user requirements are to be fulfilled by the final product. The objective of this study was to analyse and describe the obstacles and barriers to the fulfilment of user requirements encountered throughout a development project. The development of an Internet-mediated information system for public transport was used as a case study. The progress of the user requirements was followed through the development process. The studied project resulted in an information system that lacked much in content and functions required by the users because of a set of organisational, technical, competitive and social barriers. The general conclusion is that a product development process intended to be user-oriented must focus on user questions within the development process. The team should involve people with knowledge in that area, and those people should have influence on the important decisions in the project. The connection between requirements analysis and project planning must be clear, and the management of the specification of requirements should be analytical and specified. The project group should adopt a systematic view on how to create a user-oriented product; it is not necessarily done through the design of the product itself but also by overcoming external barriers. Identifying user requirements is necessary for developing a user-oriented product, but it is equally important to apply a development process that allows the project team to fulfil these requirements.

Keywords: User requirements; User needs; User-centred design; User-oriented product development

1. Introduction

The process of developing products with a user focus has many labels in literature, such as "*Customer-focused product development*", "*Customer orientation*", "*Consumer-idealized design*" and "*User-centred design*" (Kaulio, 1997). They all represent product development based on user requirements and user needs. In this paper we use the term "user-oriented product development", which was defined by Dahlman (1986, p. 19) as "*a perspective based on the interest and experiences of the user and on knowledge about use and users*".

Many studies show that the fulfilment of user requirements is an important prerequisite for the development of successful products on the market. Cooper and Kleinschmidt (2000) showed that products solving a user problem or giving users unique benefits were considered to be superior products on the market. These statements support the relevance of formulating well-founded user requirements for the product development process. Well-founded user requirements are an essential basis for the development of products with good usability (Nielsen, 1993; Jordan, 1998). Perceived usefulness and perceived ease of use are important variables in the "Technology Acceptance Model" (Davis, 1986, 1989) employed for studies of technology acceptance, i.e. studies of the acceptance of new products in the information technology area. With this background it seems important to employ a user-oriented

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development perspective and to base the development process on user requirements. Although much research has been done on eliciting representative and correct user requirements, the elicitation will not in itself result in a successful product. The work in the development process also has to be user oriented. This is not always the case, which could be the reason for the development of mismatched or failed products. According to a survey carried out by Chatzoglou and Macaulay (1996) which included 107 design projects, 31% of the projects resulted in solutions that accommodated 70% or less of the project's captured requirements.

The area of user-oriented product development and the treatment of user requirements in the development process have been researched. Rauterberg et al. (1995) describe the benefits of a proposed iterative cyclic process model for developing user-oriented software. Gulliksen et al. (2003) consider the existing definitions of user-oriented design, including the ISO definition (ISO 13407, 1999), to be too ambiguous and mean that the common user-centred approaches do not address all the obstacles to user centeredness which they have identified in their studied projects. Requirement traceability, i.e. the ability to track and describe a requirement backwards and forwards in the development process, is argued to be a critical prerequisite for software development by Gotel and Finkelstein (1994) as well as Dömges and Pohl (1998). The impact of the process of requirements capture and analysis (RCA) on development projects is described by Chatzoglou and Macaulay (1996). Their survey indicated that the knowledge about the relation between requirements analysis and project planning is low in many software development projects.

The development of an extended information system for public transport is used here as a case study to gain more knowledge of the progress of user requirements through a development process. The previous research will be further discussed in comparison with the results of this study at the end of this article.

2. The case study project

For the train traffic in Sweden, as in most European countries, a nationwide timetable information system has been available on the Internet. The information system covered all train services and all regional public transport services. Even though the system provided an appropriate timetable for a whole journey all over Sweden, the information was not considered enough when the system aimed at new target groups. For particular travellers, such as elderly and disabled people and families with small children or a lot of luggage, more information was needed about accessibility, service and characteristics of stations, terminals and transport modes.

The aim was therefore to develop a new information system including the whole transport chain and the obstacles that could be met during a journey. This information should be received before the journey started, to make the entire journey safe, secure and comfortable. The information must be adequate and easy to obtain. The target groups for the new information system were elderly and disabled people, families with children, and other interregional and regional travellers with specific needs for information. The final goal for the new information system was to gain more passengers and more revenues for operators and Public Transport Authorities (PTAs), as well as fewer passengers travelling by special transportation services for disabled persons and thereby reduced costs for municipalities responsible for these services.

The development project started in 1997 on the initiative of the Swedish Public Transport Coordinator (Samtrafiken). It was led and administrated by two persons appointed by Samtrafiken, i.e. their managing director and a well-reputed consultant, hereafter called the project leaders or producers, as their task was to lead the project and to launch the result, the new information system. Three research groups were involved in the project, each with a senior researcher and a doctoral student, in all six persons. They came from the departments of Traffic Planning at Lund Institute of Technology, Human Factors Engineering at Chalmers University of Technology and Service Research Center at Karlstad University. This group is hereafter called the researchers. The project was planned in 12 consecutive phases with (1) literature studies, (2) statistics about present travelling in the target groups, (3) precision of measurable goals, (4) choice of methods and course of action, (5) the customers' requirements and expectations, (6) organisation of data input and à-jour, (7) prioritising customer requirements, (8) constructing prototypes of the information system, (9) a regional pilot study, (10) evaluation of the pilot study, (11) external information of the project and (12) documentation of the whole project in reports. It had an explicit user orientation as it stated that the information system should be based on the needs and expectations of customers and personnel.

The researchers made focus group interviews and individual interviews with the intended users, i.e. persons with impairments (of mobility, sight, hearing), elderly persons and other travellers, especially families with children, and finally with personnel such as information officers, salesmen, customer service personnel, train guards, bus drivers, personnel working with disabled people, etc. (phase 5). Three lists of user requirements were produced from these interviews with each user category, i.e. elderly people and people with functional disabilities, other travellers and personnel. The requirements on the lists were expressed in the terms used by the interviewees. These lists were condensed into one and translated into technical terms. The resulting list was referred to all parties affected by the project, especially the PTAs, for consideration and was conclusively confirmed as "The user requirements list" (phase 7). The requirements on this list were validated and prioritised in a quantitative nation-wide survey (Waara, 2001). A field inventory was