Abstract Human, social and organisational (HSO) factors play a decisive role in software development in terms of determining functional and non-functional characteristics of software products. The significance of these factors is underlined by the need to produce applications that fit nicely in a working setting, supporting the working procedures followed and promoting users’ content and productivity. In this context, a new requirements elicitation process is proposed, a part of which utilises a short-scale ethnography analysis. The process introduces specific steps for recording HSO factors based on certain software quality characteristics that are treated as principal components for conducting requirements identification. The output of the process is the HSO document, which can be used in conjunction with the classic requirements document to identify structural and functional aspects of the system.

Keywords Ethnography analysis · Human social organisational factors · Requirements elicitation

1 Introduction

Recent advances in technology, in conjunction with major changes observed in fundamental concepts of requirements analysis, have altered the way software is produced nowadays. The explosion in telecommunications and the continuous growth of the Internet as a means to communicate, exchange information and trade, caused significant revisions in certain phases of software life cycle models. For example, the need for continuous change in content and functionality in web applications urged the establishment of tentative configuration management mechanisms and forced a quicker development of software products. In addition, users are no longer a passive component of the overall system that is subjected to ‘interrogation’ by analysts to reveal the right needs. On the contrary, they are now more intelligent compared to the past, they are well informed, they pose specific requirements on the product under development and they exhibit a certain viewpoint through which they realise the system. Furthermore, the fundamental rules for collecting requirements are shifting in importance from the data to be processed by the system and the operations which process that data, to human–computer interaction and social and organisational factors. Traditional requirements analysis focus lacks human issues and does not address adequately the impact of social and organisational matters in software systems design and development. Ethnography analysis studies have been used over the last decade to fill this gap and to provide a different viewpoint of how a software system must be conceived and examined, especially in work settings where collaboration between individuals in a computer-supported environment is the primary issue.

There is a plethora of research studies in the international literature of software engineering that support the use of ethnography and social sciences in software development. Sommerville [1] reports that social and organisational factors affect the requirements analysis process and proposes the use of ethnography on which social analysis must be based for examining the real, everyday needs of an organisation. The role of ethnography in studies of automation was first demonstrated by Suchman [2], while other studies involved with police [3], underground railway control rooms [4] and air traffic control [5,6] were also based on this technique. Ngwenyama and Lyytinen [7] propose a social action framework for analysing groupware technologies in the field of computer-supported cooperative work. Social and organisational consequences of wireless communications are analysed in Katz [8] focusing on how this technology is likely to change the way people live their lives. Other
studies provide the theory behind ethnographically informed analysis [9] and how this can be applied in systems design [10,11].

The importance of social and human factors in the design of computer-based systems is too high to be left out or to be given little attention. In addition, the significant role that ethnography analysis can play on requirements engineering, and thus to the development of software products that meet the needs of a computerised working environment and group of people, is something that must act as a driver to utilising a framework based on ethnography. Nevertheless, ethnography analysis requires a substantially long period of time to perform observation activities. This poses severe restrictions to performing ethnography analysis in practice, especially in cases of small to medium-sized software products where time and budget put hard constraints to the analysis phase. The author attempts, through this paper, to enhance the requirements analysis phase by proposing a certain process comprising simple steps for addressing and recording certain human, social and organisational (HSO) factors. The process is based on the construction of an HSO profile constituted by certain principal components, each of which is decomposed into several HSO factors. These factors can be addressed through a variety of known methods, enhanced by an oriented form of a small-scale ethnography analysis and a set of predefined focus questions. The principal components correspond to the general software quality characteristics reported in the ISO 9126 and form the basis for identifying what quality characteristics need to be addressed and set as targets prior to development, focusing on HSO features of users and their working environment. Principal quality components form the shell for a certain type of HSO requirements analysis to take place, which differentiates from classic requirements gathering techniques in two ways: First, it gives emphasis on how users themselves (culture, habits, psychology) and their working procedures (cooperation, working environment) can affect software characteristics, thus focusing mainly on the impact of HSO features that must be considered during software development. Second, its essence relies on a structure that attempts to orient ethnography analysis as we know it today, aspiring at providing the means for revealing an adequate amount of hidden information during the requirements analysis stage and at the same time shortening the time period suggested by other researchers for performing an overall ethnography analysis which covers anything (within the scope of everyday activities), anywhere (within the working environment), by anyone (any users’ working category, from junior to senior employees). The proposed analysis can be divided into several discrete activities that may run in parallel with, or after the completion of, traditional requirements gathering activities and, as will be presented later on, it is not as time consuming as other forms of ethnography analysis. The process can be integrated with the classic requirements-gathering phase feeding the process of identifying structural and functional aspects of the system under development.

The rest of the paper is organised as follows: Section 2 presents analytically the proposed human, social and organisational requirements elicitation process. This section starts with the identification of the structure of the HSO profile and the description of the principal components that the profile includes. Several ways are then proposed for the collection of information related to HSO factors within the context of the principal components. Section 2 continues with issues of modelling and verification of HSO information and ends with presenting the connection and interaction of the traditional requirements analysis phase with the proposed process. Section 3 demonstrates the performance and effectiveness of the new requirements elicitation process through two different case studies: The first one is involved with the development of a software product for the registration and processing of applications involved with issuing constructions licences by the government of Cyprus. The second one is related to the automation of the working procedures taking place within the department of Administrative and Economic Services of the University of Cyprus. The application of the proposed process is described in detail and the empirical findings are presented and discussed, along with limitations, and trade-offs posed. Finally, Section 4 presents the concluding remarks.

2 An HSO requirements elicitation process

Researchers define ethnography in a variety of ways. The two main directions of definitions reside on activities taking place through in-site observations on one hand [12], and on the epistemological stance of ethnography on the other [13]. Ball and Ormerod [11] use the term ‘cognitive’ to restrict ethnography to a form of human resources research, proposing at the same time a central, prototypical ethnography case characterised by 10 features. The 10 characteristics of their prototypical case are used to identify whether a method employed by a researcher is a genuine central ethnography method, or, otherwise, to define the level of deviation from the prototype:

1. **Situatedness.** Data is collected by an observer who is located in the client–organisation setting for which the product will be developed.

2. **Richness.** The observer studies behaviour in all possible manifestations (data is gathered from a number of sources, including interviews, discussions, documents etc.).

3. **Participant autonomy.** The observees are not required to comply in any rigid, predetermined study arrangements.

4. **Openness.** The observer remains open to the discovery of novel or unexpected issues that may be brought to light as the study progresses.