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Selecting Users for Participation in IT Projects: Trading a Representative Sample for Advocates and Champions?

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Abstract. The selection of users for participation in IT projects involves trade-offs between multiple criteria, one of which is selecting a representative cross-section of users. This criterion is basic because trading it for other criteria means basing designs on information biased toward some user groups at the expense of others. Based on interviews in development and customer organizations we find that their criteria for user selection favour persons who can contribute to the progress of the IT project over persons who are representative of the full range of users. A highly valued contribution from participating users is the ability to advocate a vision for the system and champion its organizational implementation. A survey in one customer organization shows that respondents' personal traits explain up to 31% of the variation in their experience of aspects of the usability of a recently introduced system. Thus, unless participating users are representative as to these personal traits, IT projects may, inadvertently, bring about systems that will fail to satisfy many users.

Keywords: User selection, user representatives, user advocates, system champions, user participation

1 INTRODUCTION

User participation is considered a core element in the development of usable information technology (IT), and recommendations about how to practise user participation in IT projects abound [1-6]. The group of intended users of a system is, however, normally too large for everybody to participate in the project, and participation is therefore restricted to user representatives. While the importance of selecting an appropriate group of participating users is well recognized, recommendations and techniques about user participation rarely provide detail about how user selection is to be accomplished in practice. For example, Beyer and Holtzblatt [1] and Nielsen [7] mention representativeness as an important factor in selecting users for participation in IT projects but provide neither dimensions along which representativeness must be ensured nor techniques for identifying such dimensions. Similarly, research aimed at improving our understanding of user participation often bypasses user selection and focuses on the selected users' participation. For example, Saarinen and Sääksjärvi [8] do not mention user selection in their review of the association between user participation and project success. Bødker et al. [2] do not mention representativeness, except for advising against selecting techno freaks and technophobes; they instead recommend selecting users that have a good overview of the work domain, enjoy respect among their colleagues, and are committed to the project. This will typically be characteristics of unusual users.

This study investigates the selection of users for participation in IT projects. We contend that attaining a representative cross-section of users is a basic selection criterion because it implies a focus on not excluding some user groups from participation and, thereby, missing information, needs, and priorities specific to these groups. To be able to select a representative cross-section of users it is, however, necessary to know the dimensions along which users differ in ways relevant to the IT project. Relevant dimensions may include stakeholder groups, which are mainly work-related, adopter categories, which are technology-related, and customer segments, which are person-related. While we expect that criteria concerning stakeholder groups are normally considered in the selection of users for participation in IT projects, we doubt that this is also the case for adopter categories and customer segments. In addition to criteria consistent with selecting a representative cross-section of users (e.g., periodically replacing the user representatives), the selection of users for project participation may involve criteria inconsistent with this basic criterion (e.g., selecting only users committed to

the project). In this study we investigate the criteria employed when users are selected for participation in IT projects and, specifically, how the selection of a representative cross-section of users is balanced against other selection criteria. We do this based on interviews in four IT-development organizations and two of their customer organizations. To investigate the extent to which adopter categories and customer lifestyle segments are relevant to the selection of a representative cross-section of users we supplement the interviews with a questionnaire survey of users' personal traits and their experience of the usability of a new system. The survey enables a comparison of the selection criteria from the interviews with the personal traits that affect how users experience a system.

Previous studies disagree about the importance of selecting a representative cross-section of users [9-11]. We aim to clarify these disagreements in the next section on related work. We, then, describe the method of our empirical work and present the results. In the discussion, we argue that selecting a representative cross-section of users is often traded for selecting users capable of serving a combined role of advocate for the users and champion for the system. We discuss conflicts inherent in this role.

2 RELATED WORK

User participation is widespread in IT projects but even with user participation systems are sometimes resisted by users, incompatible with work practices, or otherwise unsuccessful [12-17]. While it is unsurprising that user participation provides no guarantee for success, it calls for an understanding of the difficulties of user participation, including the selection of participating users.

2.1 User participation

User participation as a concept describes direct contact between developers and users during IT projects [16]. Apart from this defining characteristic, user participation has, however, been interpreted and applied in many different ways [18]. The reasons for this diversity include that user participation has been studied over a long period of time, for multiple types of project, and within many fields of research. In the context of IT projects, the Norwegian Iron and Metal project [19] and the ETHICS method [5] are seminal efforts, but user participation has been widely researched within, among others, participatory design [e.g., 4, 20], information systems [e.g., 17, 21], and human-computer interaction [e.g., 3, 22]. Approaches to user participation vary in type, degree, content, extent, formality, and user influence [12]. Users may, for example, participate as informants [e.g., 1], co-designers [e.g., 23], or champions [e.g., 24].

IT projects involve a customer organization and a development organization, which engage in interrelated courses of activity (in the case of in-house development the development organization is an entity in the customer organization [25]). This is illustrated in Figure 1, where the activities in the customer organization are inspired by Rogers [24] and those in the development organization by Alter [26]. User participation is essential to the interactions between the customer and development organizations. Importantly, the main direction of these interactions differs for specification/development and implementation/adoption. During specification/development user needs are specified as input to development and similarly other information is collected and analysed to inform the development activities. During implementation/adoption information about the system and associated organizational changes is disseminated to the customer organization along with initiatives promoting the adoption of the system.

During specification/development user participation is generally believed to contribute to improved user influence, system quality, and user satisfaction [8, 16, 27, 28]. In addition, some authors find that user participation leads to a smoother systems-development process [29]; others find the opposite [14]. Markus and Mao [21] present three explanations for the positive effects of user participation:

- *Improvement of system quality*; that is, user participation in development activities provides developers with the information they need to produce a high-quality system.
- *Psychological buy-in*; that is, user participation leads to a psychological state of involvement whereby participating users feel part of the development process and become committed to the system.
- *Emergence of relationships among users and developers*; that is, participation activities sometimes lead to relationships conducive to users sharing their requirements and developers incorporating these requirements in the system.

All three of these explanations are, however, vulnerable to the normal division of the intended users into a small group of participating users and a large group of non-participating users. For example, the improvement-of-

system-quality explanation seems to presuppose that participating users validly represent all users in the information they provide to developers, and psychological buy-in does not seem to explain why non-participating users should become committed to the system. This highlights the importance of how the participating users are selected. In addition, the explanations bypass that different groups of user may have conflicting needs and interests in relation to the system, precluding a consensus about user needs [15]. Beyer and Holtzblatt [1, p. 34] hint at such conflicts when they write that "customer representatives only truly represent themselves". Conflicts are particularly plausible between operational users and managers. Because the sponsors of systems are typically managers, the participation of operational users may be reduced to a largely rhetorical device [15].

User participation is also widely studied in relation to implementation/adoption. This is the case for projects where substantial IT development precedes implementation/adoption [e.g., 30] as well as for projects that mainly consist of organizational change management and involve little IT development, for example by purchasing off-the-shelf tools [e.g., 31]. Markus [32] finds that though many IT projects pay scant attention to implementation/adoption, it includes two activities crucial to system success: shakedown and benefit capture. During shakedown, users start up with the new system and encounter the problems associated with learning to use it and establishing new routines. During benefit capture, users fine-tune their routines, find additional uses for the system, and gradually begin to reap benefits from using it. Advantages of user participation in relation to shakedown and benefit capture include:

- *Helping to overcome initial reluctance and resistance*, which might otherwise cause sustained non-use irrespective of the technical quality of the system [30].
- *Diffusing the system across social worlds*, which are partly orthogonal to the formal division of organizations and therefore speed up the diffusion process [33].
- *Creatively reinventing the system* by exploiting insights from participation in the development process, tailoring the system to local practices, or working around its limitations [34].

Markus and Mao [21] propose that whereas managerial and operational participants can make equally valuable contributions to specification/development, managerial participants can make greater contributions to implementation/adoption. The rationale for this proposition is that managerial participants are more likely to be able to influence others' acceptance and use of a system. Acknowledging that a person's informal position in an organization may be as important as his or her formal position, Rogers [24] deemphasizes the distinction between managers and operational users in favour of an emphasis on champions who throw their weight behind a system and thereby boost its adoption in an organization. Champions are considered so important in overcoming indifference and creating goodwill toward new systems that Schön [35, p. 84] writes: "The new idea either finds a champion or dies". It appears that a representative cross-section of participating users may be less important to success during implementation/adoption than during specification/development.

Grudin [25] argues that in-house development offers better prospects for user participation than product development, where the potential users may be numerous and are unknown at the outset of projects, and contract development, where typical fixed-cost contracts reduce the room for adjusting initial system specifications. In this light it is noteworthy that several studies of user participation in in-house development report problems establishing an effective strategy for user participation [36-38]. Based on a review of participatory decision making, Cotton et al. [27] distinguish six configurations of user participation. They find positive performance effects of three configurations: employee ownership of the customer organization, customer organizations where users have formal influence on work decisions, and informal participation. Employee ownership and informal participation also yield positive effects on user satisfaction. Furthermore, short-term participation and participation through representatives on steering committees and other high-level management boards have virtually no effect on performance but some effect on satisfaction. The effects of consultative participation are inconclusive. In relation to IT projects, the most noteworthy findings may be the positive effects of informal user participation and the very limited effect of short-term participation.

2.2 Groups of user

Distinguishing groups of user with different characteristics is a prerequisite for identifying a representative cross-section of users. Users can be grouped according to multiple criteria, three of which are:

Stakeholder groups, which divide users by their role in the use of a system. A main distinction is between the users who operate a system and those who reap the benefits of the use of the system [39]. As an example, Ostveen and Besselaar [40] define six stakeholder groups, namely the end users of a system (i.e., the clients), the clerks operating the system, the administrative management responsible for the organization and operation of the

system, the technical management responsible for the technical infrastructure, the strategic management engaged in the deliberations creating the overall need for the system, and a residual group of other parties. While managerial stakeholder groups tend to be powerful and therefore able to ensure their representation in IT projects, other stakeholder groups are less powerful and may become un- or underrepresented.

Adopter categories, which group people by their tendency to adopt technologies either early or late. Rogers [24] distinguishes between innovators, early adopters, early majority, late majority, and laggards. These adopter categories are believed to capture characteristics important to people's general attitude to and experience of technologies. At the same time innovators and early adopters are more likely than members of the other adopter categories to volunteer for participation in IT projects and, thereby, gain influence on the design of new systems.

Customer segments, which derive from marketing research and sort people into segments according to, for example, their demographics, geographical profile, psychological profile, lifestyle, or attitudes [41]. An example of a customer-segmentation model is Minerva [42], which sorts people into lifestyle segments defined by a 2×2 matrix with the axes traditional/modern and idealistic/pragmatic. For the Scandinavian population, the four segments are about equally large; and a smaller fifth segment consists of a middle group that is neutral with respect to both axes. Whereas lifestyle segments, to some extent, predict patterns in buying behaviour [41, 43], we are unaware of studies that investigate their influence on users' experience of IT systems and, thereby, their relevance to the selection of representative cross-sections of user.

Work-related stakeholder groups feature in recommendations for user selection, see below, but research on universal usability suggests that a great many personal characteristics also affect people's ability to use IT successfully, including age, competences, disabilities, enthusiasm, gender, personal styles, and values [44]. Systematic knowledge on what dimensions it is relevant to consider in order to select a representative cross-section of users for a contract-development, product-development, or in-house project appears to be missing.

2.3 User selection

Multiple studies emphasize the importance of selecting a representative cross-section of users for participation in IT projects. For example, Damodaran [45, p. 366] writes that "the aim should be to ensure that those appointed are genuinely representative of the user population". Similarly, Wilson et al. [46, p. 184] state: "Although it sounds obvious, it is worth emphasising the importance of selecting a truly representative cross-section of users when some selection has to be made. This means selecting not just users from different work areas, or those who appear to know the most, but people of varying levels of seniority, expertise and service conditions." Mumford [5] extends these recommendations by proposing a two-tier structure consisting of a steering committee, including senior managers from affected user areas and senior trade union officials, and a project group that should "consist of representatives of all major interests in the design area. There should be a representative from each major section and function, each grade, age group and sex" (p. 65). Kujala and Kauppinen [10] do not prescribe a priori dimensions, such as age group and sex, along which representativeness must be ensured but instead propose a five-step process:

1. Brainstorm a preliminary list of users
2. List the main user characteristics, including market size
3. Describe the main user groups and prioritize them
4. Select typical and representative users from the groups
5. Gather information from the users and revise the user-group descriptions accordingly

In elaborating these steps, they suggest using a two-dimensional user/task matrix for step 3 and either random selection or stratified sampling for step 4.

A deliberate process of user selection faces, however, several challenges, including not knowing up front who the users are [47], being unable to spare the most suitably skilled people from their day-to-day work to take part in a project [45], participating users gradually becoming more ingrained in the project and more distant from their user constituency [37], and a tendency for users to prefer elected representatives whereas management prefers to select the participating users [15]. In addition, Symon and Clegg [38] identify user selection as crucially important but argue that selecting a cross-section of the users may be less important to successful user participation than selecting users who can stand up to the developers. Based on a view of IT projects as dynamic arenas for negotiation, persuasion, and power, some authors tend to be sceptical toward the very notion of a representative cross-section, which they perceive as based on simplistic assumptions about largely static and transparent projects [11, 38].

An alternative to the selection of a representative cross-section of users is to select people from the adopter category of innovators. The rationale for this lead-user approach is that innovators may experience user needs years before other users encounter them and, therefore, have experiences and visions valuable to the development of novel products [48]. The lead-user approach is specifically targeted at product development, as opposed to contract and in-house development. While studies show that innovators may contribute creatively to IT projects [9], it is uncertain whether their current needs are representative of the future needs of the majority of users. Thus, the lead-user approach relies on being able to select either innovators who experience needs that lie in the future for most users, thereby reintroducing the issue of representativeness, or innovators who will shape the future needs of other users, resembling a role as champion for the system.

3 METHOD

To investigate user selection for participation in IT projects empirically we conducted interviews in four development organizations and two customer organizations. And, we administered a survey in one customer organization.

3.1 Selection of organizations

The selection of users for participation in IT projects involves development and customer organizations. We first identified four development organizations that employ user participation in their projects. To qualify we required that users participated, to varying degrees, in both specification/development and implementation/adoption. Development organizations were contacted by phone, followed up by email, and asked to take part in our study. Apart from requiring that user participation was integral to their projects we aimed for organizations that developed different types of system. For reasons of anonymity the organizations will be named DA (for Development organization A) and so forth. DA develops systems for a fixed group of banks, DB competitively bids for development projects, DC develops systems for a fixed group of banks (not the same group as for DA), and DD develops and markets standard systems. For development organizations DA and DB we also got in contact with one of their customer organizations to complement the development organizations' views on user selection. The two customer organizations were identified in collaboration with our contact persons in DA and DB and then contacted by phone followed up by email. CA is a medium-sized, national bank, and CB is a large, multinational pharmaceutical company.

In terms of Grudin's [25] typology of IT projects as contract, in-house, or product development, the relationship between the development organizations and their customers can be described as follows:

- DA and DC resemble in-house development in that they have longstanding partnership relations with the fixed groups of bank that comprise their customers. There are, however, also elements of contract development because DA and DC are organizations of their own, and their projects with the banks, including CA, are regulated by contracts.
- DB does contract development, but in relation to CB there are also elements of in-house development because CB is a large and longstanding customer with which DB has close relations.
- DD does product development combined with contract development/implementation in terms of the often considerable configuration and tailoring of products for individual customers.

Thus, the organizations in this study mainly represent IT projects that are a mix of contract and in-house development. In addition, the development organizations make systems for other businesses, as opposed to consumers. Also, the four development organizations and the two customer organizations are based in Denmark. We acknowledge that the selected organizations constitute a convenience sample.

3.2 Interviews

We interviewed six persons in the development organizations and two in the customer organizations, see Table 1. We chose interviews as our means of data collection because we expect criteria for user selection to be known by central project staff though the criteria may rarely be explicitly stated. Thus, the criteria may neither be available in documents nor easily identifiable through observation. All interviewees were project managers or held other positions with a managerial element. The interviews, which lasted 1-2 hours, were loosely structured, audio-recorded, and subsequently transcribed in full. The overall structure of the interviews with developers and customers was similar. After explaining the purpose of the interview and clarifying the interviewees' position and tasks in the organization, we asked the interviewees questions about the users' overall role and participation

in the organization's IT projects, the concrete activities through which users participated, the concrete ways in which users were selected for participation, and the organization's general attitude to user participation. The main focus was on concrete descriptions of how users participated and were selected.

We analysed the interview data through a process of meaning categorization and condensation. This involved grouping the interviewees' statements into a number of categories and condensing their statements into shorter paragraphs than the original transcripts could provide. Initially, the questions outlining the main interview themes were used as the grouping categories, including categories such as the organizations' systems-development method and their user-selection process. During the process extra categories were added when such became apparent across the interview data. These extra categories, for example, included the purpose of user participation and the interrelations between purposes, selection criteria, and the activities in which users participated. Then, yet more interview statements were grouped by recursive application of the categories. The condensation of statements was done to allow a clearer overview of the interview data since this process reduced long and often very detailed explanations into short and precise paragraphs. To ensure that the condensation process did not alter the meaning of the interview data we compared the condensed statements with the intention of the main interview questions to ensure that a match existed after condensation. For each interview transcript, two authors were involved in the aforementioned process of meaning categorization and meaning condensation. After each transcript had been through this process three of the authors discussed the categories and the statements that were grouped in each category. We chose a data-driven method of analysis because we aimed to produce an empirical catalogue of the criteria employed when users are selected for participation in IT projects. The interviews were supplemented with sample project documents acquired from the organizations. We analysed these documents in ways similar to the analysis of the interviews.

3.3 Survey

To investigate the extent to which different groups of user differ in their experience of a system we conducted a survey in one of DA's customer organizations. The questionnaire, which concerned a system introduced recently, included five questions about aspects of the usability of the system and 15 questions about the respondents' personal traits, see Table 2. The usability questions drew on the ISO definition of usability [49] and spanned aspects of effectiveness (U_3), efficiency (U_1, U_2, U_4), and satisfaction (U_5). The person questions probed issues relating to the respondent's adopter category (P_3-P_6), lifestyle segment (P_7-P_{14}), and a few other issues (P_1, P_2, P_{15}). The questions about adopter categories were derived from Rogers [24], and those about lifestyle segments were adopted from Minerva [42] with the modification that they were adapted to an organizational context. We preferred Minerva over other instruments for probing lifestyle segments because it has specifically been devised for a Scandinavian context, which includes Denmark where we conducted our survey. Responses to the questions were indicated on five-point rating scales. With support from our contact person in the organization the survey was administered to a sample of 85 users of the system. The sample was geographically spread and comprised operational users who interacted with the system on a regular basis. We received 51 responses, for a response rate of 60%.

The survey data were analysed using linear regression. As different aspects of usability have previously been found not to correlate [50], we regressed the five usability questions individually. To determine the regression models we used a standard procedure of backward elimination [51]; that is, we initially included all 15 person questions and then sequentially removed the question that contributed the least to explaining the variation in the usability question. This removal process continued as long as the significance of the *F*-test of the removed question was greater than 0.1. The resulting regression models include the person questions that contribute appreciably to explaining the variation in the usability question and exclude the other person questions.

4 RESULTS

Below we use the interviews to analyse the different purposes of user participation and the criteria for user selection, and we use the survey to analyse the person variables that affect the experience of system usability. We start, however, by describing the types of user participation employed in the studied organizations.

4.1 Types of user participation

The systems made by the development organizations include a system for scanning and managing bank documents (DA/CA), an organization-wide intranet (DB/CB), a form-filling interface (DC), and a helpdesk (DD). These systems have a substantial user interface and their development involves establishing a fit between the system and the work procedures of the customer organization. Consistent with our criteria for selecting the

organizations we find that in all four cases one or more users have participated throughout the projects. In DA and DB the participating users have formed an integral part of the project group and spent large amounts of time working on the projects. The role of the participating users is described by CB1 in terms of a distinction between people with a focus on IT and people with a focus on business and use. In explaining her own role as a user participating in a DB/CB project, CB1 says:

> "… we have an IT project leader and a business project leader. The IT project leader's primary role is to look at the IT part of the project, and that includes everything about security and stability and flexibility… My primary role [as a participating user and business project leader] is to consider the user perspective. And in this case that includes both end users and system users."

In DB/CB and DC user participation involves cooperation between the development organization's project group and a project group consisting of individuals from all levels of the customer organization. Especially in the DB/CB case this group has a substantial impact on the development process because project leaders from DB and CB discuss and negotiate with the group of participating users throughout the specification/development and implementation/adoption phases of a project. The projects in DA and DC mostly target all banks in the fixed group of banks that comprises the customers of each of these development organizations. Consequently, the users participating in a project speak for the bank in which they are employed as well as for the banks from which no users participate. This gives the participating users, from for example CA, a strong say in the projects but it also complicates their task. In DD, we mainly got information about user participation in projects concerning the configuration and tailoring of systems for individual costumers. The extent of this configuration and tailoring is often considerable and involves collaboration between developers and a group of users from specification to completed organizational implementation.

Across the studied organizations different types of user workshops are a frequent way of organizing the user participation. For example, workshops with operational users from the customer organizations are a key part of the development process in DB, DC, and DD and provide these development organizations with knowledge about the users' requirements to the system, their work practices, and numerous contextual factors crucial to system success. Users also participate in activities that involve them in a less active but nonetheless profound manner. These activities include, among others, interviews with individual users and surveys of large user populations. Surveys are mainly used in DB/CB due to CB's large size and geographical distribution. In addition, users participate through different kinds of evaluation activities. These activities range from usability evaluations with users from across the customer organization through walk-up-and-use evaluations of systems that are in pilot use under realistic conditions, to formal acceptance tests of finalized systems. Finally, it should be noted that in all four cases users are selected, rather than elected, for participation.

4.2 Purposes of user participation

The four development organizations employ user participation for multiple reasons, which point toward different criteria for selecting users for participation in projects. Six reasons are identified in the interviews:

First, *to be competitive relative to other organizations*. For example, DA1 describes that in competing with other, much larger organizations in the banking industry it is imperative for DA and their customers that they are able to develop the right solutions without going through a large number of costly iterations and revisions. Here, user participation is employed to avoid such iterations and revisions. This is stated by DA1, saying that:

> "Our banks compete against some that are much larger than us, and if we are to deliver the same as them then it is very important that we only have to develop things once and not many times. Because then we would certainly not be able to compete."

Apart from lower cost, another benefit of quickly reaching a precise understanding of user needs is that systems can be developed in a shorter span of time. While this increased competitiveness originates in considerations about the market position of the customer organizations, DA1 extends this purpose of user participation to the development organization because DA would lose its customers unless user participation provided for an effective and efficient development process.

Second, *to develop systems that fit users' work situation*. This reason is common to all the four development organizations and to the development of systems from scratch as well as to the configuration of standard systems. For example, DD1 states:

> "So in practice one would not be able to do without that part [i.e., user participation]. In theory one could imagine that we just come in and install [this system] and that's that. But then it would not take their

work practices into account, and they might not be able to really use it. The final step would be missing – the final 20-25%, at least."

DD1 thereby acknowledges that without user participation their systems will not fit into the customer organizations and customers will often be unable to start using the systems because they disrupt some of the customers' work processes. This suggests that the users participating in a project should span the diversity of the work situations in which the system is to be used.

Third, *to recruit champions who will throw their weight behind systems during organizational implementation*. Interviewees from development as well as customer organizations state this reason for user participation in IT projects. It concerns the transition from the development process, driven primarily by the development organization, to the implementation process, driven primarily by the customer organization. For example, CB1 says:

"And that is also why it is so important for us to have these local ambassadors, who are our spokespersons and undertake a change-management effort on their own. But it has to be coordinated centrally – that is very important."

DD1 makes a similar point, and in emphasizing the importance of recruiting system champions he goes as far as saying that unless the participating users serve as system champions "the solution will be doomed". According to CB1 and DD1 an effective way of recruiting these champions is via involvement in the specification/development phase of a project, because this tends to increase the participating users support of the system during implementation/adoption.

Fourth, *to qualify some users to train their colleagues in the use of the system*. For example, DC includes the customer's business consultants in projects and involves them in the writing of the user manuals; subsequently, it is the business consultants who conduct the user training. This is another aspect of the transition from development to implementation, and user participation during development serves to prepare and ease this transition.

Fifth, *to create customer loyalty and repurchases*. For example, DB1 sees user participation as a means to ensure that customers remain satisfied with a system also six months after delivery because the system fits their needs and ways of working. Such satisfaction is crucial to customer loyalty and thereby to the long-term economic viability of DB's development process.

Sixth, *to send the right signals*. In several cases such symbolic reasons affect or even determine the users' participation in a project. An example of these symbolic reasons is found in DB where many of the participating users are selected according to a strategy designed to obtain equal geographical coverage of all sites in the customer organization. This is done to send the signal that the project is organization-wide as opposed to biased toward the headquarters (HQ), but it leads to an overrepresentation of the smaller sites and a substantial underrepresentation of the headquarters, which is the largest and most diverse site. DB1 explains:

"It would generate political resistance if it became another headquarters-initiated system… I think it has had a substantial impact on the proportion of people selected from the different parts [of the customer organization]. So you could say that compared to the number of employees in CB there was a disproportionate number of non-HQ people."

Signalling that this project was not just a headquarters project overruled all other concerns. DC2 also describes symbolic reasons for user participation. In some of the projects in DC user participation is unnecessary from a purely competence-based point of view because the developers have substantial domain experience from previous projects. DC2 is confident that the same requirements would result without the user participation, maybe even at a lower cost; user participation is retained to provide transparency and signal to customers that they are an integral part of the process:

"I think we would have reached at least the same requirements and maybe even at a lower cost if we had done it ourselves. But it [i.e., user participation] is done to ensure that it is at all times very visible to the customer organization what they get and that they are part of the process and feel that they are informed all the way."

The six reasons are intertwined, but whereas the first five reasons relate roughly to life-cycle stages – business case, development, implementation, training, and customers returning for additional business – the symbolic reason is an overarching concern. The criteria for user selection relevant in a specific project will therefore depend, among other things, on the present stage of the project.

4.3 Criteria for user selection

The criteria employed in selecting users for participation in IT projects in the studied organizations can be divided into those relating to the individual user and those relating to the sample of users. See Table 3 for a list of the identified criteria.

At the level of the individual user, two selection criteria address the user's professional competences. The first is *knowledge of the work domain*. The interviewees often emphasize that this knowledge should be concrete and up-to-date. For example, DA1 says:

> "You may come across people who have held their positions for a long time – administrative positions – where they are coordinating between DA and the bank. There might be some people that have held these positions for a long time and have not kept current. We have sometimes talked about that they could replace people every now and then, so they get some new fresh people in [the project]."

DA1 thereby voices a wish for periodic replacement of user representatives that hold administrative positions in the customer organization to ensure awareness of the details of concrete use. The second criterion that addresses the user's professional competences is *knowledge about IT*, which includes general IT knowledge as well as knowledge about the use of IT in situations relevant to the current project. This is seen as an important selection criterion, especially in DB and DD. For example, DB1 states:

> "It is partly about competences. That is, an assumption that you [as a participating user] know something about communication, something about IT, and something about intranets."

The two criteria that address professional competences are mentioned by interviewees from all organizations and relate mainly to the first and second reasons for user participation described above.

In addition to the professional competences, the individual-level criteria include an array of personal competences, the first being an *ability to empathize with others and understand their needs*. This criterion is to some extent about understanding the project group and the challenges it is facing, but it is mainly about being aware of and alert to the needs of other users. For example, DD1 says that user representatives should "have knowledge about the small requirements others might have, and thereby be good at including everybody [i.e., everybody's requirements]." The second criterion concerning personal competences is an *interest in the project and a desire to contribute to it*. All the four development organizations emphasize such commitment as a core criterion. In DC it is seen as the primary criterion, partly because the users in a project face a constant choice between their ordinary work and the project, and it is advantageous to DC if they give priority to the project. A third criterion is related to the previous and concerns an *ability to pass on knowledge and enthusiasm about the system to other users*. This criterion involves a positive attitude toward the system and skills in communicating this attitude to others, along with knowledge acquired during the project. DD1 says it very openly:

> "They are selected based on whether they are good change agents. That is, [whether they] have bought into the idea that we are going to have this new system and it will be really grand."

The fourth criterion concerning personal competences is a *readiness to work with technical issues*. In the words of DC2, the users selected for participation must "enjoy working with IT". Some of the technical issues the participating users encounter in a project will be new to them, and this criterion therefore includes a willingness to put some effort into learning technical issues. Finally, a fifth criterion concerns an *understanding of the negotiated nature of design decisions*. The interviewees mention this criterion in relation to the design discussions in which the participating users become involved. It is important to be able to take constructive part in the negotiations and compromises inherent in such discussions. DC2 says:

> "They must be open-minded and socially capable. They should not tend to have fixed opinions. And they must act sensibly in a political discussion."

The individual-level criteria are complemented by criteria at the level of the sample. Most of the sample-level criteria derive from DB and its main customer CB, possibly because the large size of CB introduces project activities uncommon in the other organizations. The interviewees refer to sample-level criteria more often for activities where many users participate briefly and, typically, as informants than for activities involving a few users over an extended period of time. Examples of the two ends of this spectrum are selection of users for surveys of user needs and for long-term project participation. Six sample-level criteria have been identified:

First, *representation of different departments, divisions, and other areas relative to their size or importance*. This is an example of stratified sampling, and it appears to be the default sample-level criterion in DB. With this criterion the number of representatives from an area increases with the importance of that area to system functionality and success.

Second, *equal representation of all geographical and business areas*. The motivation behind this criterion is the symbolic reason for user participation. While small and geographically remote areas may feel more included with this criterion, DB1 experiences it as unbalanced because the number of participating users from small areas is disproportionately large compared to the distribution of the organization's employees across areas: "If you look at how many employees there are in the individual countries then the survey is biased because we included all countries equally."

Third, *including extreme or critical users*. This criterion blends a recognition of the diversity of users with a recognition of the vulnerability of projects to a few powerful and loudly negative users. DB1 explicitly states that "the extremes are important". Selecting extreme users for participation in IT projects signals a commitment to accommodate diverse user needs, including those that constitute minority views.

Fourth, *random selection of users*. Selecting users at random is mentioned in relation to the administration of a survey to the users of a system, and it does not appear to be employed in selecting users for more direct participation in IT projects.

Fifth, *including everybody*. This criterion circumvents user selection by having all users participate. It is, however, rarely feasible to include everybody. When this criterion is employed, it is normally in the restricted sense that all users from a subgroup of users that is deemed particularly important are selected for participation.

Sixth, *command of a common language*. DB1 recounts a project in which the first selection criterion was whether people spoke English. This criterion applied to the selection of users for long-term participation in the project as well as to the selection of users for short-term activities such as interviews. While this is a very practical issue, the advantages of communicating directly at meetings, rather than through a translator, makes it an influential criterion. In a user community that spans users with many native languages this criterion may be at odds with several of the other sample-level criteria.

4.4 Person variables affecting perceived usability

The respondents to the questionnaire survey gave the usability questions U_1, U_2, U_3, U_4, and U_5 average ratings of 3.84 (*SD* = 1.08), 3.45 (*SD* = 1.05), 3.61 (*SD* = 0.83), 3.69 (*SD* = 1.05), and 3.92 (*SD* = 1.00), respectively. These averages are at the positive half of the scales, indicating that this project has resulted in a system the users generally experience as usable. While the user participation in the project may have contributed to this positive outcome, the rather large standard deviations suggest the possibility of variation in how different subgroups of respondent experience the usability of the system.

The linear-regression modelling performed on the survey data aims to identify such variation. Table 4 shows that for questions U_1, U_3, and U_4 the resulting regression models are significant, and for question U_2 the resulting regression model approaches significance. For question U_5 no model could be built because all 15 person variables satisfied the removal criterion. It is noteworthy that the same five person variables recur in several of the four regression models:

- The R^2 value shows that the variation in P_2, P_4, P_6, and P_{10} explains 22% of the variation in U_1. Thus, having *more* experience using IT systems (P_2), being *more* interested in trying out new IT systems at the workplace (P_4), being a *less* likely source of advice about new IT systems (P_6), and giving *higher* priority to a good social environment at work than to freedom to choose exciting tasks (P_{10}) correlate with finding the system *more* straightforward to use (U_1).
- The variation in P_4, P_6, P_8, and P_{10} explains 31% of the variation in U_3. Thus, being *more* interested in trying out new IT systems at the workplace (P_4), being a *less* likely source of advice about new IT systems (P_6), perceiving family as *more* important than career (P_8), and giving *higher* priority to a good social environment at work than to freedom to choose exciting tasks (P_{10}) correlate with experiencing *fewer* errors in the tasks associated with the system (U_3).
- The variation in P_{10} explains 9% of the variation in U_4. Thus, giving *higher* priority to a good social environment at work than to freedom to choose exciting tasks (P_{10}) correlates with finding that tasks involving the system have become *easier* (U_4).
- The variation in P_{10} tentatively explains 7% of the variation in U_2. This suggest that giving *higher* priority to a good social environment at work than to freedom to choose exciting tasks (P_{10}) may correlate with spending *less* time completing tasks using the system (U_2).

For the four regression models collectively we see that P_2, P_4, P_6, P_8, and P_{10} affect the users' experience of system usability, suggesting that unless these five person variables are taken into account a group of users

participating in an IT project does not constitute a representative cross-section. According to the regression modelling, the ten remaining person variables explain a negligible amount of the variation in the respondents' experience of the usability of the system.

5 DISCUSSION

Grudin [25] argues that the prospects for user participation differ with the type of IT project. In our data Grudin's project types are blended in that our data mainly represent IT projects with elements of both contract and in-house development. The limited variation in project type may explain why the types of activity in which users participate appear to exert a stronger influence on the user-selection criteria than the project type. We note that the stronger influence of activity type compared to project type accords with Keil and Carmel's [52] conclusion that many user-developer activities are unlikely to be specific to project types. Instead, the large size of CB prompts activities and associated user-selection criteria that might otherwise primarily be considered in relation to product development. A large customer organization – that is, a large and diverse user community – amplifies the need for activities intended to produce balanced knowledge about the users. This appears to be the main situation in which sample-level criteria for user selection are applied to obtain a representative cross-section of users. Otherwise, the selection of users for participation in IT projects in the studied organizations revolves around criteria for selecting user advocates and system champions. In the following, we discuss the selection of representative cross-sections, user advocates, and system champions.

5.1 Representative cross-sections

While the selection of a representative cross-section of the users is relevant to some of the six purposes of user participation identified in the empirical data, it is foreign to others. A representative cross-section is directly relevant to the purpose of developing systems that fit users' work situation, and it may be relevant to the purpose of sending the right signals. Conversely, purposes such as recruiting champions and qualifying trainers are unrelated to representativeness. The studied projects involve, as opposed to projects focusing solely on system performance, the establishment of a fit between the user interface of the system and the work procedures of the customer organization. For example, the project developing a system for scanning and managing bank documents requires knowledge about the business of the customer organization to ensure that the system fits the users' work situation. This suggests that participation by a representative cross-section of the users is important to the success of the projects, but at the same time trade-offs between a representative cross-section and other considerations are evident in the criteria for user selection. While four of the six sample-level criteria (C_8, C_9, C_{11}, C_{12}) address representativeness in some way, it appears that sample-level criteria are mostly employed for surveys and other activities where many users are involved briefly and largely as informants. Thus, the sample-level criteria are associated with the type of short-term participation that according to Cotton et al. [27] may have some influence on user satisfaction but virtually no performance effect. Conversely, the selection of a few users for participation in a project group or other longer-term activities appears to rest largely on individual-level criteria. Among the seven individual-level criteria for user selection, it is only the two about users' knowledge of the work domain and about understanding the needs of others (C_1, C_3) that touch upon representativeness. Four of the individual-level criteria concern competences that will almost certainly lead to the selection of users who are out of the ordinary:

- Knowledge about IT (C_2)
- Interest in the project and a desire to contribute to it (C_4)
- Ability to pass knowledge and enthusiasm about the system to other users (C_5)
- Readiness to work with technical issues (C_6)

Three of these criteria (C_2, C_4, C_6) are consistent with a lead-user approach [9, 48] but none of the interviewees talk about participating users as lead users, possibly because the lead-user approach is mainly associated with product development. Previous studies have pointed toward similar criteria for user selection [2, 46]; for example, Wilson et al. [46] find developers eager to involve motivated users and reluctant to involve less motivated users.

Several of the sample-level criteria are formulated in terms of departments, business areas, or geographical areas. This does, however, not imply that the sample-level criteria address the selection decisions at an overall level that leaves room for the individual-level criteria to determine the choice of concrete persons. Rather, the two kinds of criterion tend to apply to different activities. The implications of this are twofold. First, criteria for user selection must be analysed relative to the activities in which users are to participate. While this may be

unsurprising, it adds to the complexity of user selection and it has rarely been done in previous analyses of user selection, which tend to endorse either a representative cross-section [e.g., 45, 46] or the selection of users with specific personal competences [e.g., 9, 48]. Second, the activities that give users most influence on IT projects appear to be the activities for which the selection of users is affected the least by criteria concerning a representative cross-section of users. Criteria concerning the professional and personal competences of users dominate in, for example, the selection of users for direct participation in projects. For such activities the interviewed practitioners give primacy to criteria other than the selection of a representative cross-section. This practice discords with the recommendation of selecting a representative cross-section in Damodaran [45], who appears to target contract and in-house development.

Three of the five person variables that influence the users' experience of system usability in our survey are related to the user's adopter category: experience using IT, interest in trying out new IT systems, and being a source of advice about new IT systems. These three variables are also present among the individual-level criteria for user selection (C_2, C_6, C_5, respectively) but with the intention to select users with a specific profile, not to select a representative cross-section. The survey shows that it is not possible to fulfil these three individual-level criteria and, at the same time, select a representative cross-section of users. Thus, criteria such as knowledge about IT indicate a strategy different from one of selecting a representative cross-section of users. Furthermore, these criteria cannot be supplementary criteria within an overall strategy of selecting a representative cross-section of users. Interestingly, being a more likely source of advice about new IT systems is associated with experiencing the system as less usable, possibly because a person who is often asked for advice becomes aware of more shortcomings in the systems. We can only speculate about the mechanisms behind the associations between usability and the two last person variables that affect users' experience of system use: family/career and good social work environment/freedom to choose exciting work tasks. A candidate explanation could be that a preference for career and work tasks also implies a larger preoccupation with detail and special cases and a larger appreciation of the qualities of the routines that preceded the new system. The criteria for user selection contain no indications of such personal traits; thus, they appear to go unnoticed even in the situations aiming for a representative cross-section. This accords with Kujala and Kauppinen's [10] finding that developers underestimate the diversity of users.

It testifies to the difficulty of selecting a representative cross-section of users that two variables about the users' lifestyle affect their experience of a system they encounter at work. We consider it noteworthy that lifestyle variables have any effect on what constitutes a representative cross-section of users for a work-related system. All the organizations in this study are involved in the development and use of work-related systems. Lifestyle variables can be expected to exert a stronger influence on users' experience of consumer systems and, thereby, on the selection of representative cross-sections of user for such systems.

5.2 User advocates

In general, the identified criteria for user selection aim at the selection of good advocates for the users rather than at a representative cross-section. This is consistent with previous work that finds that, at least in contract and in-house development, an organizational-politics interpretation of representativeness tends to dominate over a statistical interpretation [8, 15, 37]. One of several reasons for this is that users are frequently selected for participation in activities that can only accommodate a few users – too few for a representative cross-section of a diverse user population. The focus on user advocates is most explicit in the criterion about empathizing with others and understanding their needs. This criterion implies that the users participating in IT projects are advocates for a group with needs and preferences beyond those of its advocates. The notion of advocacy shows that users participating in IT projects hold a demanding middle-level position between developers and users. On the one hand, developers may assume that user advocates represent the entire user population and thereby assign them the responsibility of acting as a representative cross-section. On the other hand, the user advocates will likely have incomplete knowledge about the user population and insufficient resources for obtaining such knowledge. Mumford [5] recommends surveys administered to all users and temporary participation by users not otherwise represented as ways of supporting user advocates. Surveys are used for this purpose in CB but the large size of CB makes it infeasible to administer surveys to all users, necessitating the selection of a sample.

Gallivan and Keil [13] argue that user advocates who are able to voice minority views can do much to open the lines of communication between users and developers because the minority views can trigger the holders of majority views to consider the alternative suggestions as well as to critically evaluate their own beliefs. Our survey suggests, however, that the role of user advocate is demanding in the sense that several person variables matter to how users experience a system. These person variables concern aspects of people's personality. Being an advocate for needs and preferences that arise partly from differences in users' personality is as much about empathy as about knowledge. Without considerable empathy it will, for example, not be possible for a person

experienced in the use of IT and interested in trying out new IT systems to advocate convincingly for needs arising from inexperience and disinterest in IT. This has direct consequences for the resulting system because Eodice et al. [53] find that when needs have advocates the needs tend to become requirements and considerable effort is made to implement them; conversely, needs without advocates do not become requirements and remain unimplemented. To paraphrase Schön [35], a need either finds an advocate or dies.

In our data user advocates are users tasked with representing the broader user group. However, some studies, often in product-development contexts, define advocates as members of the design team who may or may not be users [53, 54]. Relying on user advocates who are not themselves users further increases the risk of insufficient knowledge and empathy. As an example, Mambrey et al. [55] define user advocates as a separate group of intermediaries who are neither users nor developers but tasked with first developing an understanding of the users' work and requirements through observation and then representing the users in the IT project and during prototype evaluations. Some developers were, however, concerned that these user advocates filtered the information they received from the users and delivered a subjective report to the developers. Mambrey et al. [55] note that this critique is somewhat ironic as the original rationale for the user advocates was to act as filters making the user-developer communication more effective and efficient. The example highlights that the role of user advocate, whether held by a user or a non-user, takes skill in handling the negotiated nature of design decisions and the exposed position of the user advocate in between users and developers. As user advocates' mandate may be contested by users as well as developers, Symon [37] finds that they spend considerable time and effort consulting to ensure their mandate. The individual-level criteria for user selection emphasize the ability of user advocates to contribute constructively to the work of the project group, almost to the point of overshadowing their task of representing the users. In other studies of user advocates we find a similar tendency to include aspects of a role of system champion in the role of user advocate [2, 37, 55]. Consequently, non-participating users and IT-project members may appreciate different elements of a user advocate's role.

5.3 System champions

Whereas, for example, Markus [32] argues that IT projects tend to focus on technical development and pay scant attention to organizational implementation, we find that user selection involves considerations about both technical development and organizational implementation. The recruitment of system champions is central to considerations about organizational implementation and particularly prominent in the individual-level criterion concerning the ability to pass on knowledge and enthusiasm about the system to others. The role of system champion is essentially about representing the system, rather than its users, and may conflict with the role of user advocate. These conflicts are, for example, emphasized by Damodaran [45] who uses the term 'the propagandist role' in place of the term system champion. Our interviewees do not mention such conflicts but rather appear to see it as important to user selection that users participating in IT projects are able to handle the double role of user advocate and system champion. This tends to make it the participating users' responsibility to handle any conflicts in their double role. Though it is not explicitly stated, the criterion about understanding the negotiated nature of design decisions may be partly about the participating users' readiness to assume this responsibility and their skills in handling it. In addition, individual-level criteria such as knowledge of IT, readiness to work with technical issues, and interest in the project and a desire to contribute to it suggest that users selected for participation may more readily act as system champions than as advocates for a diverse user group, in which users differ in their experience of system usability depending on, for example, their interest in trying out new IT systems.

Markus and Mao [21] note that activities intended to support either technical development or organizational implementation may inhibit the other one of these two activities. Selecting the same users for the roles of user advocate and system champion may be an example. As an aside this may also help explain why usability professionals, who have a role as advocates for the users, often feel alone and under pressure in their work [56]. Champions are, however, crucial to organizational implementation, and this is recognized by the development organizations in our study. This is encouraging in the sense that it shows commitment to the transition from specification/development, driven primarily by the development organization, to implementation/adoption, which is primarily the responsibility of the customer organization. Markus and Benjamin [57] suggest that IT developers should engage more actively in organizational change management by assuming a role of either facilitator or system champion in place of their conventional technical-development role. They describe the role of system champion (which they term the advocate model) as a political role that differs sharply from that of user advocate in that system champions "work to influence people's behaviour in particular directions that the change agents view as desirable, whether or not the change 'targets' themselves hold similar views" [57, p. 397]. Users who participate in IT projects as system champions may want to define their role somewhat differently. This suggests that in addition to influencing decisions about the system, users who participate in an IT project

may need to become involved in designing their role in the project to avoid unmanageable aspects of a double role of user advocate and system champion.

6 CONCLUSION

User participation in IT projects implies that some users from the intended user population are selected for project participation. We have investigated user selection in practice by interviewing people in four development organizations and two customer organizations about how they select users for participation in IT projects that have elements of both contract and in-house development. Based on the interviews, we have identified 13 criteria that guide the selection of users. The criteria concern the users' professional competences (2 criteria), their personal competences (5 criteria), and the composition of the sample of users (6 criteria). The set of criteria is not consistent and reflects the multiple purposes of user participation. In particular, the criteria aim to balance a role of user advocate against one of system champion, and they deemphasize the selection of a representative cross-section of users. A representative cross-section of users is mainly considered in relation to activities involving many users for a brief period of time (e.g., surveys of user needs), whereas the selection of a few users for longer-time participation depends mainly on their ability to contribute actively and directly to the progress of the project. Our survey in one customer organization shows that personal traits, such as IT interest and experience, collectively explain up to 31% of the variation in users' experience of system usability. At the same time, the criteria for user selection give preference to users with considerable IT interest and experience. This suggests that IT projects may inadvertently, yet systematically, bring about systems that fail to satisfy many users.

This study has investigated the criteria by which users are selected for participation in IT projects. We acknowledge that the study is based on a limited number of interviews with people all of whom were involved in the IT projects. In future work it would be interesting to contrast the selection criteria identified in this study with non-participating users' preferences about the selection of their representatives.

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Table 1. Interviewees

Id	Organization	Organization type	Industry	Interviewee
DA1	DA	IT development	Banking	Project manager (female)
DB1	DB	IT development	All-round	Project manager (female)
DB2	DB	IT development	All-round	Project manager (female)
DC1	DC	IT development	Banking	Development area manager (female)
DC2	DC	IT development	Banking	Senior project manager (male)
DD1	DD	IT development	All-round	Senior project manager (male)
CA1	CA	IT customer	Banking	Project manager (female)
CB1	CB	IT customer	Pharmaceuticals	Project manager (female)

Note: CA is a customer of DA, and CB is a customer of DB.

Table 2. Survey questions and end points of response scales

Id	Question
U_1	To what extent do you find X straightforward to use? (Not at all - Completely)
U_2	After the introduction of X, are you spending more or less time completing the same types of task? (Much longer - Much shorter)
U_3	After the introduction of X, are you experiencing fewer or more errors in the tasks associated with the system? (More - Fewer)
U_4	How do you find that X has changed the tasks associated with the system? (More cumbersome - Easier)
U_5	What is your general impression of X? (I would rather be without it - I am very happy about the system)
P_1	How much influence do you experience that you have had on the design of X? (None - A lot)
P_2	In general, how much experience do you have using IT systems? (Little - A lot)
P_3	What is your general attitude to having to change your ways of working as a result of the introduction of X? (I think it is exciting when my tasks change - I prefer my tasks to remain unchanged)
P_4	How interested are you in trying out new IT systems at your workplace? (Not interested - Interested)
P_5	Do you actively collect information about new IT systems at your workplace? (Never - Always)
P_6	Do you think your colleagues ask you for advice about *new* IT systems more often than your other colleagues? (I am not the person to ask about such matters - I am often asked for such advice)
P_7	How would you characterize yourself as a career person? (Mostly the leader (seeking influence) - Mostly the expert (seeking specialization))
P_8	What is most important to you? (My career - My family)
P_9	What is most like you? (I stay in the background and leave it to others to develop the company - I seek influence on the development of the company)
P_{10}	What is your highest priority at work? (Freedom to choose the tasks I find exciting - A good social environment)
P_{11}	What is most important for you at work? (My closest colleague - The entire company)
P_{12}	What is most important for you in relation to your work? (Earning money for off-work activities - Achieving recognition among my colleagues)
P_{13}	What is your preference? (Not knowing tomorrow's tasks - Knowing my tasks in advance)
P_{14}	What form of work do you prefer? (Individual tasks - Collaborative tasks)
P_{15}	What is your level of education? (High school graduate - University master degree)

Note: In the questions, X denotes the name of the system targeted in the questionnaire.

Table 3. Criteria for user selection

Id	Criterion
C_1	Knowledge of the work domain
C_2	Knowledge about IT
C_3	Ability to empathize with others and understand their needs
C_4	Interest in the project and a desire to contribute to it
C_5	Ability to pass on knowledge and enthusiasm about the system to other users
C_6	Readiness to work with technical issues
C_7	Understanding of the negotiated nature of design decisions
C_8	Representation of different departments, divisions, and other areas relative to their size or importance
C_9	Equal representation of all geographical and business areas
C_{10}	Including extreme or critical users
C_{11}	Random selection of users
C_{12}	Including everybody
C_{13}	Command of a common language

Table 4. Results of linear-regression modelling, $N = 51$ respondents

Usability variable	Person variables	R^2	Test of significance	Regression model
U_1	P_2 P_4 P_6 P_{10}	0.22	$F(4, 46) = 3.26$, $p < 0.05$	$U_1 = 0.28P_2 + 0.35\ P_4 - 0.32\ P_6 + 0.27\ P_{10} + 1.35$
U_2	P_{10}	0.07	$F(1, 49) = 3.90$, $p = 0.05$	$U_2 = 0.27\ P_{10} + 2.52$
U_3	P_4 P_6 P_8 P_{10}	0.31	$F(4, 46) = 5.07$, $p < 0.01$	$U_3 = 0.37\ P_4 - 0.29\ P_6 + 0.33\ P_8 + 0{,}29\ P_{10} + 1.42$
U_4	P_{10}	0.09	$F(1, 49) = 4.55$, $p < 0.05$	$U_4 = 0.29\ P_{10} + 2.69$
U_5	-	-	-	-

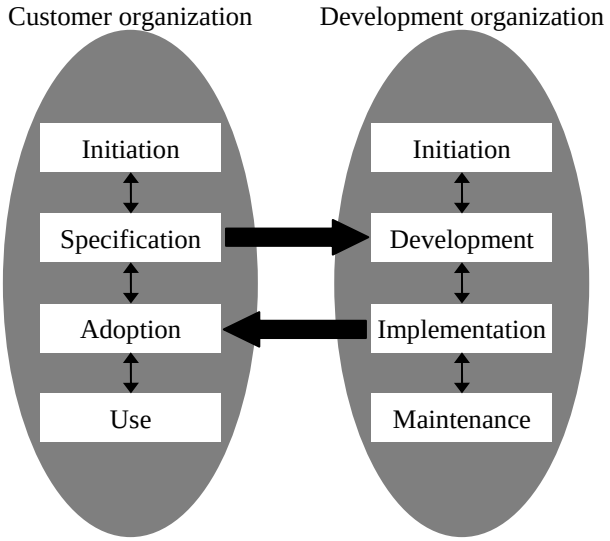

Figure 1. IT project