User participation in healthcare IT development: A developers’ viewpoint in Finland

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A B S T R A C T

Background and purpose: Recent research showed that physicians in Finland were highly critical of their information technology (IT) systems. They were also critical of the methods of collaboration with the developers of the health IT systems (HITS) in use at the time of the questionnaire. This study turned the set-up around and asked systems developers the same questions about collaboration. What is developers’ view on end user participation in HITS development at the moment? How would developers wish end users to participate in systems development? Do the developers’ views differ from the physicians’ (end users’) views of the current state of collaboration in developing IT systems?

Methods: A web-based questionnaire study was conducted in one of the major HITS provider companies in Finland among all developers, including software developers and customer support and sales personnel. Both quantitative and free-text questions of a previous study were adapted for the purpose. The responses were analyzed with qualitative and basic quantitative methods.

Results: The response rate of the questionnaire was 37% and 136 responses were received. The developers who responded were experienced workers; 81% of the respondents had 6 years or more of work experience in IT systems development and 35% of them had 6 years or more of work experience in the healthcare domain. Almost three-quarters (72%) of the respondents agreed with the statement ‘I work with users’. Almost all the developers (90%) thought that they are interested in user feedback and also 81% thought that they take the end users’ opinions and experiences into account when developing software. A majority of the developers (57%) considered that corrections and modifications are currently not implemented quickly enough. The most popular means of user participation were that ‘users would present their work and needs related to it in their workplace’ (76%), followed by user groups (75%). The developers suggested many traditional user-centered and usability design methods, too.

The developers’ views were compared to the views of the physicians who primarily used the case company’s products. The views were in direct opposition on whether developers are interested in end users’ views (90% of the developers agreed, vs. 60% of the physicians disagreed) and take them into account (81% of the developers agreed, vs. 63% of the physicians disagreed), as well as on user groups (favored by 75% of the developers vs. 14% of the physicians). The majority of the respondents, both developers (57%) and physicians (74%), were dissatisfied with the pace of implementation of corrections and modifications.

Conclusions: Both physicians and developers seem to be “willing but not able” to collaborate with each other. Possible reasons for the differences in views include the fact that there is no
return channel of communication on what happened to the end users' feedback, and that developers collaborate with customer representatives who are not end users. It is obvious that there are one or more spots along the route between the "end developers" and end users where there is a breakdown of the information flow.

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1. Introduction

1.1. Background to the study

A recent large questionnaire study among all Finnish physicians showed that they are highly critical of the information technology (IT) systems that they have to use [1,2]. A sub-study [3] showed that they are also highly dissatisfied with the means and methods of participation in the development of healthcare IT systems (HITS). Physicians are interested and willing to participate in system development but they feel that they are not able to participate properly. In their opinion, the end user point of view is missing in HITS development, developers lack knowledge of the substance of healthcare, and too few experienced clinical physicians are involved in the development. They also thought that HITS have been developed entirely by engineers and those medical doctors who are working in administrative positions. In physicians’ opinion, healthcare organizations should give more opportunities for physicians to participate in the development of their IT systems. Physicians also think that developers should be more interested in end users’ visions and needs, and visit the workplaces of healthcare workers [3].

The physicians’ opinions on the current state and methods of participation in HITS development were thus quite negative. It would be interesting to know the other side of the coin – what kind of views systems developers have about HITS development and end user participation. Knowing developers’ views could make it easier to achieve better means and methods for end user-developer cooperation in HITS development. While there are numerous studies on end user participation and its benefits, studies on the same issue from the developers’ perspective are quite difficult to find, especially in the healthcare domain. A Swedish study on computer consultants’ experiences and views of different forms of user participation found that user testing was the most common form of user participation [4].

In this paper we study HITS developers’ opinions on, and experiences of, end user participation and the methods used in system development. The issues were studied with a questionnaire which was conducted in the healthcare unit of a large software company in Finland. The target population of the questionnaire study mainly consisted of product developers and customer support personnel.

1.2. Definitions of key terms

In this paper we regard an information system as “the processes of managing (creating, using, storing, exchanging, etc.) information in an organizational setting (in work activities) for a purpose” – a socio-technical entity in the user organization consisting of people (actors), information (contents), and technology (means), linked together by a process directed toward a purpose [5]. Correspondingly, information systems development is the activity through which such socio-technical entities are introduced to or modified in user organizations.

In this view, an IT system is the core technological artifact used in information systems, and a healthcare IT system (HITS) is such an artifact used in healthcare organizations (hospitals and clinics). Although an IT system includes hardware (end user workstations, networks, servers, etc.), the dominant part of it from the end user's viewpoint is the software system (also called, e.g., software package, application software, software product). We use the term software product to refer specifically to those software systems which are produced in an industrial way and packaged as products. Software product development is then the nexus of activities that are needed to design, implement, test, modify, and distribute software products.

Software product development for healthcare takes place mainly in companies (“software houses”) which we call HITS providers. Taking their viewpoint in this paper, customer refers to a healthcare organization using the software product, and end users are the people in the customer organization who are directly using the product (doctors, nurses, etc.).

We selected the term HITS development to jointly refer to healthcare software product development by HITS providers and those parts of socio-technical information systems development in healthcare organizations that deal with the software product.

In this study, the term developers is used as a general term referring to employees of an HITS provider company. Developers are divided into two broad categories. We call people who are working in a product development department software developers. We call people working on a help desk or in customer support activities customer support.

For user-centered design (UCD) we use the definition of the User Experience Professionals Association: “User-centered design (UCD) is an approach to design that grounds the process in information about the people who will use the product. UCD processes focus on users through the planning, design and development of a product.” [6]

1.3. Related research

It is common knowledge that the success rate of IT projects is not very high. It has been argued that only 34% of IT projects are successful [7]. Understanding the use and the use context is the key issue in the success of technology projects. When hundreds of successful and unsuccessful technology projects were compared, the main differences were in the understanding of users’ needs and the quality of communication in the project. It has been claimed that the weakest part of software product development is the understanding of how end users use the IT system. In fact, it has been argued that end user
Involvement is one of the most important success factors in end user satisfaction and quality in IT projects [7-10].

End user participation does indeed have a positive impact on project satisfaction, but on the other hand, end user participation in a development project can make the process more difficult, lengthier, and less effective [4,7]. Although there are several methods for involving users, it is still a challenging task to accomplish [11]. It is important to consider who the users involved in the development activities are – only one type of user group may not be enough [12].

End user participation in development activities is one of the basic principles of user-centered methods. Early and ongoing user involvement has been recognized as one of the principles that are particularly important in health information technology [13]. User-centered and participatory design methods have also been proven to be effective when designing healthcare IT systems [14,15]. UCD methods such as personas and user profiles have produced positive experiences in the design and development of consumer health technologies [16]. User-centered design and software development process improvement have been studied and practiced for decades; nonetheless, there is an increasing need for human-centeredness in development [17]. It is not self-evident how user participation and involvement should be integrated into information systems development [18].

Today it is difficult for a company to survive in competition if it does not have proper means to improve the usability of its products [17]. Boivie et al. argue that “... with the increasing computerisation of working life and in society at large, the need to address usability in systems development has become increasingly important” [19]. In the healthcare IT field, structured data entry interfaces are increasingly used in software systems, but designing efficient and usable interfaces with structured data entry forms is a challenge to system designers. Walji et al. have recently argued that the use of structured data entry interfaces in electronic health records brings about usability challenges to the end users (clinicians) [20]. The means and methods of usability work in companies, especially end user participation, vary greatly and there are not many practical guidelines on how to involve and consider end users in development [8].

One of the methods utilized is direct developer-end user dialog. Niës and Pelayoe argue that this method is not sufficient for ensuring a proper understanding of the end users’ needs. In their opinion, human factors specialists are needed between developers and end users to analyze the users’ expressions of their needs and also to adequately formalize the requirements for design functions [21]. Pekola et al. argue that developers dislike direct communication with end users, and therefore present the concept of a “mediator” [8]; these mediators would take care of the relationship and activities with the users, while the developers would be able to focus themselves on design and implementation.

Actually, there is a gap between the methodologies for information system development and the methodologies addressing end user participation in development [8]. Another gap has been identified between the users’ and IT professionals’ views on technology; this raises barriers to IT system development through communication difficulties and misunderstanding [22]. Petersen et al. have argued that there is a need to develop better understanding of the HITS development process from the user point of view and a need for tools that make technical knowledge explicit in the development process [23]. Boivie et al. summarize that there are many obstacles to usability and user-centered approaches in system development, for example a lack of trained usability experts, the powerlessness of users in systems development (users cannot often influence the actual design), and technology-led changes in development [19].

1.4. Objectives of the study

The main goal of this study is to learn about HITS developers’ perspectives on HITS development, particularly on end user participation aspects. The first objective of the study is to investigate developers’ opinions on the current means and methods of end user participation. The second objective is to compare the already-known opinions and views of Finnish physicians on participation in HITS development with the opinions and views of the developers who created the systems. Third, the study also aims to explore developers’ views on possible weaknesses in software product development and suggestions for improving the current state.

Research questions:

RQ1. How do healthcare IT systems developers view the current state of user participation in healthcare IT systems development?

RQ2. What kinds of ideas do developers have about collaborating with users?

RQ3. How do developers’ views of the current state and collaboration differ from medical doctors’ views?

2. Materials and methods

2.1. Research methods and study design

The study was designed as a mainly qualitative single case study. The study was conducted in a large software company developing healthcare IT systems in Finland. The single case approach was selected because an industry-wide study on the same scale as the one conducted among physicians would have been beyond the limits of a doctoral study; each company would need to have been approached individually to obtain permission to send the questionnaire to their developers through their internal mailing lists.

Furthermore, the company in question is sufficiently large to form a relevant set-up (about one-third of the respondents of the study among physicians used primarily this company’s products). The products of the company had been given mid-range ratings by physicians in the previous study, so it can be considered fairly representative of the situation in Finland. In Section 3, the responses of the developers are compared to the responses of only those physicians that used primarily the case company’s products, but the figures from all the physicians are provided for comparison. The developers were asked to reflect on the projects in which they had most recently worked, so the physicians’ and developers’ views are of the same products and roughly the same projects; the case company had already started to change its software development...
methodology by the time that the questionnaire was performed. Methods used in case company before starting the change varied greatly from traditional methods to agile methods.

The data were collected by a questionnaire with a web-based form with anonymous responding. The questionnaire form was first pilot tested by five persons and a few minor corrections were made. Then information about the study and the link to the form was sent to 368 email addresses using selected email lists of the company. Those email lists consisted of people working in product development, customer support, and sales and from both private and public healthcare solutions development areas. The recipients of the email invitation also included persons who could be on a long leave of absence. The survey was conducted in May 2012 and the response time was two weeks.

The questions were designed to gather mainly qualitative data, with a few quantitative questions included (Fig. 1). The first four questions were about the respondent’s work experience and field of work. Questions 5 and 6, addressing the experiences of end user participation, were adapted from the questionnaire among Finnish physicians (Questions B and A, respectively, in Refs. [1–3]). Question 7 was an open-ended question about ideas for improvements; it was similar to Question C in the physicians’ survey, but focused on the end user-developer collaboration issue. Finally, Questions 8 and 9 were about the software development methods in the case company. In total, there were two open-ended questions, two five-point Likert scale statements, four multiple-choice questions, and one closed-ended question with multiple selections. The responses to Question 9 are not reported in this paper since they are specific to the case company.

2.2 Data and analysis

In total, 136 responses were received. The response rate was 37%. Questions 7 and 9 produced qualitative data and the other Questions 1–6 and 8) quantitative data. The processing and analysis of both the qualitative and quantitative data was conducted with MS Excel software. No statistical analysis was conducted since the quantitative data were used for qualitative purposes only.

Since the categories “Strongly agree” and “Agree” were combined into one category “Agree” and the categories “Strongly disagree” and “Disagree” into “Disagree” in the Likert scale questions of the earlier study among physicians [3], the same merger was performed in this study also in Questions 6 and 8, to make it possible to compare the views of the respondents of this study with those of the earlier study.

Two methods were utilized in analyzing the qualitative data, i.e., the answers to the open-ended questions. First, content analysis was applied by the primary researcher, who read through all the material and outlined the initial categories emerging from the answers. Classification was then conducted by reading all the material carefully several times and placing each of the answers into one or more categories. More categories were added if needed while the answers were being classified. Another researcher went through the material independently and the classification was jointly accepted.

Second, a LACASA context levels analysis [24] was conducted by the third author.

3 Results

3.1 Respondent demographics

The typical respondent had more than 10 years’ experience in IT development work, 1–5 years’ work experience in healthcare IT, and no or less than one (1) year’s work experience in the field of healthcare (Table 1), and was currently working in the software development department (Table 2).

The length of work experience in IT systems development was rather high (Table 1). About 80% of the respondents had more than six (6) years’ work experience. More than half (26% + 32%) of the respondents had worked with healthcare IT development for more than six (6) years. Interestingly, about one-third (35%) of the respondents had more than six (6) years’ work experience in the field of healthcare (12% + 23%). Customer support (CS) employees had slightly more work experience in the field of healthcare – about 60% of CS staff – but slightly less than 50% of the software development (SD) employees had more than one year’s work experience in healthcare.

3.2 Software development and user participation at present

Question 6 gathered developers’ experiences of the end users’ feedback and development activities (Table 3). In this question, the respondent was recommended to think about those projects which he or she had recently worked in.

About half (52%) of the respondents believed that users know how and to whom they can send feedback on the IT systems if needed. About half (48%) of the respondents also believed that managers in the customer organizations are interested in end users’ opinions and experiences on the IT

<table>
<thead>
<tr>
<th>Table 1 – Questions 1–3 – Work experience (N = 136).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
</tr>
<tr>
<td>In developing IT systems</td>
</tr>
<tr>
<td>In developing healthcare IT systems</td>
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<tr>
<td>In the field of healthcare</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Table 2 – Question 4 – Current work unit (N = 136).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
</tr>
<tr>
<td>Software development</td>
</tr>
<tr>
<td>Customer support</td>
</tr>
<tr>
<td>Sales</td>
</tr>
<tr>
<td>Others</td>
</tr>
<tr>
<td>Cannot tell/does not want to tell</td>
</tr>
</tbody>
</table>
1. My work experience in IT systems development (including sales, customer support)
   a) 0-1 years, b) 1-5 years, c) 6-10 years, d) more than 10 years

2. Work experience in healthcare systems development
   a) 0-1 years, b) 1-5 years, c) 6-10 years, d) more than 10 years

3. Work experience in healthcare
   a) 0-1 years, b) 1-5 years, c) 6-10 years, d) more than 10 years

4. Currently working in
   a) software development, b) customer support, c) sales, d) other, e) can’t tell / does not want to tell

5. In what ways would you like users to participate in IT system development activities in the future?
   You can select one or more choices.
   When responding to the statements below, think about the project or projects in which you have most recently worked.
   a) Users would present their work and needs related to it at their workplace to software developers.
   b) Users would participate in a development workgroup that included endusers of the systems.
   c) Users would send feedback and development ideas to a web-based forum provided by the software provider, accessible by all.
   d) Users would send feedback and development ideas directly to software developers, for example by email.
   e) Users would describe the problems with using the system to a physician in charge of developing information systems, who would be appointed in the organization.
   f) In some other way; how?

6. What kind of experience do you have about users’ feedback and development work? Rate the following statements on the basis of your experience.
   When responding to the statements below, think about the project or projects in which you have most recently worked.
   Choices: “strongly agree”, “agree”, “neutral opinion”, “disagree”, “strongly disagree”
   a) I believe that users know to whom and how they can send feedback about IT systems when they want to do so.
   b) I believe that people in managerial positions in the user organizations take endusers’ opinions and experiences as users of the IT systems into account.
   c) Here we are interested in the feedback given by endusers.
   d) We take the endusers’ opinions and experiences into account when developing our software.
   e) We implement proposals for corrections and modifications as requested by the customers.
   f) Proposals for corrections and modifications are implemented quickly enough.

7. How could cooperation with the customers be developed, in your opinion?

8. The software development process and the methods used. What is your opinion on the following statements:
   Choices: “strongly agree”, “agree”, “neutral opinion”, “disagree”, “strongly disagree”
   a) In my experience, the feedback from customers is communicated from the customer interface all the way through to software developers.
   b) I work with users.
   c) Our current way of developing software supports cooperation with customers well.

9. In your opinion, what are the strengths and areas for development in our current software development?

Fig. 1 – The questionnaire translated into English.

systems. It can be said that developers are interested in the feedback of the end users, since almost all (90%) agreed on that statement (6.c). They also consider that they take end users’ opinions and experiences into consideration (81% agreed). More than half (55%) of the respondents were of the view that errors are corrected as the customers requested, but the time needed to implement those corrections was too long in the view of 57% of the respondents.

The opinions of the two main respondent groups, i.e., software development and customer support, differ only slightly (Table 3). The software developers thought more often (86%) than the customer support persons (64%) that they take users’ opinions and experiences into consideration when developing software. A quarter (25%) of the customer support persons disagreed that customers’ proposals for corrections and modifications were implemented as requested, while only 8% of the software developers disagreed with that statement. Both groups agreed (84% and 95%) on the statement that developers are interested in the feedback given by users.

When the results from this questionnaire study are compared with the physicians’ opinions from the earlier questionnaire study (Table 4) [3], some differences are striking: the developers viewed themselves much more positively than their end users (Finnish physicians) did. The biggest differences between the opinions of the two groups appeared with statement 6.c. 90% of the developers thought that they are interested in the feedback given by users, while only 13% of the physicians viewed developers as being interested in their feedback. There was also a big difference in the responses to statement 6.d: almost two-thirds (63.4%) of the physicians
Table 3 – Question 6 – Views on users’ feedback and development work. The strongest agreements are with a light background, the strongest disagreements with a dark background. The main differences between customer support (CS) and software development (SD) personnel’s views are in bold.

<table>
<thead>
<tr>
<th>View</th>
<th>N</th>
<th>Unit</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) I believe that users know to whom and how they can send feedback about IT systems when they want to.</td>
<td>135</td>
<td>all</td>
<td>52%</td>
<td>14%</td>
<td>34%</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>CS</td>
<td>52%</td>
<td>11%</td>
<td>27%</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>SD</td>
<td>46%</td>
<td>18%</td>
<td>36%</td>
</tr>
<tr>
<td>b) I believe that people in managerial positions in the user organizations take end users’ opinions and experiences as users of the IT systems into account.</td>
<td>132</td>
<td>all</td>
<td>48%</td>
<td>21%</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>CS</td>
<td>49%</td>
<td>22%</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>74</td>
<td>SD</td>
<td>46%</td>
<td>24%</td>
<td>30%</td>
</tr>
<tr>
<td>c) Here we are interested in the feedback given by end users.</td>
<td>135</td>
<td>all</td>
<td>80%</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>CS</td>
<td>84%</td>
<td>11%</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>77</td>
<td>SD</td>
<td>95%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>d) We take the end users’ opinions and experiences into account when developing our software.</td>
<td>133</td>
<td>all</td>
<td>61%</td>
<td>14%</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>CS</td>
<td>64%</td>
<td>22%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>SD</td>
<td>86%</td>
<td>12%</td>
<td>3%</td>
</tr>
<tr>
<td>e) We implement proposals for corrections and modifications as requested by the customers.</td>
<td>133</td>
<td>all</td>
<td>55%</td>
<td>32%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>CS</td>
<td>44%</td>
<td>31%</td>
<td>25%</td>
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<tr>
<td></td>
<td>76</td>
<td>SD</td>
<td>62%</td>
<td>30%</td>
<td>8%</td>
</tr>
<tr>
<td>f) Proposals for corrections and modifications are implemented quickly enough.</td>
<td>133</td>
<td>all</td>
<td>23%</td>
<td>20%</td>
<td>57%</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>CS</td>
<td>28%</td>
<td>8%</td>
<td>64%</td>
</tr>
<tr>
<td></td>
<td>76</td>
<td>SD</td>
<td>18%</td>
<td>28%</td>
<td>54%</td>
</tr>
</tbody>
</table>

Table 4 – Question 6 – Developers’ vs. physicians’ views on users’ feedback and development work. The strongest agreements are with a light background, the strongest disagreements with a dark background.

<table>
<thead>
<tr>
<th>View</th>
<th>N</th>
<th>Group</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Users know to whom and how they can send feedback about IT systems when they want to.</td>
<td>135</td>
<td>Developers</td>
<td>52%</td>
<td>14%</td>
<td>34%</td>
</tr>
<tr>
<td></td>
<td>1384</td>
<td>Case physicians</td>
<td>42.9%</td>
<td>10.1%</td>
<td>47.0%</td>
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<tr>
<td></td>
<td>3851</td>
<td>All physicians</td>
<td>42.8%</td>
<td>9.8%</td>
<td>47.4%</td>
</tr>
<tr>
<td>b) People in managerial positions in the user organizations take end users’ opinions and experiences as users of the IT systems into account.</td>
<td>132</td>
<td>Developers</td>
<td>49%</td>
<td>21%</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>1371</td>
<td>Case physicians</td>
<td>33.2%</td>
<td>26.7%</td>
<td>40.0%</td>
</tr>
<tr>
<td></td>
<td>3813</td>
<td>All physicians</td>
<td>30.8%</td>
<td>25.5%</td>
<td>43.7%</td>
</tr>
<tr>
<td>c) Software providers are interested in the feedback given by end users.</td>
<td>135</td>
<td>Developers</td>
<td>80%</td>
<td>7%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>1370</td>
<td>Case physicians</td>
<td>13.0%</td>
<td>27.0%</td>
<td>60.0%</td>
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<tr>
<td></td>
<td>3810</td>
<td>All physicians</td>
<td>14.7%</td>
<td>25.5%</td>
<td>59.8%</td>
</tr>
<tr>
<td>d) Software providers take the end users’ opinions and experiences into account.</td>
<td>133</td>
<td>Developers</td>
<td>81%</td>
<td>14%</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>1365</td>
<td>Case physicians</td>
<td>8.1%</td>
<td>28.4%</td>
<td>63.4%</td>
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<tr>
<td></td>
<td>3792</td>
<td>All physicians</td>
<td>9.8%</td>
<td>26.9%</td>
<td>63.3%</td>
</tr>
<tr>
<td>e) Software providers implement proposals for corrections and modifications as requested by the customers.</td>
<td>133</td>
<td>Developers</td>
<td>55%</td>
<td>32%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>1360</td>
<td>Case physicians</td>
<td>6.6%</td>
<td>30.8%</td>
<td>62.6%</td>
</tr>
<tr>
<td></td>
<td>3781</td>
<td>All physicians</td>
<td>8.1%</td>
<td>28.1%</td>
<td>63.8%</td>
</tr>
<tr>
<td>f) Proposals for corrections and modifications are implemented quickly enough.</td>
<td>133</td>
<td>Developers</td>
<td>23%</td>
<td>20%</td>
<td>57%</td>
</tr>
<tr>
<td></td>
<td>1363</td>
<td>Case physicians</td>
<td>4.1%</td>
<td>22.2%</td>
<td>73.7%</td>
</tr>
<tr>
<td></td>
<td>3785</td>
<td>All physicians</td>
<td>5.1%</td>
<td>21.3%</td>
<td>73.6%</td>
</tr>
</tbody>
</table>
thought that software developers do not take the end users’ opinions and experiences into account, whereas more than four in five (81%) of the developers thought the opposite.

More than half (55%) of the software provider’s employees regarded customers’ proposals for corrections and modifications as being implemented as requested (statement 6.e), but only about 7% of their customers’ physician employees thought so. The time used for development activities was too long in the opinions of both respondent groups.

Question 8 and the open-ended Question 9 covered overall opinions on the present state of software development in the case company. The respondents had positive opinions on all three statements within the question about the software development process and methods used (Fig. 2). In contrast, the open comments on Question 9 highlighted more negative attitudes.

Almost three-quarters (72%) of the respondents agreed with the statement ‘I work with users’. About half (47%) of the respondents thought that feedback from customers is communicated from the customer interface all the way through to software developers, while more than one-third (35%) disagreed. Statement 8.c, on the support provided for cooperation with customers by the development process and the methods in use at the time of the questionnaire, divided the opinions the most. Only 42% agreed that the process supported customer cooperation, while 28% disagreed and about the same amount (30%) had a neutral opinion on that statement.

The differences between the employment units were minor. Naturally, almost all the customer support persons collaborated with customers/users (97%), but most of the software developers (56%) also collaborated with customers.

The customer support persons agreed more often (57%) than the software developers (37%) with statement 8.a ‘In my experience, the feedback from customers will be communicated from the “customer interface” to software developers’. About half (46%) of the software developers thought that the then current way of developing software supported cooperation with customers (statement 8.c), while only one-third (32%) of the customer support persons agreed on that.

3.3. Proposed ways of user participation

The ways in which the respondents wished end users to participate in HITs development activities in the future are now presented, in comparison to the views of the physicians in the earlier study (Question 5; Table 5). The physicians did not have strong opinions, but the option (53.4%) that found the greatest favor among them was 5.e: “Users would describe the problems with using the system to a physician in charge of developing information systems, who would be appointed in the organization”. Most physicians thus wished to share their thoughts with their colleagues, not necessarily with developers [3].

Developers observing users’ work in the actual use context (option 5.a) was a way in which both stakeholder groups liked to collaborate; it was the second most popular option (35.6%) among the physicians and the most popular one (77%) among the developers.

The biggest difference was about user groups (option 5.b in this study), which the developers strongly liked (75% in favor) but the physicians disliked (only 14.0% in favor). User groups are a method for gathering user needs and requirements that is currently used quite often in Finland. The developers seem to wish to continue with that kind of collaboration, but most of the physicians seem to have concluded that it is not a satisfactory way to achieve user-friendly solutions in products [3].

Almost one-third of the physicians (28.1% in favor) would like to provide direct feedback to developers, for example, by email (option 5.d in this study) [3], but this option was the one least favored (only 12% in favor) by developers.

Only 9 free text answers were received for option 5.f. Suggested alternative ways of collaborating included that instead of direct email users should be able to send comments to some kind of a “pool”, that users should tell their ideas to one person (for example the product owner), who would compose them and communicate with the developers, and that focused questionnaires should be conducted among end users about specific issues in development. It was also suggested that the customer organization should provide enough knowledge (persons) in all necessary areas of the product being developed. The requirements gathering and testing phases were seen as the most important phases in which users should participate.

Open-ended ideas were sought from the developers through Question 7 on how cooperation with customers could be developed. About half (46%; 63 persons) of the respondents answered this question. Similar responses were categorized into groups using the contents analysis method. Ultimately, six categories were formed (Table 6). The need for user participation in the development process was brought up several times (12); users need to be involved all the way from the beginning and throughout the development. Observing users while they are working in their workplace was mentioned about the same number of times (11). The developers also wished to have more direct contact with end users (5). Some well-known usability engineering techniques [25] were suggested, namely user testing (4) and prototyping (2). User groups were also mentioned in these responses as a means of cooperation. Finally, some developers suggested that end users should, in general, be more visible to all developers. There were also quite a large number of other development ideas and other comments which were not exactly ideas for developing the end user-developer cooperation.

The developers’ open-ended responses were also analyzed from a “levels of analysis” perspective [24]. At the level of individuals, the respondents wished for more opportunities to observe end users’ work, to continuously collect feedback from end users, and to understand end users’ work better.

At the group/activity level, the respondents wanted to develop collaboration with groups of stakeholders (such as customer support, development, sales). A lack of sufficient resources was experienced as a complicating issue: the developers would need more resources for more intensive collaboration with end users, and especially for focusing on analyzing and understanding user feedback.

At the organizational level, the developers needed commitment on continuous feedback and support. Respect for, and understanding of, users on the organizational level was seen as an important factor. On the other hand, the lack
Fig. 2 – Question 8 – The software development process and methods in use at the time of the questionnaire.

Table 5 – Question 5 – Ways of user participation: differences between developers and physicians. The most favored options are with a light background, the least favored with a dark background.

<table>
<thead>
<tr>
<th>Question</th>
<th>Developers</th>
<th>Physicians</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Users would present their work and needs related to it in their workplace to software developers.</td>
<td>76%</td>
<td>35.6%</td>
</tr>
<tr>
<td></td>
<td>81%</td>
<td>37.6%</td>
</tr>
<tr>
<td>b) Users would participate in a development workgroup that included end users of the systems.</td>
<td>75%</td>
<td>14.0%</td>
</tr>
<tr>
<td></td>
<td>75%</td>
<td>15.5%</td>
</tr>
<tr>
<td>c) Users would send feedback and development ideas to a web-based forum provided by the software provider, accessible by all.</td>
<td>31%</td>
<td>18.9%</td>
</tr>
<tr>
<td></td>
<td>34%</td>
<td>18.6%</td>
</tr>
<tr>
<td>d) Users would send feedback and development ideas directly to software developers, for example by email.</td>
<td>12%</td>
<td>28.1%</td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>29.5%</td>
</tr>
<tr>
<td>e) Users would describe the problems with using the system to a physician in charge of developing information systems, who would be appointed in the organization.</td>
<td>29%</td>
<td>53.4%</td>
</tr>
<tr>
<td></td>
<td>27%</td>
<td>52.2%</td>
</tr>
</tbody>
</table>

of understanding of a customer/user organization’s policies and activities – for example, uncertainty about how the user organization operates and its hierarchy and allocation of responsibilities – was regarded as problematic.

3.4. Answers to research questions

RQ1. How do healthcare IT systems developers view the current state of user participation in healthcare IT systems development?

Questionnaire Questions 6 (Table 3) and 8 (Fig. 2) dealt with this research question. All the subgroups of developers were strongly of the view that they themselves are interested in end users’ feedback, and take their opinions and experiences into account; they were much less confident that hospital and clinic managers would do the same. A small majority also considered that developers implement the customers’ proposals for correction as requested, and that users know how to send feedback. There were slightly more customer support persons than software developers who considered that end

Table 6 – Question 7 – Open-ended ideas about collaboration with customers (N = 63).

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>User involvement throughout the development/right from the beginning (6 + 6)</td>
<td>12</td>
</tr>
<tr>
<td>Visiting end users’ workplace/observing their work</td>
<td>11</td>
</tr>
<tr>
<td>Customer/user group</td>
<td>9</td>
</tr>
<tr>
<td>UCD techniques: user testing at an early stage of development (4) and prototyping (2)</td>
<td>6</td>
</tr>
<tr>
<td>Direct contact between the software developers and end users</td>
<td>5</td>
</tr>
<tr>
<td>End users’ opinions should be more visible (4)</td>
<td>4</td>
</tr>
<tr>
<td>Other development ideas and comments (22)</td>
<td>22</td>
</tr>
</tbody>
</table>
users’ opinions and experiences are not taken into account and that corrections and modifications are not implemented as requested; however, such views were a minority.

The only issue on which all the developer groups took a critical stand was about the timeliness of corrections and modifications. The views on the development process in use in the company itself were more divided; only slightly more respondents agreed than disagreed that the process supported cooperation with customers and that customer feedback was communicated from the customer interface all the way through to the software developers.

It should be noted that not only the customer support people but a majority of the software developers also stated that they work with end users.

In summary, the developers have a positive view of the current state of user participation in HITs development, and particularly of their own attitude to it.

RQ2. What kinds of ideas do developers have about collaborating with users?

Questionnaire Questions 5 (Table 5) and 7 (Table 6) dealt with this research question. Regarding the choices that were given, all the subgroups of developers strongly favored direct observation in the end users’ workplaces and the traditional user groups. Direct email from end users did not receive support.

In the open-ended responses, the role of user involvement throughout the development activities was heavily stressed. As in the multiple-choice question, visits to the end users’ workplaces and user groups were suggested, but unlike in the multiple-choice question, direct contact between software developers and end users received some support, too. It can be inferred that the means of direct communication should not be Many traditional user-centered methods were also suggested, as well as a large variety of individual ideas.

In general, the developers again showed their general support for customer and end user collaboration, but did not have very specific ideas about how to improve it.

RQ3. How do developers’ views of the current state and collaboration differ from medical doctors’ views?

Questionnaire Questions 6, 5 and 7 in this study, as well as the respective questions A, B and C in the previous study among Finnish physicians, provided the materials for this research question (Tables 4 and 5). The developers’ and physicians’ views on the developers’ attitude toward end users were in direct opposition – the developers regarded themselves very strongly as being interested and taking the end users into account, while the physicians regarded them as not being interested. The majority of the respondents to both studies were dissatisfied with the pace of development of new products, updates, and corrections.

Regarding the preferred ways and means of collaboration, both the developers (strongly) and the physicians (mildly) favored visits by developers to end users’ workplaces. Opinions on user groups were in direct opposition – the developers liked them, the physicians did not.

4. Discussion

4.1. Possible reasons for the findings

How can the differences in opinions between developers and physicians about the current state of collaboration be so huge, particularly when the developers in this case have quite considerable experience in the healthcare field?

One explanation can be that end users rarely or never get feedback on what happened to the feedback they give – there is no two-way channel of communication for development activities. The software development process is a black box to physicians – they cannot see how their feedback goes forward inside the software company and in the software maintenance or development process. Additionally, the long period of time it takes to construct the software and implement corrections may influence the view that feedback is not considered in software development activities. Both end users and developers may lack a clear understanding of how the end user feedback and development proposals process goes between and within customer and developer organizations.

It is also possible that both views are actually correct – but with different meanings. Developers may see that they collaborate with customer representatives in meetings and user groups, while end user physicians may think that these representatives do not know about the actual end users’ work. The other way round, physicians may consider that software provider companies are not interested in their needs, while the employees of those companies can indeed still be interested. This possible explanation is corroborated by the differing opinions on user groups as a means of developer-end user collaboration, and by the physicians’ view that HITs are developed by “engineers and [those] medical doctors who [are] in administrative positions” ([3], page 106).

The same mismatch between ‘customer representatives’ vs. ‘end users’ may explain the finding that slightly more customer support persons than software developers considered that end users’ opinions and experiences are not taken into account and that corrections and modifications are not implemented as requested; software developers may regard the requirements from customer representatives as equal to end users’ needs, while customer support persons may have more direct interaction with the actual end users.

After a correction proposal is implemented, most end users are still not satisfied; only 8% of the physicians agreed that corrections are implemented in the way they requested. However, the majority of developers consider that improvements and modifications are conducted as the customer requested. Why is that so? Maybe not enough end user testing is done when corrections are implemented, or maybe the wrong kinds of users (not physicians that are in clinical work) accept the corrections.

4.2. Strengths, limitations, and contributions

The main strength of this study is the opportunity to compare the results with those of the previous study among physicians. Although the study was conducted in one company only, the company is one of the major actors in the national healthcare...
IT market; about one third of the respondents of the previous study used primarily that company’s products. Because of the size of the company and the good response rate (37%), the sample size is quite big (136 respondents) – several times the total number of developers in most HITS provider companies in Finland. The physicians’ and developers’ views are of the same products and roughly the same projects. This can be regarded as a strength of the single-case setup.

On the other hand, a single case study can, of course, never be generalized, and this study particularly cannot be generalized to small and medium-sized HITS provider companies. Notwithstanding the limitations, the results of this study can be used as an input for improving the HITS development process and methods.

The main contribution to prior theoretical understanding, as reviewed in section 1.3, is the finding that HITS developers strongly acknowledge the importance of user centered design and end user participation; the key issue is not any more to raise awareness in HITS provider companies. However, despite all the recommendations in the literature on human factors, agile methods, etc., it is still not clear how the good intentions should be implemented in the practice of HITS product development.

4.3 Needs for further research

Four main directions for further research can be identified.

1. To find out how representative the results are of the HITS industry in Finland in general, a quantitative survey among a broadly representative sample of companies would be needed.
2. To find out how specific or generalizable the results from Finland are to other countries, both the study among physicians (or all clinicians) and the study among developers should be repeated in a number of different countries.
3. To find out how the long response time taken to implement modifications, acknowledged by all, can be addressed, action research with more agile methods is required.
4. Finally, to find out the actual reasons for the contradictory situation wherein all stakeholder groups from end users to “end developers” are interested in collaboration but the results are still unsatisfactory, an in-depth analysis of the entire two-way nexus of activities between the two ends is required. It is obvious that there are one or more spots along the route where a breakdown of the information flow happens.

This study showed that at least in one major HITS provider company in Finland, the developers are interested in developing their working conventions and methods and they were able to identify weaknesses in their work environment and processes. The respondents to this questionnaire were highly proficient and skilled persons who have unexpectedly high level of work experience in the field of healthcare.

All the subgroups of developers were strongly of the opinion that they themselves are interested in end users’ feedback, and take their opinions and experiences into account. They have a positive view of the current state of user participation in health IT systems development. This is in sharp contrast with what physicians think about developers’ attitudes.

There was only one issue in which the views of the developers and physicians were the same. The majority in both studies were dissatisfied with the pace of development of new products, updates, and corrections.

Neither physicians nor developers have very specific ideas about how to improve the collaboration between developers and end users.

Both physicians and developers seem to be “willing but not able” to collaborate with each other. Possible reasons for the differences in views include the fact that there is no return channel of communication on what happened to the end users’ feedback, and that developers collaborate with customer representatives who are not end users. It is obvious that there are one or more spots along the route between “end developers” and end users where there is a breakdown of the information flow.

Author contributions

The first author designed the questionnaire study, actually implemented it, processed the data into graphs and tables, and wrote the initial version of the entire paper. The second author mentored the study throughout and fine-tuned the paper. The third author processed the open-ended material independently, accepted the classifications together with the first author, and conducted the analysis of the context levels, as well as commented on the whole paper.

Competing interests

The first author conducted the study as part of her doctoral research but is also an employee of the case company. The company did not sponsor the study financially. The questionnaire explicitly emphasized that it was not an in-house study but a scientific one aimed at being published in an international scientific journal, that the respondents could not be identified, and the name of the company would not be mentioned.
Summary points

What was already known about the topic?
- Physicians in Finland are highly critical of their IT systems.
- They are also critical of the current state and methods of participation with IT systems developers.

What did this study add to our knowledge?
- Developers have a positive view of the current state of user participation in health IT systems development, and particularly of their own attitude to it.
- The majority of both physicians and developers were dissatisfied with the pace of development of new products, updates, and corrections.
- Neither physicians nor developers have very specific ideas about how to improve the collaboration between developers and end users.

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