User Participation in Configuration of a Large-Scale Electronic Health Record System: Experiences and Expectations

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Large-scale generic IT systems are central digital infrastructure in large user organizations. To optimize use, such systems typically need to be configured to local requirements. However, little is known about how users participating in system configuration experience such processes. To learn from relevant cases, a study was conducted on user participation in the configuration of an electronic health record system in Central Norway. Nine participating healthcare professionals were interviewed, revealing unmet system and process expectations as a recurring issue. The results highlight how respondents' initial expectations, toward both the system and, especially, the configuration process play an important role in their assessment of their participation, the process, and their personal influence on the resulting system. Drawing on a pre-existing multidimensional understanding of participation, the findings are assessed. The paper concludes by offering key lessons regarding differences in configuration versus design, managing expectations, and the need for flexibility in configuration processes.

CCS CONCEPTS • Human-centered computing • Human computer interaction (HCI) • Empirical studies in HCI

Additional Keywords and Phrases: User participation, Configuration, Electronic health record (EHR), Large-scale generic IT systems

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1 INTRODUCTION

Large-scale generic IT systems are software solutions designed for a broad market but with possibilities for configuring implementations to better fit the needs and requirements of specific user organizations [11, 24]. Examples of such systems include SAP and Oracle ERP. Such software systems are often considered essential components of the digital infrastructure in large organizations, including businesses, educational institutions, and healthcare organizations [11]. Envisioned benefits of implementing large-scale generic IT systems include cost savings, enhanced collaboration and productivity, and greater flexibility compared to non-configurable alternatives [8].

Despite their possible benefits, large-scale generic IT systems can pose considerable challenges in terms of usability and user acceptance [21, 22, 23, 26]. Considering the design life cycle of such systems, it has been argued that they are essentially 'half a product' [29] when acquired, as they require further tailoring or configuration to suit the specific needs and requirements of the user organization. This highlights how large-scale generic IT systems follow a different design life cycle than software systems that are developed for a specific context of use from the outset. Such a two-phased design life cycle arguably also sets different premises for user involvement in design, with some design decisions being taken and embedded into the generic IT system before the involvement of users in the configuration process occurs after acquisition. While user involvement is widely recognized as a best practice in software development [20], their participation in the configuration of large-scale generic IT systems remains a largely unexplored topic within Human-Computer Interaction (HCI) research. Understanding how users can meaningfully participate in the configuration of these systems is critical, as the extent to which they are involved in this process may significantly impact system usability, acceptance, and the overall success of implementation.

Inspired by how the concept of participation is conceptualized in the Participatory Design (PD) tradition, this paper aims to offer a more comprehensive understanding of such configuration processes from the perspective of participating users. Specifically, the present study has been guided by the following research question: *How do future users involved in configuring a large-scale generic IT system to local needs experience the configuration process, their participation, and their influence on the result?*

We explore the research question above by drawing on participant interviews conducted as part of an embedded case study of a large Norwegian health IT project. The project's goal was to implement a common electronic health record (EHR) system for health care services in Central Norway by configuring a large-scale generic EHR system to local needs. Healthcare professionals (i.e., future users of the system) were engaged in the associated configuration process.

Our findings highlight the unmet expectations of participating users concerning the generic software system that was to be configured and, especially, the associated configuration processes. Considering the findings in the light of a multi-dimensional understanding of the notion of user participation [3], the paper discusses aspects that shaped user participation in the configuration process, implicitly directed what the participating users were involved in, and affected the level of participation reflected in the end result. While no configuration processes are identical, our case study findings contribute to establishing an initial empirical understanding of challenges that user participation in the configuration of large-scale generic IT systems may present. Based on these findings, we offer three key lessons learned that are particularly relevant to the planning of such processes.

A license to collect and store study data was obtained from the Norwegian Centre for Research Data under license no. 699313.

2 USER PARTICIPATION IN CONFIGURATION OF LARGE-SCALE GENERIC IT SYSTEMS

This paper addresses a topic that, within the existing research literature, is often considered two distinct matters. First, it concerns the challenge of user participation in the development of large-scale IT systems. Secondly, it investigates issues about user configurability – how users' tasks can be solved by allowing them to take part in configuring or tailoring system functionality and behavior to their specific needs. Below, we provide a succinct account of these two strands of research and explain how the current study is positioned vis-á-vis prior work.

2.1 User participation and the problem of scale

Given the increasing size and complexity of IT systems, the involvement of users in their development has garnered significant attention in studies of HCI and PD-related studies. In a review article from 2008, Simonsen and Hertzum [31] noted that "PD experiments have been restricted to small-scale systems or to the initial parts of larger-scale information-systems development followed by a conventional contractual bid". As user involvement and participatory methods are integrated into the development of large-scale IT systems, many of the presumptions regarding the underlying participatory context of small-scale IT systems development no longer apply [40]. Existing studies have outlined various challenges in this regard. These encompass the involvement of large portions of user groups in design-related activities, the heterogeneity that may exist within large user groups, and the discontinuity of user groups [28, 39]. Other research points to the problem of intergroup communication as a notable hurdle in large participatory endeavors [7]. Looking beyond the more logistically oriented challenges mentioned above, recent studies have highlighted how large-scale projects may require alternative strategically oriented approaches beyond typical participatory design (PD) activities to establish suitable conditions for PD [5]. Furthermore, other studies have raised questions about the identity and representation of users involved in large-scale IT projects, and how their roles as representatives may evolve throughout such projects [41].

2.2 User configuration

Regarding user configuration, existing studies in HCI have mainly focused on how users without programming skills can be provided with effective means for specifying system behavior through various techniques (e.g., [9, 30, 37]). This strand of research is, in some cases, referred to as end-user programming or end-user development [2, 25]. A considerable part of this research has focused on contexts where users configure a system to be used by themselves or a small group of users (e.g., family members [6]). User configuration of large-scale generic IT systems used in organizations, on the contrary, often involves users in configuring system behavior that affects many users and possibly a wide variety of user groups (e.g., [17, 35]). Despite user involvement in the configuration process, several studies have found that usability and user acceptance tend to be major concerns with the solutions generated through configuration processes (e.g., [19]). While there may be various interconnected reasons for usability issues and low user acceptance often associated with such systems, existing work offers valuable insights into these challenges. Regarding configurable EHR systems, studies have pointed to the challenge of conflicting needs among various user groups in an organization, leading to some needs being prioritized over others [12]. Another relevant issue in this context is the potential conflict between national concerns, which often presume more standardized solutions, and local concerns, which call for more custom-made solutions [11]. Studies have also underscored how technology implementation projects in organizations may inflate user expectations to foster enthusiasm, leading to subsequent disappointment when the technology fails to meet these heightened expectations due to, for example, organizational and situational factors [18].

2.3 Positioning the current study

While user participation in the configuration of large-scale generic IT systems presents complex and multifaceted issues, as outlined above, there remains a notable scarcity of studies examining how these configuration processes are experienced by the participating users. Hertzum and Torkilsheyggi [17] explored users' perceptions of continuous configuration of an EHR system post-deployment. In contrast, our study delves into users' experiences prior to system deployment, highlighting conflicting perspectives. This gap in empirical knowledge highlights a potential lack of understanding concerning pertinent issues and strategies for their resolution. The current study endeavors to address this gap by investigating a specific configuration process and the corresponding experiences of participating users.

3 THE CONCEPT OF PARTICIPATION

To explore how participation is experienced in the configuration of a large-scale generic IT system, a detailed examination of the concept is warranted. Participation is a multifaceted concept, its meaning varying across contexts. At its most basic level, participation is akin to attending or being present at an activity or event. In the realm of public policy and democracy discourse, participation denotes emancipation and empowerment, signifying the ability to influence and take part in decision-making processes. Arnstein's [1] "ladder of participation" provides a widely recognized framework for illustrating participatory citizen control. It depicts participation as a continuum from non-participation at the lowest rungs to varying degrees of tokenism in the middle, and ultimately to degrees of citizen power at the upper rungs.

Turning to how participation is understood in the PD tradition, we find that the term carries similar emancipatory connotations as in Arnstein's [1] "ladder". The considerable attention that PD discourse has paid to the question of what participation entails (e.g., [4, 32, 33]), has helped produce a set of comprehensive conceptual "lenses" by which participation can be understood and assessed. One such lens is the multidimensional understanding of participation proposed by Bratteteig and Wagner [3] (Figure 1), in which participation is described along three dimensions, each denoting a guiding question: *What shapes participation? Participation in what? How participatory is the design result?*

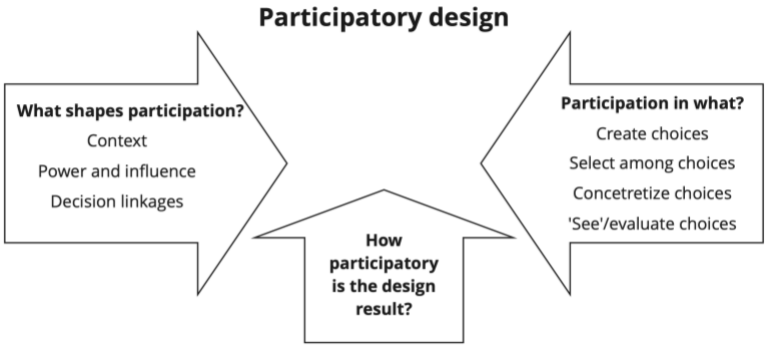

Figure 1: Dimensions of participation (adapted from [3]).

The first dimension, "What shapes participation?", involves factors that affect the possibilities for participation and power sharing. The *context* in which participation takes place, including aspects such as project size (small or large), project timeline (short or long), type of project (industry or research) who the participants are (homogenous or heterogenous), and the institutional setting in which the participation occurs is one such factor. Another factor is the *power and influence* exercised by participants, which concerns the extent to which participants have a real possibility to control the design output, both vis-à-vis one another and vis-à-vis external aspects. The last factor, *decision linkages*, refers to how choices taken by those involved in a design process may influence future participation and decisions in a wide variety of ways.

The second dimension, "Participation in what?", concerns the type of design decisions or choices in which participants are involved. In this context, Bratteteig and Wagner [3] distinguish between four types. When *creating choices*, participants actively contribute to expanding design possibilities. Participatory activities involving choice creation typically occur in the early stages of a project, helping to keep multiple options open. Conversely, when participants are allowed to *select among choices*, there is a narrowing of design options, limiting available pathways for future design. Participatory activities aimed at *concretizing choices* involve participants in 'fleshing out' or elaborating on previously selected choices in further detail. Lastly, participants may *see/evaluate choices*, implying that they are involved in assessing design solutions built

through design processes in which they may or may not have been involved. The results of such assessments may be used to inform further design solutions or to approve a specific solution. Participants in a project may engage in some or all of these choices, impacting their influence on the resulting design solution.

The third and final dimension, "How participatory is the design result?", concerns the design outcome resulting from participatory processes and the extent to which participants can recognize their input or contributions to the end result. This aspect can thus be seen as a validation for participants of their influence and the degree to which they have had a say in shaping the output of the process.

4 CASE STUDY: A REGIONAL EHR IMPLEMENTATION PROJECT

Our investigation into the experiences of users participating in the configuration of large-scale generic IT systems is based on an embedded case study of an IT project in healthcare, conducted in the spring of 2022. Background information about the case was retrieved from publicly available information. The project aimed to implement a common EHR system for primary and secondary healthcare in Central Norway, serving a population of 720,000 residents and 44,000 healthcare professionals. The process to acquire the EHR system commenced in 2012. Following a competitive tendering process, a US-based software company (referred to as the vendor organization) was selected as the provider for the EHR system in March 2019 [14]. The project's estimated cost was EUR 270 million.

The chosen EHR system was a generic software solution with a core system known as the Foundation system, used globally by multiple hospitals across several countries. Although tailored to specific user needs, all installations utilize the Foundation system's core functionality [15].

Although the participation of healthcare professionals (i.e., future users of the system) was a significant aspect of the configuration process, user empowerment as understood in PD [10, 34] was not explicitly outlined in the project objectives. The project nevertheless forms an interesting case where PD and HCI can learn from the experiences of users participating in the configuration of a large-scale generic IT system.

4.1 Stakeholder organizations

At the time of the study, the EHR implementation project involved three main stakeholder organizations:

- *Client organizations and client group:* This involved (1) the regional public health authority running and coordinating the region's state-owned hospitals, (2) the municipal body overseeing administrative functions in the region, and (3) a group of primary care physician offices (general practitioners organized as independent entrepreneurs).
- *Client project organization*: After the procurement, the client organizations established a joint-stock company to manage the project. The main function of the project organization was to facilitate the implementation of the EHR system for the client organizations and client group. To participate in the process of configuring the EHR system to local needs, the project organization employed more than 600 healthcare professionals, mainly from the client organizations and client group. To address potential disagreements in the configuration process, the project organization implemented a four-level decision structure. The majority of healthcare professionals were placed at the lowest level, where most configuration decisions were intended to be made.
- *Vendor organization*: The US EHR system vendor organization relocated some of its US-based employees to Norway for the project's duration, where the vendor's priorities revolved around adhering to requirements set by the contract to the distinct needs of the healthcare organizations.

4.2 Healthcare professionals involved in the project

As previously noted, a large number of healthcare professionals were involved in the configuration process fulfilling different roles. Roles of relevance to the current study are described below:

- *Subject-matter experts (SMEs)*: The client project organization employed over 400 healthcare professionals, primarily from the client organizations and the client group, in part-time or full-time roles as SMEs. These SMEs, who would also become users of the new EHR system, represented various medical specialties. Their intended role was to ensure the system was configured to meet professional needs and recommendations [16]. Technical configuration was handled by trained application analysts, as SMEs were not trained in this area.
- *Application analysts*: To configure the EHR system in accordance with the needs and recommendations of the SMEs, the client project organization employed more than 200 application analysts. Most application analysts had a professional background in healthcare. Unlike the SMEs, the application analysts underwent technical training, specifically focusing on configuring the system.
- *Superusers*: To help facilitate the transition to a new EHR system among healthcare workers in different units and services, the superusers were appointed to act as local support. These were healthcare professionals who were given extensive training in the use of the system prior to the implementation phase. While superusers did not have a formal role in the configuration of the EHR system, they were nevertheless consulted in questions related to the configuration of the system and work practices, in the later phases of the project.

4.3 Project timeline and phases

The EHR implementation project followed a six-phase plan [13] (Figure 2). The *Preparation Phase* involved the establishment of the client project organization and the hiring of staff, including SMEs and application analysts. The subsequent *Specification Phase* focused on preparing workflows and setting up the initial version of the EHR system. Next, the *Development Phase (2019-2020)* involved configuring the EHR system to local needs and preferences as specified by the SMEs. The *Test and Approval Phase* incorporated a significant number of test users in workflow testing, with a focus on integrating various system modules. The *Training Phase* was dedicated to training healthcare personnel in the use of the new EHR system. Finally, the *Implementation Phase* involved deploying the EHR system in the client organizations, concluding with "Go live", which marked the point at which the new system would be put into operation in the regional healthcare services.

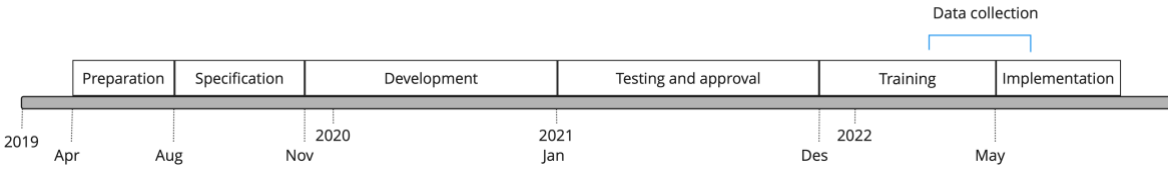

Figure 2: The EHR implementation project timeline and different phases.

5 METHODS

To develop a comprehensive understanding of how healthcare professionals involved in configuring the EHR system perceived the process, we conducted a set of semi-structured interviews with SMEs and superusers.

5.1 Respondents

A sample of nine respondents (R1–R9), consisting of six subject matter experts (SMEs) and three superusers, was recruited for the study. The respondents were recruited mainly from two different medical departments through a combination of purposive sampling and snowball sampling [27, p. 98]. To ensure respondent anonymity, specific background information for each respondent has deliberately been withheld.

5.2 Data collection

To support the interview process, an interview guide was developed. The interview guide contained questions concerning four different thematic areas: (1) healthcare professionals' understanding of their role in the project, (2) challenges of user participation in the configuration process, (3) reflections on the current state of the system before implementation, and (4) reflections over future adoption of the system. The interview guide was sent out to the participants a few days before the interview, with the intent to allow the participants to review the questions beforehand.

The interviews were conducted over approximately three months (marked *Data collection* in Figure 2), from early March to late May 2022, corresponding to between the *Training phase* and the early *Implementation phase* of the project. The main author conducted all interviews individually via Microsoft Teams. Each interview lasted between 30 and 60 minutes, with an average duration of 50 minutes. All interviews were audio recorded and transcribed.

5.3 Data analysis

The transcribed interviews were analyzed following a stepwise-deductive inductive approach [36, pp. 3–8], as illustrated in Figure 3. In the initial coding phase, the first author repeatedly reviewed the audio recordings and manually transcribed the recordings. After this was done, the transcripts were carefully reviewed to identify passages related to the themes of the interview guide. Codes, consisting of words or phrases from the transcript excerpts, were then assigned to ensure that they accurately represented the empirical content, employing an iterative inductive (bottom-up) approach. The subsequent coding phase involved organizing these codes into higher-level groups, accompanied by descriptive labels. Each code group was cross-referenced with the original transcript excerpts to ensure alignment with the empirical content. In the final step, the code groups were grouped into themes, representing the key findings of the study. The interviews were, at the various phases in the coding process, analyzed by both the first and last author by utilizing a deductive (top-down) approach to serve as a formal quality check.

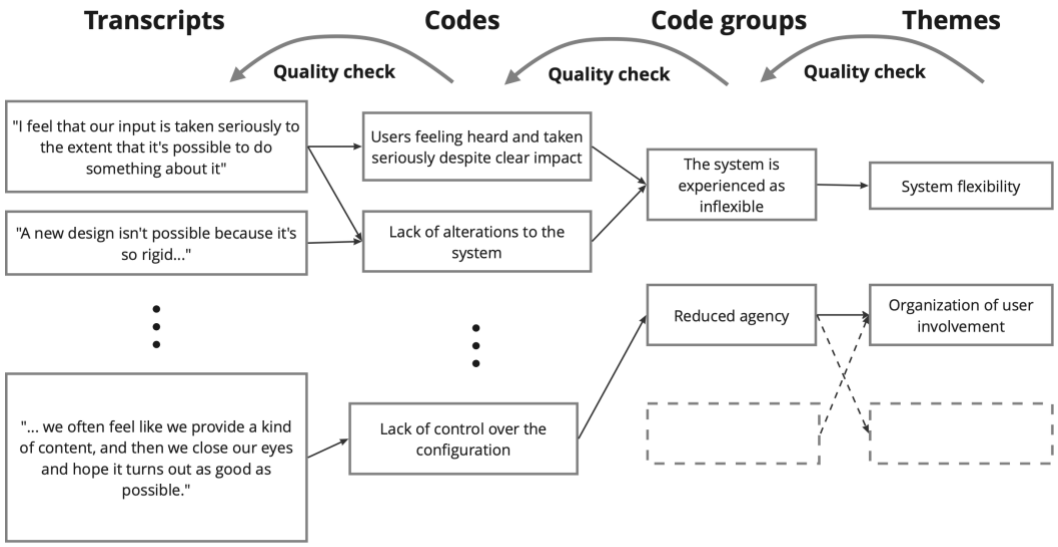

Figure 3: Example of how parts of the transcript were coded.

6 RESULTS

The analysis of the transcribed interviews identified four recurring themes, each representing a group of related concerns expressed by respondents regarding the configuration process. The four identified themes were: (1) system flexibility, (2) methods of user involvement, (3) organization of user involvement, and (4) user influence. What the respondents described as unmet expectations with respect to the listed themes stood out as a unifying topic. For each theme, relevant quotes from the interviews, along with our interpretations, are provided. Each quote is marked with a unique identifier, referencing the quoted respondent and their project-related role (e.g., "Quote 1, R1, SME").

6.1 System flexibility

The first central theme that the analysis revealed concerns how the respondents perceived the flexibility of the generic EHR system, that is, the extent to which the acquired system was regarded as sufficiently configurable to accommodate the needs and requirements of the healthcare workers participating in the configuration process. Considering the perceived system flexibility, one of the respondents expressed:

> "I entered this project believing that [the generic EHR system] was a highly customizable system – that you could do whatever you wanted with it – but that's not true at all. The system is largely from the 80s, and there's not much you can do with it. There's an extreme range of things we can't do. A new design isn't possible because it's so rigid… So, I'm extremely disappointed by how little you can do… Another problem is that we cannot modify the program because doing so would alter the program for tens of millions of users. We can make slight adjustments and adaptations to the content for our use, but we are not allowed to design new content. If we do that, it's no longer [the EHR system]; it becomes a different program. It took a long time for me to come to terms with the fact that this is how it is. Many workflows we want to change are not allowed to be altered because it affects multiple user groups." (Quote 1, R1, SME)

Respondent 1 highlights a discrepancy between personal expectations toward the system prior to the project and perceived possibilities after taking part in the configuration process, emphasizing limitations in customizing the generic EHR system to local needs. Pointing out the challenge of adjusting the Foundation system, which impacts configurable parts, the respondent notes reluctance from the vendor due to potential impacts on other installations worldwide.

Other respondents maintained a more positive stance regarding the system's flexibility while acknowledging the challenges of adjusting beyond what the system inherently supports:

> "If I were to say that something is a problem, then relatively small changes can be harder to achieve. There is quite a bit of flexibility built into the program, but if you want to do something beyond the predefined variables, more fundamental program changes are required, which nobody here can do, neither the application analysts we have trained nor the [the vendor organization's] programmers who are with us. It has to be done by an IT group based in the USA. It's a very cumbersome process, so changes that seem fairly simple to us can be almost impossible to accomplish. There is a lot of flexibility designed into it. Very little that is locked down, but some changes can be cumbersome to implement. There are some things we had expected that have proven to be very difficult to achieve." (Quote 2, R2, Leading SME)

Respondent 2 expresses that while regarding the system to be fairly flexible when it comes to tailoring it to user needs, achieving adaptations beyond the configurable options that the SMEs are presented with can be challenging. More fundamental changes to the system require expertise that neither the application analyst nor the local system developers from the vendor organization possess.

While some respondents considered the perceived limitations to accommodate user needs as primarily a technical constraint, others problematized the vendor organizations' will to accommodate user needs:

> "The suggestions are taken seriously, but they are prioritized based on how difficult they are to implement. They also evaluate them in comparison to what they already have. If they have something similar already and it's easy to adapt, then this is prioritized… We have consistently heard that there is a template at the core that is the 'default configuration', and it's easier for everyone if we use that." (Quote 3, R3, Superuser)

Respondent 3 agrees healthcare professionals' input is considered by the system vendor. However, the respondent doubts how their suggestions are prioritized – The vendor seems to prioritize easily solvable issues, reusing existing configurations, while deprioritizing suggestions that require further software development and changes to the Foundation system.

Quotes 1–2 illustrate the diversity in respondents' perspectives regarding the system's ability to accommodate user needs as expressed by the respondents. Most respondents experienced that the system did not meet their initial expectations in terms of flexibility and ability to accommodate user needs through configuration (e.g., Quote 2). Realizing changes to the system beyond what the configurable options allowed for was seen as a highly complex process (Quotes 1–2). While the majority of the respondents described limitations in system flexibility as technical constraints, some respondents also questioned the vendor's will to prioritize issues that could not be solved through configuration, and which required more significant system modifications (Quote 3).

6.2 Methods of user involvement

A second concept that was identified through the analysis concerns the methods by which participating healthcare professionals were involved. Method of involvement, here, refers to the specific approach by which they were engaged in the configuration process. In this regard, one of the respondents expressed:

> "When making decisions, I think we have consistently requested to be presented with what the different alternatives are and what the consequences of these alternatives would be, and what leads you towards that decision. Often, it has been the case that you enter such a meeting, and a PowerPoint presentation is given, 'when a user does this, you have choice A or choice B.' And we've asked, 'but what leads the user to that choice?' and no one can answer that. Or what the consequences of choice A or choice B are. Clearly, you can't work like this; the decisions then get based on a very inadequate foundation." (Quote 4, R4, Leading SME)

In Quote 4, the respondent questions the basis for SMEs' opinions on system configuration. Despite opportunities in project meetings, the lack of concrete alternatives and context for decisions is questioned. According to the respondent, insufficient shared contextual understanding increases the risk of suboptimal design decisions.

Other respondents expressed concerns about how their issues regarding the methods of user involvement were addressed by the client project organization:

> "We were shown some screenshots and asked about our thoughts on this way of working. When we replied that we couldn't say anything about it without seeing the context, we weren't asked much more. Instead, they hired others who could provide simpler answers. It's not that they haven't done a good job, but we wish that [the client project organization] had been more present here with us, and not just bringing in individuals from the hospital. We had to persuade one of the leaders for the [medical specialty] team to come here and see how we work." (Quote 5, R3, Superuser)

The respondent in Quote 5 expresses concerns about having been excluded from the decision-making process and being replaced by others after questioning the methods by which healthcare professionals are involved. Furthermore, the respondent points to an experience of a lack of sufficient understanding of existing work practices among the client project organization and the vendor organization.

Quotes 4–5 highlight issues related to the methods used to involve healthcare workers in the configuration process, emphasizing the need for a more comprehensive understanding of the context and consequences of various options to make better design decisions. The concerns raised include the reliance on screenshots of user interface configurations in decision-making, the lack of a rich and shared contextual understanding among meeting participants, and the challenges of providing the vendor with in-depth knowledge about work practices at the regional hospitals (implementation sites).

6.3 Organization of user involvement

The third concept that was identified as central in the respondents' accounts concerns the organization of user involvement in the configuration process. It refers to the overall structure for how healthcare professionals were involved in the configuration process and how their input was integrated into the decision-making. In particular, we found two recurring issues pertaining to the organization of user involvement in the respondent's accounts. The first issue is related to decision-making, which deals with the question of how to meaningfully involve all the participating healthcare professionals in the configuration of the system. The second issue is related to the SME–application analyst interaction, which deals with the

question of what challenges have occurred in the interaction between SMEs and application analysts during the configuration process.

6.3.1 Decision-making

One topical challenge is the issue of how to meaningfully involve all the users in the configuration of the system, as highlighted in the quote below:

> "I think we've been involved in quite many aspects. Nevertheless, it has been a challenge that a few of the subject matter experts have had more prominent positions, making most of the decisions and receiving the most information. Not all of the 200 subject matter experts have been effectively involved because it became too heavy and lengthy a process from the side of [the client project organization]. As a subject matter expert, I don't know, when I identify problems in the software in terms of content, whether this has been discussed beforehand, and someone has actively taken a stance. It's difficult for me to know if someone actively wanted it to be that way or if it's a mistake…The communication between the [medical] fields has been difficult… There have also been many instances where you feel that others have made decisions for you, and you can't provide input. Especially when you feel you possess essential expertise but aren't asked, it has led to errors and deficiencies in the software, which later require a lot of time to rectify." (Quote 6, R5, SME)

Quote 6 highlights some of the challenges faced by the respondent in terms of the organization of user involvement in the project. While there have been numerous participating healthcare professionals involved, the decision-making process has occasionally been dominated by a few SMEs in higher positions. From the perspective of the respondent, there has also been insufficient transparency in decision-making, leading to uncertainty about whether certain issues or concerns have been addressed beforehand or if they are simply errors in the software. The sheer size of the project has made it difficult at times for individual users to feel heard and valued, thereby lowering the overall user participation.

Another topical challenge is the frequent inadequate communication flow within the project, coupled with challenges in user-to-user communication, as demonstrated in the quote below:

> "Also, there has been poor information flow within [the client project organization], which leads to some information being lost from one silo to the next. This has led to significant changes having to be made to certain key software applications towards the end, as it became apparent that they were built contrary to the decisions. Much of this is due to the inadequate communication flow within [the client project organization]; someone may have consulted the subject matter experts, but then this information has been lost and not conveyed further, resulting in the [configuration] of software applications that are contrary to the decisions made by the subject matter experts. At some point, the information has been lost. The organization is responsible for ensuring that information flows seamlessly. This cannot be an individual effort. There have been some personnel changes, but that is not the only explanation. They did not have procedures and strategies in place to disseminate decisions effectively." (Quote 7, R4, Leading SME)

The passage highlights what the respondent considers poor information flow and a high turnover rate within the project, leading to information getting lost. As a result, key changes had to be made towards the end of the project, when it was discovered that some configurations were done contrary to the suggestions initially made by the SMEs. The respondent considers it to be the responsibility of the project organization to establish routines and strategies to ensure that decisions are effectively communicated.

Quotes 6–7 highlight issues related to how to meaningfully engage all the SMEs when configuring the system to local needs, instead of a few SMEs getting more power to influence. Another topical challenge is the frequent inadequate communication flow and high turnover rate within the project, where there is a desire for the organizations to have routines and strategies in place to mitigate these challenges within the project.

6.3.2 SME–application analyst interaction

Another central aspect concerning the organization of user involvement in the configuration process involves the interaction between SMEs and application analysts responsible for implementing decisions made by the SMEs as system configurations. Reflecting on this interaction, one of the interviewed SMEs stated:

> "When it comes to the extent to which we, as subject matter experts, collaborate on creating the product with the application analysts, we often feel like we provide a kind of content, and then we close our eyes and hope it turns out as good as possible. To a significant extent, the application analyst drives the process around the design of new content. It also takes a lot of effort to persuade the application analyst. We find that they have very strong opinions of their own. This contradicts what I believe the application analysts should be doing. From my understanding, their task was to build what we, as subject matter experts, wanted. However, due to their strong opinions, it didn't always turn out that way, and it affected the final product. Many times, we experienced arguments with them, and they demanded explanations for why we wanted things a certain way." (Quote 8, R5, SME)

Quote 8 suggests a mismatch between SME needs and how application analysts configure the system. The distributed collaboration, with SMEs and application analysts working separately, causes uncertainty about input translation. The respondent (SME) finds it problematic that application analysts make configuration decisions without the approval of SMEs, as the role of the analysts in the configuration process is understood as instrumental.

Other SMEs expressed concerns regarding a configuration process that relied too heavily on the assessments of the application analysts:

> "We quickly learned that if we made a request and were told it wasn't possible, we couldn't just accept it at face value. We had to investigate why it wasn't possible. It could be for the reasons you mentioned, that towards the end, they were falling behind and didn't have time, so they said it wasn't possible. Or they genuinely couldn't do it. Or they thought it wasn't possible, but it turns out it actually was. So, we've learned not to take a 'no' for a 'no' but to examine whether it's really impossible. And often, we've found that, yes, it is actually possible, but the application analyst may not know how to do it or may not have wanted to ask someone, or feels they don't have the time, and things like that. Or the person simply believed it couldn't be done." (Quote 9, R2, Leading SME)

Respondent 2 notes that SMEs frequently verify, on their own initiative, application analysts' assessments in cases where the SMEs' initial requests were declined. The SMEs cross-check technical documentation themselves to determine feasibility. Reasons for potential inaccuracies include lack of competence, failure to discuss issues, and time constraints.

Reflecting further on the perceived challenges of the collaboration between the SMEs and the application analysts, Respondent 5 stated:

> "I had envisioned a completely different approach to the process. I imagined that as a subject matter expert, I would sit together with my application analyst, whether it was digitally or in person – although I prefer in person

– and go through our desires for how it should look and explore what is possible with the system. If the application analyst couldn't answer, we could bring in people from [the vendor organization] who could tell us whether it was possible or not. This way, we could work through it all. Instead, as subject matter experts, we were asked about things at fairly long-time intervals, and then we entered this information into some Excel sheets. Then, a long time passed (perhaps up to a year) before we were presented with a solution, where someone had created and translated the requirements we had entered in the Excel sheets. Many times, we were dissatisfied with this and had to explain why they had misunderstood us, and it wasn't how we had envisioned it. This way of working made it very hard to keep track." (Quote 10, R5, SME)

Quote 10 indicates the respondent's differing expectations for SMEs and application analysts' collaboration in configuring the system compared to the practical outcome. The SME anticipated closer, synchronous, preferably collocated interaction, contrasting with the asynchronous, infrequent, and indirect interaction that transpired. This mode of collaboration is problematic, hindering effective communication from the SMEs' perspective and making it challenging to track how their needs are understood and implemented by analysts.

Quotes 8–10 shed light on the diverse challenges respondents described regarding the collaboration between SMEs and application analysts. These challenges include conceptual distance, varying expectations for the collaboration, friction in the collaborative process, and a lack of trust. Consequently, SMEs learned not to immediately accept rejections of their requests, as they sometimes found the initially proposed functionality feasible after a thorough investigation (Quote 9). Finally, a significant source of dissatisfaction among respondents was the implicit power of the application analysts, surpassing initial expectations. Instead of solely implementing SMEs' requests, the application analysts were perceived to often assert their own opinions on what should be built.

6.4 User influence

The analysis also identified concerns regarding the respondents' perception of having influence, as domain experts, on the configuration of the EHR system being implemented. Reflecting on this matter, one respondent explained:

"There was a lot that was decided to be included that didn't get included. So, I feel that the role of the subject matter expert was definitely exaggerated. Much of what we wanted and decided to include hasn't been implemented, or it has been built incorrectly, or they haven't communicated functional limitations in [the Foundation system], which prevents us from building in line with the decisions. Instead, they have made approximations without consulting those who made the decisions. It has also been a problem that it has been built the way they want it, but not the way we want it." (Quote 11, R4, Leading SME)

Respondent 4 finds SMEs' influence on the design solution below their expectations. This view is supported by instances where SME input during the design process was inadequately reflected in the emerging solution, either being ignored, misunderstood, or only partially implemented.

The following statement illustrates how some SMEs considered their roles to have changed because of the perceived problem of ensuring their input was effectively incorporated:

"The intended role is to be consultants and explain how we work, describe the daily workflow, procedures, and so forth, so that we can build [the EHR system] accordingly. However, the role has shifted more and more towards a control/testing function because they haven't managed to build what we agreed upon, and the system is full of errors. So, recently, we've spent most of our time testing the system, identifying, and describing errors,

> and how it deviates from expectations and what we've agreed upon, as well as what would be functional." (Quote 12, R2, Leading SME)

Quote 12 illustrates the respondent's view on SMEs' role evolution, from domain experts informing design to primarily assessing system versions. This shift, per the respondent, stems from dissatisfaction with the quality of presented system versions.

The following statement illustrates how some respondents were ambivalent concerning the influence of the SMEs within the configuration process:

> "I can't say that the system with subject matter experts hasn't worked, but they aren't included enough in critical processes, and they don't get a good enough overview of the processes… However, I believe it was important that we had so many subject matter experts with us, but the project's size makes it difficult for individual subject matter experts to feel heard." (Quote 13, R5, SME)

Respondent 5 raises concerns that the SMEs are not adequately integrated into critical processes and lack a comprehensive understanding of these processes, given the challenge of making individual SMEs feel heard due to the project's significant size.

Quotes 11–13 underscore various issues concerning the SME experience, revealing discrepancies between expectations and reality, as well as an evolving perspective on the SME role. Quotes 11-12 illustrate instances where decisions were not implemented correctly, leading to a perception of the SME role as overstated. Quote 12 illustrates a shift towards a control/testing function due to deviations from SME requests. Quote 13 depicts challenges in individual SMEs feeling heard amidst the project's scale.

6.5 User expectations

A recurring theme in several of the quotes presented above concerns the unmet expectations of the respondents. Commenting on the perceived flexibility of the generic EHR system, one of the respondents (Quote 1) stated: "I entered this project believing that [the generic EHR system] was a highly customizable system – that you could do whatever you wanted with it – but that's not true at all…". Another statement implying a letdown of expectations regarding the possibilities offered by the system is reflected in parts of Quote 2: "If I were to say that something is a problem, then relatively small changes can be harder to achieve… There are some things we had expected that have proven to be very difficult to achieve."

Regarding the participatory configuration process, similar statements signaling unfulfilled expectations can be found. For example, part of Quote 4 suggests an unmet expressed need when it comes to the SMEs' basis for making decisions: "When making decisions, I think we have consistently requested to be presented with what the different alternatives are and what the consequences of these alternatives would be, and what leads you towards that decision." In particular, several respondents expressed having different expectations of the collaboration between the SMEs and the application analysts. This included concerns about handover issues as reflected in Quote 10 ("I had envisioned a completely different approach to the process. I imagined that as a subject matter expert, I would sit together with my application analyst… and go through our desires for how it should look and explore what is possible with the system"), but also concerns regarding the SMEs' level of influence on the design solution versus that of the application analysts, as reflected in Quote 8 ("From my understanding, their task was to build what we, as subject matter experts, wanted. However, due to their strong opinions, it didn't always turn out that way, and it affected the final product.")

Similarly, Respondents' statements on their influence on the generated solution suggest a gap between expectations and perceived reality. For instance, in Quote 11 the respondent states: "There was a lot that was decided to be included that didn't get included. So, I feel that the role of the subject matter expert was definitely exaggerated." Quote 12 suggests that perceived change in the role of the SMEs throughout the project also was unanticipated: "The intended role is to be consultants and explain how we work […] so that we can build [the EHR system] accordingly. However, the role has shifted more and more towards a control/testing function because they haven't managed to build what we agreed upon, and the system is full of errors." Table 1 presents a summary of the respondents' unmet expectations both toward the system and toward the configuration process.

Table 1: Identified themes with expectations and experiences.

Themes	Expectation	Experience
System flexibility	The system would be highly customizable	The system was rigid and inflexible, a major problem being that suggested customizations risk affecting other system installations and their users
		The system was relatively flexible. However, some seemingly minor changes can be challenging to achieve if they risk affecting other system installations
Methods of user involvement	SMEs would provide advice on how the system should be configured based on a sufficient understanding of alternative options and the consequences of choices made	SMEs often had an insufficient contextual understanding for making decisions regarding system configuration. This made it challenging to see the consequences of their design choices
	Direct observations of work practices in the clinics would complement the (off-site) configuration work	The configuration work was disconnected from clinical practice. The client project organization was not sufficiently present in the clinics to achieve a sufficient understanding of their work practices
Organization of user involvement, decision-making	SMEs would be closely involved in decisions concerning the system configuration	Decision-making in the configuration process has occasionally been dominated by a few individuals in higher positions (i.e., leading SMEs). Decision-making has also suffered from insufficient transparency
Organization of user involvement, SME–application analyst interaction	SMEs and application analysts would sit together (same time, same place) when configuring the system	The interactions between the SMEs and the application analysts were often asynchronous and distributed in nature (different time, different place)
	Application analysts would configure according to the specified needs and preferences of the SMEs	The deliverables of the application analyst were frequently not in line with the specifications of the SMEs. Application analysts would sometimes make decisions on their own and, occasionally, misinform the SMEs about the technical possibilities of the Foundation system
User influence	The SMEs would act as domain experts throughout the configuration process providing input about their work practices and procedures	The role of the SMEs gradually transitioned from domain experts into that of functional testers due to the frequent and substantial disparities between the SMEs' specifications and the system configurations made by the application analysts
	SMEs would have a strong influence on the configuration of the system	The involvement of numerous SMEs made it challenging for individual voices to be heard and their input considered

7 DISCUSSION

7.1 Assessing user participation in the configuration process

Having described the respondents' experiences from their participation in the EHR system configuration process, we will now discuss how the reported concerns can be understood in light of the conceptualization of participation in relevant literature. To elucidate this, we will employ the previously described framework of Bratteteig and Wagner [3], specifically

addressing the framework's three guiding questions: (1) What shaped participation, (2) what did the participating users participate in, and (3) how participatory was the result? The purpose of contextualizing the reported concerns within a broader theoretical framework is to provide a deeper understanding of these concerns and their implications.

7.1.1 What shaped participation?

In Bratteteig and Wagner's [3] framework, the three dimensions that influence what shapes participation are (as previously stated in Section 3.1): *context, power and influence*, and *decision linkages*.

In terms of how the project's *context* shaped user participation, the size of the project, and especially the high number of SMEs involved in the configuration process appeared to affect the respondents' perception of personal influence. For example, some respondents (cf. Quote 6) pointed to the problem of having a say, as an individual SME, in a process involving a considerable number of stakeholders playing a similar role. As such, the project's size also affected power and influence (further discussed below), as perceived by respondents. Moreover, the project's size and number of SMEs involved can also be seen as a reason why the responsibility for technical configuration of the system was delegated to trained application analysts. This division of responsibility also affected participation in the project, as seen from the perspective of respondents (cf. Quotes 8-10).

Regarding *power and influence*, the project's decision structure formed the foundation for the formal hierarchy and protocols for decision-making within the project. As previously mentioned, the SMEs constituted the initial tier of this structure, intending to grant them substantial influence over the configuration of the EHR system, since most decisions were supposed to be made at this level. However, the findings showed that several respondents expressed a perceived lack of influence over the emerging solution. Some (cf. Quote 1) attributed this to the inflexibility inherent in the EHR system. Others (cf. Quotes 6–10) highlighted the organization of user involvement and, especially, the arrangement with application analysts as the 'implementers' of SME decisions, as a central issue in this regard. While respondents presented varying perspectives on the role and work of application analysts, there was a shared concern that this arrangement compromised the power and influence of the SMEs vis-à-vis the application analysts. SMEs viewed the decline in their influence on the solution as problematic, fearing it would lower its quality.

Considering *decision linkages*, which refer to how participants' choices were influenced by previous decisions, it is important to note that the SMEs were not taking part in a process where a solution was designed from scratch. Instead, they were involved in a process where the basis of the system (the Foundation system) had already been established. Thus, the Foundation system, upon which specific configurations could be built, can be considered an embodiment of numerous design decisions made prior to the configuration process and the EHR project. These decisions embedded in the Foundation system impacted to various extents the choices of the SMEs, often limiting their possibilities (cf. Quote 1-2). As described earlier, our findings suggest that respondents found it problematic to acknowledge and accept the implicit restrictions that the design decisions related to the Foundation system imposed on their choices (cf. Quote 1).

7.1.2 What did the users participate in?

Regarding the question of what the users participated in (i.e., *creating, selecting among, concretizing,* or *seeing/evaluating choices* (Bratteteig and Wagner, [3])), the engagement of the SMEs mainly revolved around *selecting among choices*. The SMEs were typically presented with preconfigured options to select from during project meetings (cf. Quote 4). These options (configurations) had been made a priori to the participatory meetings, often reflecting configurations implemented at other installation sites (i.e., other hospitals). Attempts made by the SME to *create choices*, for example, to tailor solutions

beyond what the options allowed for, were generally perceived as highly time-consuming and challenging to achieve (cf. Quote 2).

While the SMEs were given the possibility to explain their needs and requirements in greater detail during project meetings, the concretization of choices in the project (i.e., translating the needs and requirements into concrete configurations) was largely left to application analysts. Several of the presented quotes (e.g., Quote 8) illustrate the dissatisfaction among SMEs of not being given the possibility to take a more active part in this concretization, by working closer with the application analysts. This dissatisfaction mainly presented itself when SMEs later were given the possibility to *see/evaluate decision choices* (the implemented configurations made by the application analysts) and found that the configured solutions did not sufficiently meet their expectations. The problem that the SMEs associated with not playing a more active role in the concretization of design choices resulted in some SMEs taking steps to increase their influence on the emerging solution. One way this manifested was through the SMEs searching on their own in the technical documentation, to examine if their declined suggestions nevertheless were technically feasible, thus bypassing the original structure of participation in the project (cf. Quote 9).

Considering what the users participated in, one plausible explanation for the expectation gap, then, is that their participation was largely limited to one (i.e., *selecting among choices*) out of four activities described in Bratteteig and Wagner's [3]. Their limited involvement, both in *concretizing the design choices* and in *seeing/evaluating choices*, severely restricted the possibilities for providing guidance and feedback during the configuration process.

7.1.3 How participatory was the result?

The final dimension within Bratteteig and Wagner's [3] framework of participation delves into assessing whether the outcome derived from the project truly embodies a participatory nature. As previously discussed, a key criterion for users to acknowledge a design solution as participatory hinges on their ability to identify and perceive their contributions within the resultant solution. Yet, insights gleaned from the collected interview data indicate a concerning trend: a notable number of respondents experienced difficulties in establishing this crucial connection. Their struggle to discern their input within the generated solution suggests a perceptible diminishment of this linkage between their involvement and the final outcome (cf. Quote 11).

7.2 Open questions

Considering the key findings through the lens of Bratteteig and Wagner's [3] framework sheds light on a variety of aspects of the project that may hinder the influence of participating users. Several of the challenges pertaining to the project's context, power and influence, and decision linkages are scale-related and bear resemblance to findings described in related work (e.g., [7, 28, 39]).

However, there are still questions that remain unanswered after the above assessment. For example, neither the collected empirical data (i.e., statements from the respondents) nor the applied framework sheds light on aspects that shaped the SMEs' initial expectations toward the system and the configuration process. The Unified Theory of Acceptance and Use of Technology (UTAUT) [38] points to several factors that might relevant in this regard, including performance expectancy, effort expectancy, and social influence. However, we do not know the extent to which these or other factors played an influential role. The conducted interviews, however, suggest that the respondents were initially highly motivated for a participatory configuration process. Similar findings concerning initially highly motivated participants are also reported in [39, 41]. In many ways, the interviews also indicate that the respondents were expecting the configuration

process to be characterized by genuine participation and a high degree of user influence, much akin to what is considered best practice within the PD tradition.

One interesting question arising from the above is whether respondents would have expressed a more favorable view of the configuration process and been less critical regarding their ability to influence the result if they had more realistic expectations from the outset. Applying the same notion to participatory and user-centered design processes in general, it is reasonable to ask if participants' satisfaction (or dissatisfaction) with such processes is closely connected to their initial understanding of their potential impact and the transparency of the decision-making mechanisms involved. From this perspective, dissatisfaction may not necessarily be related to a lack of power to influence per se but rather to the perception of empowerment that turns out to be illusory or inflated. While raising users' initial expectations regarding new technology may be considered beneficial in arousing their interest and enthusiasm [18], such measures may be counterproductive if the methods by which the technology is designed or implemented do not align.

7.3 Lessons learned

Drawing on the case study respondents' unmet expectations toward the system and the configuration process and the above assessment, three main lessons and corresponding suggestions can be obtained. We consider these to be of particular relevance to the planning of processes in which users will participate in the configuration of large-scale generic IT systems:

1) **Differences in Configuration vs. Design**: Users participating in configuring large-scale generic IT systems face unique challenges compared to designing systems from scratch, particularly due to pre-existing constraints. These constraints can lead to misunderstandings and inflated expectations about their ability to customize the system to their needs. To mitigate these challenges, clear communication about the system's limitations and what aspects users can and cannot modify should be provided early in the process to avoid inflated expectations.
2) **Managing Expectations**: Participating users have expectations about the system's flexibility and their role in the configuration process. Unmet expectations can reduce their satisfaction and sense of influence. Setting realistic expectations from the start is crucial to prevent dissatisfaction and perceived participatory tokenism. This is not to say that users should not be encouraged to contribute their ideas and preferences, but rather that clarifying the boundaries of system tailorability, and what the users will participate in, is essential for fostering realistic expectations and ensuring meaningful user participation. To address this, project planners should emphasize transparency about the scope of user influence and manage expectations through consistent and open communication about the level of customization available.
3) **Adaptive Process**: A successful configuration process requires flexibility, addressing and adapting to participating users' concerns and feedback regularly. Without this adaptability, user discontent may grow, highlighting the importance of feedback in shaping the process. In this regard, participating users may be considered a valuable source not only in the configuration of the generic system but also in forming the associated process. This flexibility and adaptiveness need to be planned for. To help overcome this challenge, an iterative and responsive approach could be integrated into the configuration process, ensuring user feedback is continuously gathered and used to shape both the system and the process itself.

The above lessons highlight that although the motivation for involving users in the configuration of large-scale generic IT systems may be well-intended – aiming to increase system usability and user acceptance – the foundations for user influence are largely established prior to the commencement of the configuration process.

7.4 Limitations

The study presented in this paper was conducted using a qualitative interpretive approach. As with all qualitative interpretive research, the results need to be considered in light of relevant methodological aspects.

First, the focus of this study has been on exploring the subjective perspectives of respondents, reflecting diverse interpretations and experiences rather than objective realities. It is important to note that interviews with application analysts were not conducted. Although some SMEs criticized the application analysts' work (e.g., Quotes 8-10), we lack insight into how application analysts perceived their interaction with SMEs and their specifications.

Second, the reported experiences and concerns reflect only those of the respondents. While the respondents to a large degree raised similar concerns, thus adding to the credibility of the results, we do not know the extent to which they also represent the perspectives of others with similar roles as the study's respondents. This limitation highlights the need for caution when generalizing the results, as different SMEs may have diverse experiences and concerns that could significantly influence the understanding of the configuration process.

Third, an interpretive approach is prone to interpreter bias. Researchers may validate anticipated themes or overlook alternative interpretations of transcript excerpts. To mitigate this bias, the coding process was iterative and subject to constant reassessment. While the initial coding was done by the first author, subsequent iterations and discussions involved multiple authors (cf. Sect. 5.3). The themes identified in Sect. 6 are our interpretation of the data collected. This does not preclude other interpretations and themes.

Fourth and last, while the unmet expectations of the participating users emerged as a common theme, we have not investigated what shaped their initial expectations toward the EHR system and the configuration process.

8 SUMMARY AND CONCLUDING REMARKS

The current study investigated how users participating in the configuration of a large-scale generic IT system experienced the associated process, their participation, and their influence on the result. The empirical basis for this investigation was an embedded case study of healthcare personnel participating in the configuration of a large-scale EHR system in Central Norway. The results highlight how the respondents' initial expectations – toward both the system and the configuration process – shaped their assessment of the process, their participation, and personal influence. To increase the likelihood of a positive outcome in this regard, we recommend that in the planning of participatory configuration processes, particular attention is given to the challenges specific to configuration versus design, understanding and managing user expectations, and the integration of users' feedback through an adaptive process.

We hope that the insights from the current study can benefit future projects and inspire further research on the topic of user participation in the configuration of large-scale generic IT systems.

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