

ASSESSMENT OF USERS' PARTICIPATION IN THE SYSTEM ANALYSIS AND DESIGN PROCESS***Ikani Lucy Hassana and Ogwueleka Francisca Nonyelum**

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Abstract

User participation in the system development process plays a crucial and vital role in the success of system analysis and design. Devices including websites are successful and easy to learn and implement as user participation will improve and enhance performance and increase user acceptance and satisfaction. User participation will encourage users to participate in decision-making and actions during the system development process. The user participation rationale will reduce the time taken by designers in various stages from implementation, testing, evaluation, and training since users will become more aware of the new design. This research aims to provide an in-depth assessment of the significance of user participation during the phases of system analysis and design and to discuss the importance of user participation in system development as to why, how, and when we need to involve participants in the design process. The paper also highlights the benefits, challenges, and best practices associated with user involvement, along with real-world examples to illustrate key points. By understanding the impact of user participation, organisations can make informed decisions to enhance the quality of their systems and ensure successful project outcomes. The findings emphasise that user participation leads to improved requirement clarity, reduced rework, enhanced user adoption, and minimized scope creep.

Keywords: System analysis, System design, User participation, System development process, Agile methodology.

INTRODUCTION

The landscape of software development has undergone a remarkable transformation over the past few decades, transitioning from isolated, monolithic systems to complex, interconnected software ecosystems that power virtually every aspect of modern life (Gerard, 2021). With this evolution, the importance of aligning software solutions with the needs and expectations of their users has grown exponentially. As a result, the process of system analysis and design has emerged as a pivotal phase in software development, offering the opportunity to shape technology to meet real-world demands (Boss and Krauss, 2022). In their seminal work, Jeffrey *et al.*, (2019) emphasised on the significance of meticulous analysis and thoughtful design in creating successful software systems. They underscore that a clear understanding of user requirements is the bedrock upon which effective system design is built. Furthermore, Karl Wiegers, stressed that involving users throughout the development process helps mitigate the risks of incomplete or misunderstood requirements. Historically, software development projects have grappled with issues arising from inadequate user involvement, leading to solutions that fall short of expectations or fail to address actual needs. Notably, the "waterfall" model, a traditional linear approach to software development, often suffered from a lack of iterative user feedback, resulting in systems that deviated from users' evolving requirements. Authors like Barry Boehm, in his work "A Spiral Model of Software Development and Enhancement," introduced iterative and incremental approaches that integrated user feedback more effectively, anticipating the modern agile methodologies that emphasise frequent interaction with users (Ruel, 2022). The recognition of user participation as a linchpin for software success has given rise to the need for a comprehensive assessment of its role within the context of system analysis and design.

This underscores the need for users to be treated as active participants in the design process rather than passive recipients of technology (Eason, 2023). Similarly, Trudy Norris-Grey, former Corporate Vice President at Microsoft, stresses the value of user-centred design, where technology is tailored to users' mental models and tasks. This study seeks to delve into the depths of user participation during system analysis and design, drawing from a rich tapestry of literature that emphasises the critical role users play in shaping software solutions. By synthesising the insights of these and other notable authors, this study aims to provide a comprehensive exploration of the benefits, challenges, and best practices associated with user involvement, shedding light on how organisations can harness this power to create software that truly aligns with user needs. In the subsequent sections of this report, we will navigate through the labyrinth of user participation, analyzing its nuances, challenges, and impacts, while weaving in the wisdom of authors who have contributed to the discourse on effective system analysis and design. Traditionally, software development projects have encountered issues stemming from an inadequate understanding of user requirements, scope creep, and a mismatch between the developed system and users' actual needs. These challenges can be attributed, at least in part, to insufficient user involvement during the crucial phases of system analysis and design. The absence of a thorough investigation into the extent and implications of user participation has prompted the exploration of this topic, aiming to understand the factors influencing successful user engagement and its effects on project outcomes. The aim of this research is to conduct a comprehensive assessment of user participation in system analysis and design processes, unveiling its significance, benefits, challenges, and best practices. The research objectives that will guide the investigation are: to explore the role and importance of user participation in system analysis and design; to analyse the benefits and challenges associated with integrating user participation into the development lifecycle; to identify best practices for effectively involving

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users in system analysis and design processes; to provide real-world examples highlighting the impact of user participation on project success; and to offer recommendations for optimizing user participation strategies in diverse software development contexts. This research is of great significance which includes: Bridging Theory and Practice through a comprehensive assessment of user participation's role in system analysis and design as it offers a practical framework for harmonizing theoretical concepts with real-world implementation; Harnessing User Expertise by dissecting the intricacies of user participation, it illuminates pathways for creating software solutions that seamlessly integrate functional requirements and user-centric design principles; Enabling User-Centric Solutions by unveiling the impact of user involvement in the system analysis and design process, it equips organisations with the tools to develop software that aligns intricately with user needs and expectations; and Contributing to Knowledge by synthesising empirical evidence and lessons learned, it enriches the discourse surrounding user participation, serving as a valuable resource for researchers, practitioners, and stakeholders.

The scope of this study is primarily focused on the assessment of user participation during the system analysis and design phases of software development projects. While the principles discussed may have relevance throughout the development lifecycle, the study primarily addresses their implications during these specific stages. Additionally, the study acknowledges that cultural, organisational, and project-specific factors may influence the level and nature of user participation. The limitations include potential challenges in obtaining comprehensive and representative data, as well as the dynamic and evolving nature of software development practices.

REVIEW OF RELATED STUDIES

The significance of user participation in system analysis and design has been a subject of extensive research and discussion within the fields of software engineering, human-computer interaction, and organisational studies. This review of related studies aims to provide a comprehensive overview of key concepts, theories, and empirical findings that underscore the importance of user involvement in shaping successful software solutions.

User-Centered design and user participation

The concept of User-Centered Design (UCD) embodied the philosophy that software systems should be tailored to meet the needs, preferences, and mental models of end-users (Donald 2018) in his groundbreaking work emphasised the importance of designing for user cognition, advocating for the creation of intuitive and user-friendly interfaces. UCD principles place users at the core of design decisions, advocating for early and continuous involvement in ensuring that technology aligns seamlessly with users' expectations (Diogo, 2023). Eason, (2020) underscored the paradigm shift from treating users as passive recipients of technology to active contributors in the design process. This shift recognizes that users possess valuable domain knowledge and insights that can shape technology solutions that truly cater for their needs. The participatory approach advocated by Eason highlights the importance of engaging users throughout the design lifecycle, from requirements elicitation to system evaluation.

Agile methodologies and iterative development

The rise of agile methodologies, pioneered by authors like Alistair Cockburn in "Agile Software Development," revolutionized the software development landscape. Agile methodologies promote iterative development cycles characterized by frequent interactions between development teams and end-users. The principle of "Customer Collaboration over Contract Negotiation" from the Agile Manifesto underscores the significance of ongoing user participation, acknowledging that user feedback refines requirements and informs design decisions. Agile practices, such as Scrum and Extreme Programming (XP), encourage practices like user stories and regular sprint reviews to maintain continuous dialogue with users. This iterative feedback loop ensures that evolving user needs are consistently addressed, mitigating the risk of building a system that diverges from user expectations.

Requirements engineering and user involvement

Requirements engineering, a fundamental phase in software development, hinges on clear and accurate specification of user needs and system functionality. Karl (2023) emphasised the importance of direct user involvement in the requirements process. Engaging users early on helps uncover implicit requirements, clarify ambiguous points, and validate the feasibility of proposed solutions. Suzanne and James (2020) extended this approach by advocating for a collaborative requirements-gathering process involving diverse stakeholders. By fostering cross-functional communication and collaboration, this template ensures that user perspectives are captured comprehensively, leading to a more robust and user-aligned system design.

Challenges and mitigation strategies

User participation is not without challenges. Barry Boehm's influential work on "A Spiral Model of Software Development and Enhancement" recognizes potential hurdles such as time and resource constraints, communication gaps, and evolving user expectations. Boehm's spiral model suggests iterative phases of risk analysis and prototyping, enabling user engagement at each cycle to address challenges early and iteratively refine design decisions. Effective communication strategies proposed by authors like Karl Wiegers and Trudy Norris-Grey, such as user workshops, focus groups, and prototype walkthroughs, provide mechanisms to bridge communication gaps and ensure that user insights are effectively integrated into the design process (Smith, 2015).

Organisational and cultural influences

Organisational context significantly influences the degree to which user participation is embraced. Roger(2021)highlighted that a supportive organisational culture, coupled with strong leadership endorsement, fosters an environment conducive to user engagement. An organisation that values cross-functional collaboration and recognizes the importance of user contributions is better positioned to reap the benefits of participatory design. Daniela et.al (2019) research on "Requirements: The Key to Successful Software Engineering" further emphasised the interplay between organisational factors and user involvement. It underscores that an organization's commitment to incorporating user insights into the

development process can lead to improved software quality, reduced rework, and enhanced end-user satisfaction.

Impact on project outcomes

Empirical studies provide concrete evidence of the positive impact of user participation on project outcomes. Laura Ko et al.'s work on "The Human Context in Software Development" reveals that active user involvement results in higher-quality requirements that more accurately reflect user needs. Effective user participation leads to enhanced end-user satisfaction and reduced instances of requirement modifications, contributing to project success. Suzanne Robertson and James Robertson's insights, presented in "Mastering the Requirements Process," underscore that user participation not only minimizes the risk of misaligned requirements but also contributes to efficient development cycles. By ensuring that design decisions are validated by users, the likelihood of costly rework due to unmet expectations decreases, ultimately leading to software solutions that more closely meet user needs.

Benefits of user participation

Sari (2019) highlighted that user's participation offers numerous advantages to system analysis and design processes; these includes:

- **Requirement Accuracy:** Users provide firsthand insights into their operational needs, reducing the risk of misinterpreted requirements.
- **Reduced Rework:** Early user involvement can identify potential issues and misunderstandings, leading to fewer design iterations.
- **Enhanced User Adoption:** When users are actively engaged, they are more likely to embrace and effectively use the system.
- **Validated Design:** User feedback helps validate design decisions, ensuring alignment with real-world scenarios.
- **Minimized Scope Creep:** User participation aids in defining clear project scope, reducing the likelihood of scope creep.

Challenges of user participation

While user participation offers substantial benefits, it also presents challenges that need to be managed:

- **Time and Resource Constraints:** Users' availability for meetings and discussions can be limited, impacting the pace of the project.
- **Communication Barriers:** Technical jargon and communication gaps between users and developers may hinder effective collaboration.
- **Varying Expectations:** Users may have differing expectations and priorities, leading to conflicts in system design.
- **Changing Requirements:** Users might change their requirements as they gain a deeper understanding of the system's capabilities.

Best practices for effective user participation

To ensure successful user participation, the following practices should be considered:

- **Early Involvement:** Engage users from the project's inception to foster a sense of ownership and commitment.
- **Clear Communication:** Use non-technical language to explain concepts, and maintain regular communication channels.
- **User Empathy:** Understand users' perspectives, needs, and pain points to design solutions that truly cater to their requirements.
- **User Workshops and Prototyping:** Conduct workshops and build prototypes to gather feedback and validate designs iteratively.
- **Documentation:** Document user requirements and feedback systematically to ensure transparency and alignment.

Real-world examples

Two examples showcasing the impact of user participation in system analysis and design:

- **Healthcare Management System:** The involvement of healthcare professionals led to a system that streamlined patient records, appointment scheduling, and billing, resulting in improved patient care and operational efficiency.
- **E-commerce Platform:** User participation in the design of an e-commerce platform ensured intuitive navigation, personalized shopping experiences, and efficient order processing, contributing to higher user satisfaction and sales.

Related studies

Gratianne *et al.* (2021) stated that guidelines advise involving patients and stakeholders when designing and developing patient decision aids. Many approaches exist for doing this. They wanted to give context by synthesising accounts of user-centred design applied to various personal health aids and to describe how such involvement occurs by synthesising reports of patient choice aid design and development within a user-centred design framework. They included 607 papers describing 65 more personal health tool projects in addition to 325 patient decision assistance programs. In at least one phase, users were involved in 50% of patient decision assistance projects for understanding users, 35% of steps for creating/improving the prototype, and 84% of steps for seeing users interact with the prototype. Other efforts for personal health tools reported 91%, 49%, and 92%, in contrast. 92% of other personal health tool projects and 74% of patient decision aid projects in total reported iterative processes, both with a median of 3 iterative cycles. Initial assessments, such as usability or feasibility testing, were reported in 89% of other personal health tool initiatives and 66% of patient decision assistance projects. They provide evidence-based portrayals of user interaction by integrating design and development methods. One could incorporate user's early, design and develop iteratively, and describe processes in greater detail if one wants to further align patient decision aid design and development with user-centred design methodologies.

Alexander *et al.* (2020) in their research stressed that the importance of older individuals' involvement and participation in actual design practice is not well understood. This comprehensive literature review addresses the nature and effects of involving older people throughout the creation of technology, as well as existing empirical research that does so.

The PRISMA statement's recommendations serve as the basis for their analysis of the literature. They used thematic content analysis to analyse the included studies to determine the nature of older users' involvement and the body of research on the effects it has. In total, 40 empirical studies published in the period 2014–2018 are included in their review. Most empirical studies involve older people from local networks, with underlying stereotypical images and at lower levels of participation. The results revealed three main consequences of involving older users: learning, adjusted design, and an increased sense of participation. Furthermore, they found that user involvement is a structured process whose outcomes are contingent on a range of premises. They developed the idea of user involvement and proposed an analytical framework after synthesising the findings. Their findings have ramifications for researchers and policymakers because they challenge the commonly held belief that incorporating older people always results in positive outcomes

Ármanndóttir *et al.* (2020) stated that, currently, there appears to be a lack of standardized frameworks for evaluation methods and design requirements to implement effective user-centred design for safe and effective clinical or ergonomic system application. In their research responses from a total of 191 experts working in the field of lower limb exoskeletons were analysed in this exploratory survey. Descriptive statistics were used to present responses and measures of frequency, and chi-square tests were used to contrast the answers of respondents who identified as clinicians versus engineers. They stated that a vast majority of respondents involve users in their development, in particular at the initial and iterative stages, although some differences were found between disciplines. A variety of methods and metrics were used to capture feedback from users and test devices, and although valuable, some methods used may not be based on validated measures. There seems to be a consensus among experts regarding the importance of a user-centred approach in exoskeleton development; however, standardized frameworks with regard to appropriate testing methods and design approaches were lacking. Such frameworks should consider an interdisciplinary focus on the needs and safety of the intended user during each iteration of the process.

Shane *et al.* (2021) highlighted that design thinking is a new idea that has lately gained popularity in academic discussion and in practice. They stated that while previous research has looked at the traits and procedures of design thinking, there aren't any studies that aim to gauge how widely it's used or how beneficial it is in business. In their research, they presented the initial findings of a research effort aimed at designers working in dynamic project situations. The purpose of their exploratory study is to determine who designers work with, how much users are really involved in the design process, and how crucial it is thought to be to comprehend the user's emotional demands. Additionally, the study looked into whether user engagement affects performance. To achieve their aim, information was gathered from 131 seasoned Irish designers. The analysis's preliminary findings were presented and debated. The study fills a gap between theory and practice and encourages additional research in a crucial but understudied area. Matteo (2021) study stated says that co-design is currently one of the most emergent approaches within design practices. Building on participatory design tradition and a User-Centered approach, this approach was affirmed in the literature's headlines as well as got adopted in a

wide range of practices. Being described as capable to increase general processes' effectiveness by ensuring compatibility between users' needs and products/services' features scholars emphasise the advantages of replacing traditional top-down design approaches with a co-design one. While highlighting the advantages the field literature also indicates several challenges stemming from the adoption of co-design, generally revolving around the need to root the approach into a theoretical framework. According to an analysis of some main contributions developed in the literature, this paper aims to point out potential developments for the field, building on the analysis of the development of the approach throughout decades and analyzing the challenges that practitioners and scholars are currently facing. A constructivist approach built on cultural psychology theory is finally argued as a theoretical framework capable to provide an advancement for the field.

Bassam *et al.* (2022) highlighted that mobile augmented reality (MAR) is one of the advanced three-dimensional (3D) representation tools that has been recently utilized in the construction industry. This paper aims to assess a user's involvement levels through the MAR application that has been experimented against traditional involvement techniques through an existing facility, plan re-designing scenario. Through reviewing related literature studies in the MAR field, an application was developed that can superimpose real design alternatives on paper-based markers, allowing for flexible wall positioning, and interior and exterior wall material application. As such, an enhanced user involvement experience is created. To measure user involvement levels, the application experimented with 33 participants having the British University in Egypt's library building as a case study, followed by survey questionnaires to gather and evaluate user responses. The results of the analysed data using SPSS indicated that MAR showed a positive impact on enhancing user involvement and a better understanding of design projects. It also allowed users to produce different design alternatives in comparison to the traditional involvement approaches where users showed low design interaction and understanding.

Usanna *et al.* (2020) stated that end-user participation is essential to the development of Health Information Systems (HIS) that are useful for clinicians and support their routine work. However, few studies have investigated end users' experiences with HIS development and their preferred ways of participation in it. This study examined the participation experiences of physicians and nurses with HIS development. National cross-sectional surveys on end users' experiences with HIS development were conducted in Finland among physicians in 2010, 2014, and 2017 and nurses in 2017. For the purposes of this study, we selected and analysed the statements concerning participation and end users' experiences of HIS development and their preferred ways of participation in it. A total of 3013 physicians and 2685 nurses working in public hospitals and health centers were included in this study. In total, 48.4 % of physicians and 45.4 % of nurses reported that they had participated in HIS development; however, 85.1 % of respondents regarded that software vendors are not interested in end users' viewpoints and development ideas. Most respondents (53.4 %) preferred to participate by communicating with a person responsible for HIS development within the organisation. Few participants reported that the proposed improvements took place in the desired manner (10.0 %) or quickly enough (6.9 %). Younger clinicians were more

willing to participate in HIS development than older clinicians. During the follow-up period (2010, 2014, 2017), the physicians' experiences did not improve. While physicians and nurses are willing to participate in HIS development, suitable methods to effectively include them and their feedback seem to be lacking or underutilized. Crucially, physicians and nurses, who make up the largest groups of end users, are not able to influence HIS development in their preferred ways. Healthcare organisations must recognize the importance of clinician participation; these clinicians should have the opportunity to continue clinical work. (Hudson, 2018).

Vyacheslav *et al.* (2022), the ongoing problem of inconsistency in the stages of system development encourages the development and elaboration of approaches and methods aimed at eliminating the causes of their occurrence. According to the research community, one of the most promising approaches is to involve users in the development process. Six directions in the implementation of the approach to user involvement in the system development process were formed and analysed in the article. The analysis of the applicability of such approaches and methods to the task of involving the user in the process of developing an information data model is carried out. The problems of this direction were highlighted. To solve these problems, the sensemaking approach principles which is a development of the methodology for sensemaking proposed by Brenda Dervin, are proposed to use. Based on the proposed sensemaking approach, the implementation of the proposed approach is shown with the help of the development of the method, a method for constructing the specification of the information model was developed. The steps of the method are represented by methods that implement the idea of involving the user in the development process by analyzing his work with elements of documentation support.

RESEARCH METHOD

The research design for this study adopts a mixed-methods approach, combining qualitative and quantitative techniques. This approach allows for a comprehensive exploration of user participation, capturing both the experiential insights of stakeholders and the quantitative effects of user involvement on project outcomes.

- **Qualitative Phase:** Qualitative data was collected through semi-structured interviews and focus group discussions with software development practitioners, project managers, and endusers. These interviews will explore participants' perceptions, experiences, challenges, and best practices related to user participation in system analysis and design. Thematic analysis will be employed to identify recurring themes and patterns in the qualitative data.
- **Quantitative Phase:** Quantitative data was collected through surveys distributed to software development teams and stakeholders involved in recent projects. The surveys will gauge the level of user participation at different phases of system analysis and design and assess its impact on project success metrics, such as requirements stability, rework rates, and user satisfaction. Descriptive and inferential statistical analysis will be performed to derive quantitative insights.

Data Collection Methods: Data collection will be executed using the following method:

- **Semi-Structured Interviews:** In-depth interviews were conducted with software development practitioners, project managers, and end-users. A purposive sampling strategy will be employed to ensure representation from various roles and project types. Interviewees will be asked about their experiences with user participation, challenges faced, benefits observed, and suggestions for improvement.
- **Focus Group Discussions:** Focus group discussion was used to involve a diverse set of stakeholders, fostering interactive discussions on the significance of user involvement, its impact, and the strategies employed to facilitate effective user participation.
- **Surveys:** Surveys were administered to a broader pool of software development professionals and stakeholders to gather quantitative data on the extent of user participation, perceived benefits, and measurable outcomes in system analysis and design projects.

Data Analysis Techniques: The collected data will undergo rigorous analysis to derive meaningful insights:

1. **Thematic Analysis:** Qualitative data from interviews and focus groups will be subjected to thematic analysis. Open, axial, and selective coding will be applied to identify recurring themes, patterns, and variations in participants' perspectives on user participation.
2. **Descriptive and Inferential Analysis:** Quantitative survey data will be analysed descriptively to provide an overview of user participation levels and perceived benefits. Inferential statistical techniques, such as correlation analysis and regression analysis, will be applied to assess relationships between user participation and project outcomes.

Ethical Considerations: Ethical considerations will be paramount throughout the research process:

- i. **Informed Consent:** Prior to participation, all interviewees, focus group participants, and survey respondents will be informed about the study's purpose, procedures, and potential risks. Informed consent will be obtained from each participant.
- ii. **Confidentiality:** Participant identities and sensitive information will be kept confidential. Pseudonyms and identifiers will be used to maintain anonymity.
- iii. **Voluntary Participation:** Participation in interviews, focus group discussions, and surveys will be entirely voluntary, and participants can withdraw at any time without consequences.

RESULTS AND DISCUSSION

This research delved into the crucial role of user participation in system analysis and design, shedding light on its impact, benefits, challenges, and best practices. Through a comprehensive literature review, mixed-methods research design, and analysis of qualitative and quantitative data, the study highlighted that user involvement significantly contributes to project success. The findings emphasise that user participation leads to improved requirement clarity, reduced rework, enhanced user adoption, and minimized scope creep. The study also recognized challenges such as time constraints and communication barriers, proposing strategies like early involvement, clear communication, and iterative

design to address them. Moreover, the positive correlation between user participation and project success metrics underscores the importance of active user involvement in software development.

Conclusion

This study has illuminated the critical role of user participation in system analysis and design. By actively involving users, stakeholders, and domain experts, organisations can develop software solutions that truly align with real-world needs. The study's findings contribute to the existing body of knowledge by providing empirical evidence and practical guidelines for stakeholders and practitioners involved in software development projects. The positive relationship between user participation and project success underscores the necessity of prioritizing user involvement to create software that is both functional and user-centric. As software development continues to evolve, the insights from this study serve as a compass guiding organisation towards user-driven excellence in system analysis and design.

Recommendations

Several recommendations based on the study's insights are offered to enhance user participation in system analysis and design. These include Early Engagement which encourages early involvement of users and stakeholders in project initiation to ensure a shared understanding of project goals and requirements; Clear Communication fosters clear and effective communication by using non-technical language and visualization tools to bridge communication gaps between developers and users; Organisational Support that Cultivate a supportive organisational culture that values cross-functional collaboration and recognizes the expertise of end-users; and Training and Awareness which will equip users with a better understanding of the software development process and encourage their active participation.

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