

User Involvement Quality Model for Software Development Management

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Abstract — nowadays with the prosperity of the software industry and its spread around the world and the users' dependence on software in various matters of life, it has become imperative to ensure that the user's needs are met and to achieve business value in order to ensure the continuity of the software's use and minimizing the user's resistance to it. The effect of user involvement during the software development cycle using different development methodologies (Traditional Methodology, Agile Methodology) plays an important role in the success of software development & Implementation projects, as it is considered a major process in building software as well as the nature of the project, whether it is built as a product or provided as a service. In this paper we will work on providing new user involvement quality model by exploring activities and attributes which have impacted on user involvement during software development process and specifying quality characteristics, relation and associated metrics for user involvement in Software Development Life Cycle whether it is developed as a product or offered as a service, as well as determine how to measure those characteristics to ensure high quality in user Involvement. And will demonstrate that the quality model provide best practice to ensure high quality user Involvement.

Keywords — *User Involvement; Quality Metrics; Software as a Products; Software Development Management; Quality Model; Success Implementation, User Resistance.*

I. INTRODUCTION

The volume of work and effort expended in software development projects is costly for all parties. Therefore, this effort must meet the user's needs and fulfill their aspirations. Otherwise, what is the benefit from that? The software project managers sometimes focus on completing the required tasks and delivering the project. As a result of increasing competitiveness in the business world, it was necessary to focus on the quality of the business and ensure the success of the project implementation with the highest quality. This showed the need for project managers to know the factors that affect the quality of the project and to determine how to measure those factors and at what stage they can be dealt with.

For more than four decades, it has been widely accepted that user involvement (UI) during software system development is

essential and that it contributes to system success. [1] Merely involving the users in software development won't guarantee system success. User involvement is a complex, multifaceted phenomenon with a good side, a bad side, and an ugly side. [2] Yet user engagement (UE) is an abstract construct that manifests differently within different computer-mediated contexts, and this has made it challenging to define, design for, and evaluate. [3] The effect of user involvement during the software development cycle with different methodologies plays an important role in the success of software development projects, as it is considered a major process in building software or the nature of the project, whether it is a product or service. A better, deeper understanding of those sides can help project managers develop responsive strategies for increasing user involvement's effectiveness. [2]

The importance of user orientation in innovation activities is emphasized in business filed as well as in political and societal discussions. In today's dynamic and changing business conditions, technologies derived from the customer's needs are an efficient way to support market success. If users involve into the system development cycle, they can give more information details. [4]

II. RELATED WORK

There are many researches published focused on studying user involvement in the stages of software development. With the development of methodologies used in software development projects, researchers have studied the role of the user in the success of project implementation in an attempt to identify the patterns of users and their impact on the success of implementing projects.

M. A. Akbar et al [5] propose AZ-Model of software development is broadly divided into three phases. The first phase is design and communication (customer involvement phase), during this phase, a customer is involved till the design is finalized. Customer satisfaction is extremely important for passing the design phase to proceed to the next phase. The second phase refers to the phase of growth that starts with coding. If the outcome of the implementation test is acceptable, the product enters the third step of the AZ-Model, in which it is put on the market on the basis of the product's design and

ownership.

G. A. O. Abusamhadana et al. [6] proposes an integrated model to assess and verify the factors of active user engagement in the production of information systems. To verify the success of user interaction variables and display their interrelationships, a qualitative approach is applied. To explain the essential factors of the a-priori model, an in-depth exploratory case study process (interview with experts) was performed. The qualitative approach adopted resulted in the provision of user involvement factors with 12 success factors.

An exploratory case study of standards about user involvement in agile software development was performed by J. Buchan et al. [7]. The perceptions of two stakeholder groups (software development team and software users) regarding user involvement were compared and contrasted. Via interviews, qualitative data was collected to establish a new approach for determining the alignment of user participation preferences by applying Repertory Grids (RG).

D. Zowghi et al. [8] introduced Empirical research that studies power and politics of user involvement in software development, collected data through 30 interviews with 20 participants, attending workshops, observing project meetings, and analyzing projects documents. The qualitative data were rigorously and iteratively evaluated and the findings suggest that politics was an important factor used in decision-making processes to exercise power and control. For political reasons, contact networks have been abused. This led to the frustration of the users with their participation, thus influencing the outcome of the project.

M. Bano et al.[2] performed several case studies that took about 2-3 years to evaluate the relationship between user satisfaction with the sharing process and their satisfaction with the system provided, and the findings show that two significant factors played a critical role in raising the benefits of user involvement in achieving user satisfaction as follows: The complex management techniques identified in the Portal project and the efficacy of user representation (SME) in the project define obstacles that avoid user participation as follows: (time, resources, strategy) as shown in Figure 1.

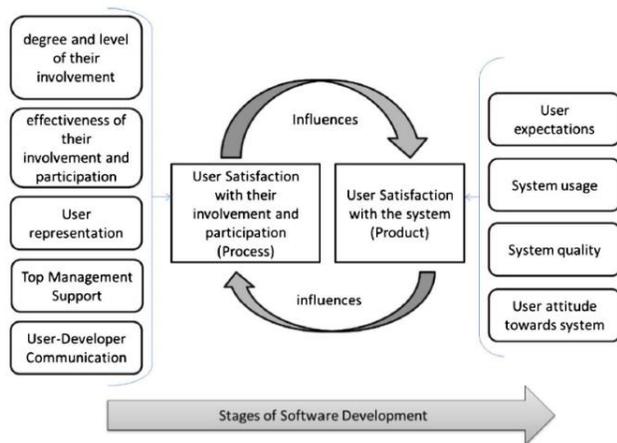


Fig. 1. Relationship between user satisfaction & Involvement. [2]

R. Thakurta et al. [9] conducted an empirical study into

factors affecting the involvement of users during a custom software development project split into two phases, phase 1, using focus group interviews to understand the mechanism of user participation in a software project. This culminates in a "user involvement enabler model" that, in order to illustrate the mechanism, incorporates the associated antecedents into a structural equation model. In phase-2, based on a questionnaire survey, the model is validated. Two sets of variables, i.e. "perceived project importance" and "perceived ease of user participation" are described by survey responses as the primary drivers behind "user intention towards participation" leading to participation. This study was intended to direct user participation levels towards reducing project risk.

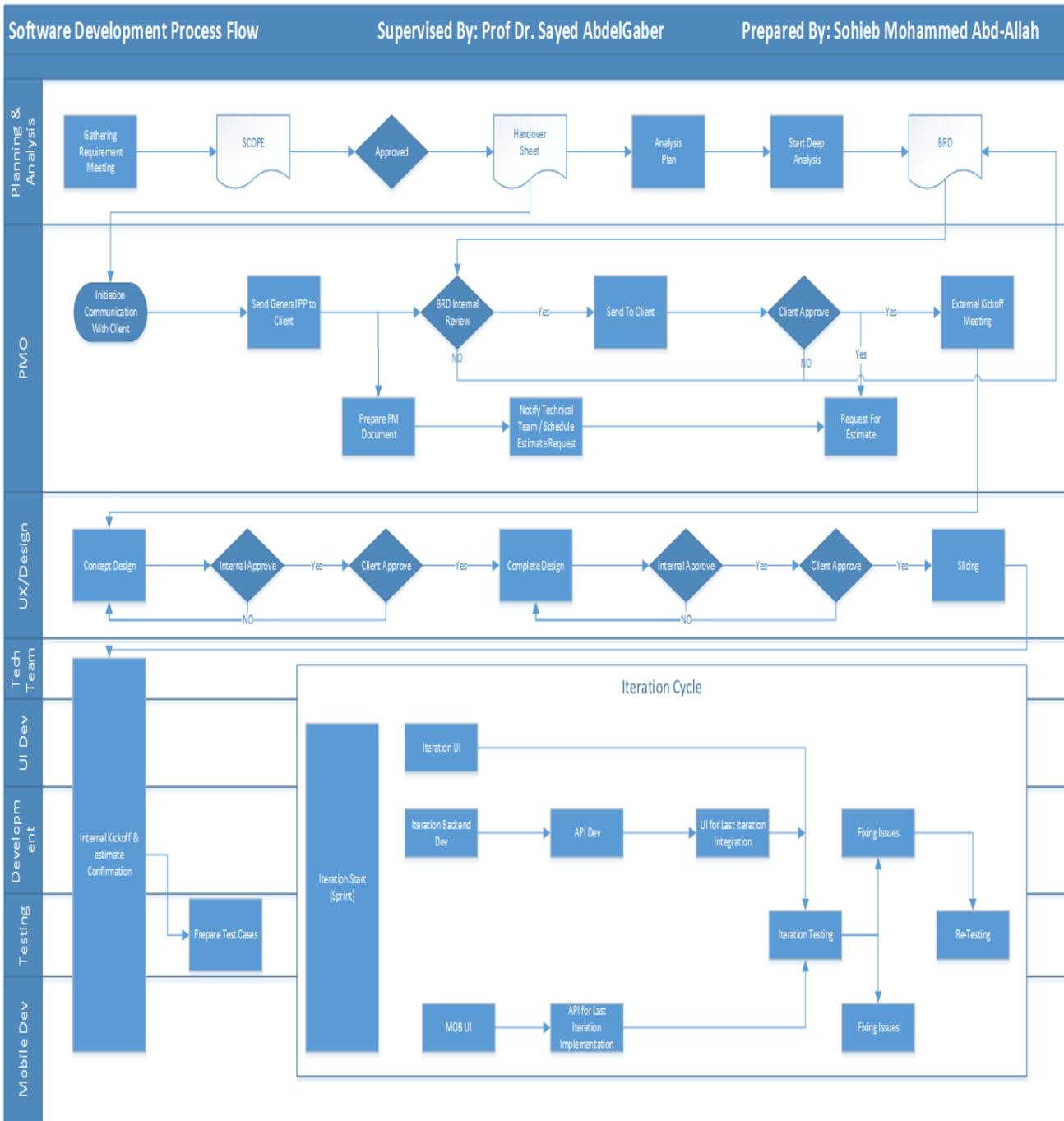
D. Zowghi et al. [4] suggest that it is not always possible to assess the performance of software projects in terms of expense, schedule and efficiency. The project will still be considered a failure without social approval. UI is considered one of the ways of gaining social acceptance among users. The analysis of the problems and challenges of the UI in software development [10] revealed 7 key groups of problems directly related to users: motivation; attitudes; expectations; expertise; appreciation or resistance to change; cooperation; and user perceptions of the development team.

R. A. Majid et al. [11] reports on a study that was conducted to investigate user involvement in the SDLC process. In the study the Human Centered System Development Life Cycle (HCS DLC) model was used as the research model. HCI is a discipline that emphasizes on the usability of a software product. Usability is one of the six software quality attributes that are concerned with software system comprehensibility, understanding, operability, attractiveness and compliance. A survey was conducted in the study and 32 software practitioners responded to the survey. The outcome of this survey revealed that user involvement is overwhelmingly based on the collection of functional requirements rather than the collection of non-functional requirements.

V. A. Shekhovtsov et al. [12] the paper discusses the problem of quality in the service-oriented systems software process, argues for the need to include users/stakeholders in the specification and quality assessment of quality (requirements). Introduce classifications of consumer and quality categories and as a framework for characterizing assessment cases for this purpose.

III. PROPOSED MODEL

The impact of user Involvement during the software development cycle with different methodologies plays an important role in the success of software development projects, as it is considered a key process in building software or the nature of the project, whether it is a developed as product or as service. Therefore, the proposed quality model will removing or minimizing user resistance to implementing the software during the development life cycle to ensure successful implementation by identifying a set of key "factors" that represent the high level of quality and setting smart metrics to determine the presence of each factor in the system.



In order to ensure that high-quality user involvement is achieved, it was important to study and identify the main factors that affect high-quality user involvement and to know the volume of their impact on all phases of SDLC. As shown in Figure 2.

Fig. 2. Software Development Process Flow.

We should also determine how to measure these factors for the different methodologies used in development in order to be able to measure the quality of user involvement in all project stages.

A. The Software Project Nature (Product or Service)

With the growth of technology, people and companies are more relying on software systems. For that, we need a product/software that is trustworthy, reliable, and economical.

[13] Therefore, the degree of user involvement varied according to the nature of the projects. Consequently, the user's roles and the impacted factors at each stage. For example, in Software development projects as a product, there is new role called Product Owner "PO" who is the link between the technical team and other stakeholders, In some cases the "PO"

may play the role with no technical background and focuses on business value and study market.

B. Various Users Roles

The first thing we should take in our consideration is the user's categories. This classification depends on the role it plays and what are the functions of this role? Each type of user has a different degree of influence on the project depending on the level of Authority, knowledge, and experience. Each type of users has factors that affect at every stage of development, and identifying these factors is the beginning of ensuring the quality of user involvement in the project phases.

C. The Development Methodology

Each methodology has its own way of dealing with software development and project implementation. User roles differ according to the development methodology. For example, in the traditional methodology such as Waterfall, changes are not appreciated, and user involvement is high early at the beginning of the project, then gradually disappears and not appear until implementation phase. As for the agile methodologies, it appreciates the user's continuity involvement and has the ability to accept change as it is one of its principles. It is more flexible, which makes it more used and aligned with the market. Therefore, many development teams use agile methodologies in development to ensure the quality of user involvement.

D. The Implementation Methodology

The method of implementing the project is one of the most important factors of project success. It may be considered as one of the factors that affect in removing or minimizing user resistance to ensure the success of the project implementation. The leadership factors are the main cause of information system project success or failure in software implementation. [14] It is very necessary to agree with the stakeholders on how to implement the project early. If the project will be released as a SaaS, then the stakeholders have a feeling of insecurity and that the data needs to be secured, and this could lead to the failure of the project and also there must be preparing a training plan for users to make you sure that they are not frustrated by the software and cause project implementation failure due to not being involved in the project implementation phase.

E. Definition of Done (DOD)

As Agile development methods have become more and more popular [16], the question arises: how do these methods address early defect removal? Using the Scrum concept of Definition of Done to drive quality improvements and reduce technical debt. [15] Often times a culture is formed by the technical team that the task is completed as soon as the developer finished and tested by the quality team, but in fact there must be a vision beyond this that a definition of done is by releasing (production) and testing it by continuity using by the user and receiving feedback from him only then task considered as completed or

done. Also describe how the Definition of Done can be a vehicle to implement standards, use checklists, and introduce compliance measures in the agile development process. [15]

F. The Virtual User Involvement (V-UI)

The total amount of data created, captured, copied and consumed in the world is forecast to increase rapidly, reaching 59 zettabytes in 2020. [17] With this massive volume of data, new technologies such as AI, machine learning and data science have flourished in an effort to implement processes that the human mind cannot handle. At first glance, a person may be fooled if he believes that these technologies will be an alternative to the human being, but after careful thought we will notice that all these technologies are based on user involvement because they depend on historical data produced by the user and an attempt to predict the behavior of the user.

IV. RESEARCH METHODOLOGY

The research questions should be broken down into their key components in order to carry out this study: users with various positions/Roles, the whole stage and the effect on user involvement. User Involvement research will be undertaken to understand what user involvement understands, how it is applied, who the key stakeholder is and what their perceptions are for its implementation. [18] This will include a detailed description of the activities related to user involvement and related factors affecting the project. This will help to set the metric for the method to calculate each factor and its presence. In addition, to get as complete a view as possible and see how well these matched, it is desirable to survey all the different positions on the importance of quality in user involvement. The goal of the research is not only to better understand what is meant by quality user involvement, but also to explore what practices are being introduced to achieve high quality.

A. Case Study Approach

Case studies can provide a detailed view of real-life circumstances and can also show the explanations for and mechanisms for the emergence of particular phenomena. Our aim is to explore user involvement in software development management in order to recognize key factors for achieving high quality and achieving best practice that can be applied to various development methodologies.

There are 2 type of the case study approach; single and multiple case studies. Case studies may be a combination of quantitative and qualitative data. Single Case Studies are also used in the testing of well-formulated theory to validate, question or expand this theory. Such studies help to re-examine and re-focus the investigation in a whole area.

A Multiple case study research for the software company will be carried out using various development methodologies to assess the type of user involved at each phase and what factors influence the quality assurance of the user involvement.

B. Data Collection - Dataset

We will collect quantitative and qualitative data that will help us explore the realistic situation and evaluate our proposed model, perform semi-structured and open-ended telephone or face-to-face interviews with various types of users interested in different software methodologies. Semi-structured interviews encourage improvisation and thus promote the exploration of the cases studied.

Rather than randomly selecting the cases for the analysis, we would choose an organization that has its own Software Product and as it offers services to customers in order to study the possible effects of the volume of users. The company selected would encourage its users to provide input and will be interested in understanding it. We use this objective sampling approach as we consider the resulting cases to be most important to our proposal. The selected company has historical data on the projects it developed stored on it - Task Management Tool - and it is classified as follows:

- 1) *National / Governmental Sector*
Solid Waste Management Project in cooperation with the Egyptian Ministry of Environment and the GIZ.
- 2) *Software Product Sector*
Quality & Audit Management Project for companies operating in Oil & Gas and Construction Industry.
- 3) *Private Sector*
Multiple Projects as Websites, Web Applications and Mobile Applications.

C. Data Analysis

We will analyze the data that we have collected to answer the research questions. Also, through the data analysis, we can make a mapping between the main factors and their criteria and determine the factors of each phase in different methodologies. We can extract the relationship between factors and the user role which lead us to build the proposed model and setting valid and smart metrics.

V. RESEARCH CHALLENGES

We may face some challenges in research, for example:

- A. The biases of individuals while participating in the research or forming a negative image in advance with the stakeholders, which is reflected in their responses during the research.
- B. The possibility of applying the research results to real projects in order to be able to study the extent of improvement in the success of project implementation after applying the proposed model in light of the acceleration of the pace of work and the desire of organizations to implement projects in the least time and cost.
- C. The work team members participating in the research change either to leave their jobs or the project is not

completed, which leads to a change in user roles as a result of different cultures and experiences.

- D. The new quality model for user involvement needs many practices in order to verify the accuracy of the relationships between the factors and sub-factors (Criteria) for each phase of software development life cycle and to what extent the metrics we have set can achieve high-quality user involvement.

VI. CONCLUSION

The world is changing rapidly, and as is the software industry. This change revolves around meeting user needs and achieving added value. Therefore, the paper proposes a model to ensure user involvement through which we can identify the factors that affect the quality of user involvement, as well as how these factors can be measured to ensure the success of implementing software projects. Setting a SMART metrics to measure the quality of user involvement for each phase which lead to Maximizing the chance for the successful implementation of software

We will explain the extent of improvements we gain through the quality model, as well as identify best practices to reach the high quality for user involvement. To ensure the continuity use of Software and achieving customer competitive advantage.

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