User Involvement in Software Development and System Success: A Systematic Literature Review

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ABSTRACT
Context: In the last four decades involving users in the software development process is claimed to have a positive impact on the success of that software. However, previous reviews on this topic have produced conflicting results. Objectives: Our aim is to present a review on user involvement in software development process and investigate its relationship to software system success. Methods: For our exploration, we performed a Systematic Literature Review using the guidelines provided in the Evidence Based Software Engineering literature. Results: 87 relevant empirical studies were selected and reviewed that investigate various perspectives and concepts of user involvement in software development process during the period of 1980 – 2012. Among 87 studies reviewed, 59 report that user involvement positively contributes to system success, 7 suggest a negative contribution and 21 are uncertain. Conclusions: Our results show an overall positive impact of user involvement on system success. It also suggests that the relationship between user involvement and system success is neither direct nor simple, and it depends on many different factors and conditions surrounding systems development processes.

Categories and Subject Descriptors
D.2.9 [Management]: Lifecycle

General Terms
Human Factors, Management.

Keywords
User involvement, software development, system success.

1. INTRODUCTION
Over the past four decades, user involvement in software development was considered as one of the key factors to play a positive role in achieving system success [1]. During software development, the users are typically involved in early phases of development for requirements elicitation and feedback [2]. But due to the increasing number of project failures because of user dissatisfaction [3], involving users throughout the software development lifecycle was intuitively considered to achieve user buy-in, approval and hence system success [1]. The idea has been reflected in various software development methodologies including prototyping, Agile, Joint Application Development (JAD), ETHICS etc.

However, research literature has previously yielded inconsistent results ([1] [4] [5] [6] [7]). The causes of these inconsistencies identified in the literature are said to be methodological problems [1], confounding effects of the terms “user involvement” and “user participation” [4] [8], and contingency factors [9]. The phrase “user involvement in software development” is a very abstract concept with many ambiguities in defining the terms users, involvement and software development. Firstly, users can play many different roles within organizations. Secondly, software development lifecycle has many phases and activities that depend on various dynamic factors such as methodologies used, application domains where software will be situated, and technological changes [4]. Thirdly, the term “involvement” has often been used inconsistently in previous studies. This inconsistency has lead to ambiguity which makes the meaning and usage of this word to remain unclear. Barki and Hartwick [8], in their highly cited definition, make a distinction between user involvement (“a subjective psychological state reflecting the importance and personal relevance of a system to the user”) and user participation (“a set of behaviours or activities performed by users in the system development process”), although these two concepts are mostly considered to be the same in the literature.

The term “user engagement” is used in the literature to refer to both concepts of involvement and participation [5]. To define or precisely measure what system success is also not trivial. The most referred criteria of system success in the literature are user acceptance and user satisfaction of the system, which are often used synonymously. There are also other factors used for measuring system success including system quality, information quality, information use, individual impact and organizational impact [10].

In this study our aim is to present a review on user involvement in software development processes and investigate its relationship to software system success by exploring the published empirical research literature for the period 1980-2012. We were performing this review to form a basis for our case study design and interviews, therefore the concepts prior to 1980 were too obsolete to be used for an empirical inquiry in current day software industry. For our exploration, we performed a Systematic Literature Review (SLR) using the guidelines provided in the Evidence Based Software Engineering (EBSE) [11].

The paper is organized as follows; Section 2 describes background and motivation. Section 3 describes the systematic review methodology with details of all the sub phases. Section 4 describes the results obtained from executing SLR. Section 5 is the discussion on results and Section 6 points out the limitations of our results. Section 7 gives conclusion and suggests future work.
2. BACKGROUND AND MOTIVATION

Although for a long period of time it was considered axiomatic that user participation has positive influence on success of the system being developed, but the empirical literature has shown conflicting results over the past four decades ([1] [4] [5] [6] [7]). Ives and Olsen [1] reviewed 22 empirical studies published during the period 1959-1981 and found that only 36% of the studies were showing positive impact of user involvement on system success. Cavaye [4] reviewed 19 studies published during 1982-1992 and found 37% studies were showing positive results. The meta-analysis performed by Hwang and Thorn [5] on 25 studies for the period 1976-1996, shows positive relation of user participation to system success. Another meta-analysis by He and King [6] performed on 82 empirical studies published up to 2007, shows that user involvement/participation has statistically significant positive effect on system success.

In this study we have performed a systematic review to investigate the impact of user involvement in software development on system success. Previously published literature reviews on the topic lack this rigor of search and selection method. We were interested to investigate this phenomenon using guidelines of EBSE. The contributions of this paper is thus three fold: (1) providing the first ever SLR on user involvement using EBSE guidelines, (2) identification of new factors that play a role in systems success in addition to the user involvement, and (3) offering new insights on the factors that determine the relationship between user involvement and system success.

3. SYSTEMATIC LITERATURE REVIEW

We followed the guidelines of Kitchenham et. al. [11] and carried out all the proposed phases of SLR staring from the development of protocol. The protocol was pilot tested for evaluating the completeness of our search string, and correctness of inclusion/exclusion criteria and data extraction strategy. After Pilot testing the updated version of the protocol was sent to the external reviewers (including Kitchenham), and the recommended changes (especially related to the scope of the study) were accommodated in the final version of protocol.

3.1 Research Question

Our goal was to investigate the empirical literature on user involvement and system success relationship. Our study was guided by the following research question;

*RQ1: What is the relationship between the user involvement in system development and the system success?*

Keeping our approach serendipitous, during data extraction we also gathered other factors that affect user involvement and system success relationship.

3.2 Primary Search Strategy

Our research question has three major search terms i.e. user, involvement and software development. Table 1 shows the alternatives we used for these terms which were gathered from pilot testing and reviewing relevant results and previously conducted literature reviews. Concatenating the terms got the following search string:

**ON ABSTRACT** ((user OR customer OR consumer OR “end user” OR end-user) AND (involv* OR participat* OR contribut*) AND (“software development” OR “software project” OR “IS” OR “information system” OR “IT” OR “information technology” OR “SDLC” OR “product development” OR “IT adoption” OR “IT diffusion”))

<table>
<thead>
<tr>
<th>User</th>
<th>Involvement</th>
<th>Software Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>End user</td>
<td>Involv* (Involvement, involve, involved, involving, &gt;&gt;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participat* (participation, participate, participating, participated, &gt;&gt;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contribut* (contribution, contribute, contributing, contributed, &gt;&gt;)</td>
<td></td>
</tr>
<tr>
<td>Consumer End user</td>
<td>Software Development; Software Project; IS; Information System; IT; Information Technology; SDLC; Product Development; IT Adoption; IT Diffusion;</td>
<td></td>
</tr>
</tbody>
</table>

The string was customized for different online databases according to their interface requirements while keeping the logical order consistent. For primary searches we selected a range of online databases; ACM Digital Library, IEEE xplore, Science Direct, Google Scholar, Citeseerx, Springerlink, and MIS Quarterly.

3.3 Study Selection Criteria

Once the results were obtained, we applied the selection criteria to filter out the irrelevant studies. Both authors carried out the process independently, and for differences the decision of second author (supervisor) was considered final. Study selection process was carried out in three steps.

**Step 1:** The results from the primary search strategy were initially screened on abstracts only to filter out totally irrelevant papers that were retrieved due to poor execution of search string by online search engines specially Citeseerx and Science Direct [12].

**Step 2:** After initial screening the papers on abstracts only, we excluded the studies that were not from the domain of IT/CS/SE/IS and were not following empirical method.

**Step 3:** Duplicates were discarded prior to applying the selection filter. If we would get multiple publications from one research study for conference and extended journal versions only journal paper was included in the final results. During quality assessment phase we came across some extremely low quality and plagiarized papers (though in both cases they were relevant), we excluded them.

3.4 Secondary Search Strategy

Secondary searches were performed in four steps.

**Step 1:** Based on the retrieved results, we scanned and reviewed all the references of included studies. All the eligible citations were applied with same inclusion/exclusion criteria described in section 3.3.

**Step 2:** from results of step 1 of secondary searches, we realized that the issue of user involvement in software development was focused more in management journals rather than computing and software engineering therefore we decided to extend our searching space By using INFORMS online (Operation Research and Management Sciences) online we performed online search on the following journals’ archives; Journal of Management Science, Journal of Information System Research, Journal of Operations Research. To further ensure the reliability of our results, we searched Association of Information System electronic Library (AISeL) which we came to know from our secondary search results.
Step 3: Furthermore, we checked DBLP publication profiles of few authors who were highly cited for their work on user involvement. They included: E. Mumford, H. Barki, J. Hartwick, M. H. Olson, J. J. Baroudi, B. Ives, G. Torkzadeh, W. J. Doll, R. Hirschheim, Khalid El Eman, L. A. Keppleman, J. D. McKeen, and S. Kujala.

Step 4: The final step to ensure that we do not miss any important and relevant papers; we selected three of the published literature reviews (not systematic) which are highly cited and published in top ranked journals, one from each for last three decades [1] [4] [6]. We scanned all the references (from 1980 onwards) in those literature reviews and papers that were eligible for consideration were treated with the same three step selection criteria described in section 3.3.

At the end of all four steps of secondary search strategy, duplicate papers were discarded and duplicate studies were grouped together and their journal versions were selected as they provided more details.

3.5 Quality Assessment

The quality assessment of the study was evaluated on the research method adopted and reported as it is the only mean of quality assessment available to us [13]. We reused the checklist developed in our previously conducted SLR [14]. The quality assessment was not used for ranking but rather to filter out low quality publications. First author (student) applied the quality checklist on the selected studies with discussion and feedback from second author (supervisor). The quality of conference/journal where the paper is published was also taken into account. For that purpose we used the ERA (Excellence of Research in Australia) ranking of 2010.

3.6 Data Extraction, Synthesis and Analysis

Based on the guidance provided in [15], we extracted three types of data; Publication details, Context description, and Findings. From each paper we extracted the main information required to answer our question, i.e. “User involvement or participation or engagement” was taken as independent variable, whereas “system success” was taken as dependent variable and checked whether the results from empirical study were positive, negative or uncertain about the relationship of user involvement and system success.

Coding technique was used manually to identify the relevant text in finally included papers while reading the entire paper. Later on we transformed the codes to NVivo and performed the synthesis and further analysis using thematic analysis [15], to answer our research question. In synthesis we were interested to divide the results against two criteria; the year of publication (divided in three decades) and research methodology utilized by the study in producing the results. The reason for analyzing year of the publication was to see the overall trends in three decades to compare with the previous reviews, and the reason for methodology was to evaluate the differences of results based on inquiry design as it was said in [1] [4], to be giving rise to conflicting results and making meta-analysis difficult.

4. RESULTS

By executing our search string on selected resources, we retrieved a total of 2776 in our results for primary searches. The papers which were totally irrelevant (retrieved due to poor execution of string by online database interfaces), were filtered after initial screening (step 1, Section 3.3). We were then left with 290 relevant papers. After the checks from step 2 of inclusion/exclusion criteria 69 studies were left. After screening the papers from step 3, a total of 37 studies were left for primary search results. The following table gives details of our primary search results;

<table>
<thead>
<tr>
<th>Step 3</th>
<th>Step 2</th>
<th>Step 1</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>290</td>
<td>37</td>
<td>112</td>
<td>793</td>
</tr>
</tbody>
</table>

We then performed step 1 to 3 of secondary search strategy to ensure the completeness of our results (See Section 3.4). We retrieved further 21 studies that were relevant and were missing in primary search results. After this phase our total number of included/papers raised to 58 studies. Step 4 of secondary search, comparison with references of three published literature reviews, resulted in further 29 new empirical studies which were included in those literature reviews but were missing in our results. Out of our 58 only 13 studies were found similar where as 45 studies included in our results were missing in those reviews. After this step we ended up with a total of 87 studies for our final inclusion (See Appendix A).

<table>
<thead>
<tr>
<th>Research Method</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey</td>
<td>31</td>
</tr>
<tr>
<td>Case Study</td>
<td>31</td>
</tr>
<tr>
<td>Experiment</td>
<td>50</td>
</tr>
<tr>
<td>Field Study</td>
<td>69</td>
</tr>
<tr>
<td>Action Research</td>
<td>29</td>
</tr>
<tr>
<td>Experience Report</td>
<td>11</td>
</tr>
<tr>
<td>Ground Theory</td>
<td>11</td>
</tr>
</tbody>
</table>

We performed thematic analysis of included studies and arrived at above classification. The themes that were arrived at were: percentage, dissatisfaction, development, and comparison with previous reviews. Below table 3 and 4 gives the details of the included studies and the themes that were arrived at.
Table 3 shows the detailed breakdown of frequencies of characteristics of resulting papers in terms of three decades, research methods, ERA ranking. Table 4 shows the breakdown of the frequencies of the results. The results are classified in three categories, Positive (+, showing the user involvement has positive influence in bringing about system success), Negative (-, showing that user involvement does not have positive influence on system success) and uncertain (? , the results of the studies are inconclusive). The frequencies are further refined against research methodology adopted to obtain results and the decade to which that publication belongs to give a more comprehensive picture of the results obtained.

Table 4. Relationship of User Involvement to System Success

<table>
<thead>
<tr>
<th>Research Method</th>
<th>Decade</th>
<th>Results</th>
<th>Survey</th>
<th>Case Study</th>
<th>Experiment</th>
<th>Field Studies</th>
<th>Action Research</th>
<th>Exp Report</th>
<th>Grounded Theory</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship of user involvement and system success</td>
<td>1980-1989 (15)</td>
<td>+</td>
<td>S2, S5, S26, S29, S40, S43, S62</td>
<td>S32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>S31</td>
<td>S27, S30, S39, S51</td>
<td>S28</td>
<td>S60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>?</td>
<td>S2</td>
<td>S8, S12, S13, S15, S34, S35, S37, S45, S46, S64, S65, S68, S70, S75, S76</td>
<td>S14, S33, S49</td>
<td>S11, S36, S57, S71, S72, S73</td>
<td>S44, S47, S63, S66, S7</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1990-1999 (39)</td>
<td>+</td>
<td>S8, S12, S13, S15, S34, S35, S37, S45, S46, S64, S65, S68, S70, S75, S76</td>
<td>S14, S33, S49</td>
<td>S11, S36, S57, S71, S72, S73</td>
<td>S44, S47, S63, S66, S7</td>
<td></td>
<td></td>
<td></td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>S33</td>
<td>S38, S55, S69, S74</td>
<td>S39, S56</td>
<td>S9, S56</td>
<td>S52</td>
<td>S42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>?</td>
<td>S32</td>
<td>S16, S22, S50, S58, S61, S78, S79, S82, S83</td>
<td>S1, S4, S6, S20, S21, S23, S25, S55, S39</td>
<td>S85, S87</td>
<td>S19</td>
<td>S41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000-2012 (33)</td>
<td>+</td>
<td>S31, S84</td>
<td>S10, S18, S24, S48</td>
<td>S54</td>
<td>S74</td>
<td>S9, S56</td>
<td>S52</td>
<td>S42</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>S36</td>
<td>S38, S55, S69, S74</td>
<td>S39, S56</td>
<td>S9, S56</td>
<td>S52</td>
<td>S42</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>?</td>
<td>S37</td>
<td>S16, S22, S50, S58, S61, S78, S79, S82, S83</td>
<td>S1, S4, S6, S20, S21, S23, S25, S55, S39</td>
<td>S85, S87</td>
<td>S19</td>
<td>S41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>(87)</td>
<td>+</td>
<td>31</td>
<td>12</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>59 (68%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>7 (8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>?</td>
<td>10</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>24</td>
<td>(24%)</td>
<td></td>
</tr>
</tbody>
</table>

5. DISCUSSION
The overall results are showing a positive reflection of user involvement on system success and confirm the “common wisdom” about this phenomenon, which has attracted huge research interest for the past four decades. But upon a deeper and closer look at the resultant studies (Table 4), we found that meta-analysis may not be possible due to variability of the factors and differences in the reported details of each study. The inconsistencies in the results analysed from published empirical studies were due to major differences on various factors; e.g. Research design, type and size of organizations and projects, instruments used for measuring user involvement, data collection method and phases of SDLC when data was collected, respondents’ sample type and size, user involvement or participation method or approaches followed in development (e.g. PD, JAD, ETHICS, Prototyping, Agile, UCD, CSCW etc.), types of information systems developed (e.g. DSS, Expert Systems), since they have different requirements from involving the users, perspectives of inquiry (e.g. psychological, cultural, political, organisational, managerial).

Table 4 reveals some insightful findings from the empirical studies. Overall 68% of the studies were reporting positive effect of user involvement on system success. But when divided on the basis of decades, from 1980 - 1989 only 53% show positive results, which is closer to [1] [4]. While in the second and the third decades, 74% and 67% showed positive results respectively which is consistent with [6] (See Section 2. Background and Motivation).

In first decade, 80% of the studies are using Survey research method and almost all studies are of very good quality. In second and third decade the trend of using other research design has increased but the quality of publications is gradually decreasing. The conflicts among the results are highest in first decade than the other two.

Out of 87 studies, 46 have used survey as a data collection method. The percentages of research methods utilised in the included studies are: survey 53%, case studies 23%, experiments 13%, and field studies 8%. Out of 46 survey studies, 67% show positive results, while case studies show 60%, experiments show 81%, and field studies show 86%. Surveys are used to collect data from large sample to test a hypothesis but they not considered appropriate for exploring relationships among complex phenomenon [4]. They only provide surface level agreement from respondents. Case studies are considered more effective for investigating contextual phenomenon. In our SLR results they show conflicting results by 60% agreement on positive and the remaining 40% do not. This may be due to the fact that data was collected at different stages of software development life cycle, organisations were of different sizes, projects were developing different types of systems, and the development methodologies were varied. Although the problem of the choice of research methodology mentioned above has long been identified (since 1984) as one of the reasons for lack of consistency in empirical findings [1], but to date we have not found a study that has utilized mixed method research approach to produce results with contextual details that is also generalizable at the same time. We found in our results that researchers agree user involvement alone cannot ensure system success. It is a complex phenomenon and many factors contribute to it. A software development process itself is complex and dynamic in nature involving technological and organizational factors for management [6].

6. LIMITATIONS OF THE RESULTS
Though we have tried to follow a very rigorous search strategy to ensure the completeness of our resulting studies, still there can be a possibility of missing out some papers due to their unavailability in electronic resources.

At the time of constructing the search term based on the result of our pilot study and testing, we missed an alternative term “engagement” for “involvement” which we found later on being
used by some of the papers. With our rigorous secondary search strategy we tried to compensate for this limitation. Another possible limitation could have been the elimination of the term “stakeholder” as a variant of the term “user” in our search string. This we did intentionally because not all stakeholders are considered as users of the software product. The participating users are the members of subset of the stakeholders [16]. Participants are often selected from among stakeholders based on the benefits they can bring to the system development because not all stakeholders carry equal relevance to the software.

7. CONCLUSION AND FUTURE WORK

Our Systematic Review confirms the positive effects of user involvement on system success. But the deeper analysis of the results shows that user involvement is a multifaceted phenomenon which cannot be easily evaluated by simple binary relationship with system success. Our review has revealed many diverse factors that characterize user involvement and its contribution to the system success which will be presented with detailed analysis in our future publications. The results that we obtained from this SLR were used to set the scene and context for our case study research that we have conducted in collaboration with software development organizations and we are currently performing qualitative analysis of huge amount of interview and observation data gathered from these two case studies.

REFERENCES


APPENDIX A: LIST OF INCLUDED 87 STUDIES

S49

S44

S38

S31

S30

S28

S26

S24

S23

S22

S21

S20

S19

S18

S17

S16

S15

S14

S13

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S10

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S7

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S5

S4

S3

S2

S1

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