Usability Evaluation of a Locally Developed Software in Libya Using IsoMetrics

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Usability Evaluation of a Locally Developed Software Using IsoMetrics

Alla Elmhdwi

Faculty of Information Technology, Libyan International Medical University (LIMU), Alla.Mehdawi@limu.edu.ly

Ehab A. Omar Elfallah

Faculty of Information Technology, Libyan International Medical University (LIMU), Ehab.Elfallah@limu.edu.ly

Sami Hamdi Benamer

Faculty of Information Technology, University of Benghazi, sami.benamer@uob.edu.ly

Abdelsalam M. Maatuk

Faculty of Information Technology, University of Benghazi, Abdelsalam.maatuk@uob.edu.ly

In the information technology era, there is a rapid noticeable increase in software application demand, especially in the last decade. Software development firms are established to meet this demand. Due to the common lack of usability feedback in locally developed systems in Libya, a usability evaluation framework is needed. In this research, a usability evaluation of locally developed software was performed and conducted on Bank Current Accounts Function users (the account handlers within the bank) on Almezan Banking Software System, in Libya. The research aims to measure the usability of Almezan software from the user point of view, using the international tool IsoMetrics (ISO) standard. The study methodology steps included preparing and describing a questionnaire, then defining the type of the sample of the population and the place of distribution of the questionnaire. The results of the data analysis show that the principles of Controllability and Suitability for learning from a user point of view, have received the best-rated feedback of the system. Unlike in Error tolerance and Suitability for individualization, which got lower-rated feedback according to users' expectations. A comparison has been made between the software under this study's results and another source of study. The results of the comparison have revealed that the Almezan Software got higher usability of users' expectations in Suitability for the task, Self-descriptiveness, Controllability, and Conformity with user expectations, while their mean values were significantly different. Furthermore, Error tolerance, Suitability for individualization, and Suitability for learning results were similar, while their mean values showed that they were not particularly different.

Keywords: Software Usability, IsoMetrics, Libyan Software Industry

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1 INTRODUCTION

Software development life cycle is a set of activities and associated results that produce a software product. There are many different software process models, for example (Incremental Model, V- Model, Agile Model, …, etc.), nonetheless, all must include activities that are fundamental to software engineering [1]. These activities are software specification, design, implementation, validation, and evolution. In the design stage, in particular, the importance of usability has become central and essential.

Usability is the degree of the ability to use a product efficiently (user-friendliness). Software usability refers to the quality of a user's experience when interacting with software products or systems, including websites, software, devices, or applications [16]. Nowadays, the usability aspect has become essential to any system. This was influenced by the rapid technological developments, which gave new importance to the analysis of how technology affects organizations and its assent to be involved in the design phase (into the software development lifecycle).

The success of a product is based mainly on user satisfaction. Many products have been proved ineffective even though they met all scientific and technical design aspects [14, 15]. Developers should pay more attention to user usability, according to the standard of IsoMetrics (ISO) 9241, Part 10 used to assess the product. The ISO 9241 Part 10 formulates several principles regarding the design and the evaluation. The design principles of ISO 9241 Part 10 are the seven corresponding elements of user-perceived quality: task suitability, self-description, controllability, user expectations, error tolerance, and personalization. Conformity, adaptability to learning) as shown in Table 1. However, the author of ISO (9241) Part 10 emphasizes that the principle can only be used as a general guideline in system development or evaluation [2].

The development of technology and its expansion led to its adoption in Libya. Over time, companies and organizations opted to utilize locally developed software systems because of many advantages, for example, the ease and flexibility of communicating with programmers in Libya, Hence, local software development has been expanding, especially in recent years. Despite this expansion, there are still a lack and problems in usability.

Table 1: ISO (9241), Part 10 seven principles

Principle	Definition
Suitability for the task	How reasonable the system is in order to complete a specific task.
Self-descriptiveness	The system is able to describe itself, in which users realize what and how they can interact with the system without external help.
Controllability	The ability to achieve satisfactory control performance
Conformity with user expectations	The system performs as users expect it to
Error tolerance	The ability of the system to be resilient and handle human errors
Suitability for individualization	The ability to accommodate the system to users' own needs.
Suitability for learning	How much is the system uncomplicated to learn to use a certain function

The software industry in Libya is expanding regularly. With this demand, it observed that there is an increase in software development firms in Libya. These firms develop software from a developer's point of view. These software products are used by different types of users. Although, with this expansion of locally developed software, there is still a lack of usability feedback provided by Libyan users who use such software. This research aims to measure the usability of local software development in Libya from the user point of view using a summative questionnaire adapted from the IsoMetrics usability inventory based on ISO 9241/10[3]. The research was conducted on Almezan Banking Software System, developed by Estishari, a local software development company that specializes in the banking sector. Almezan software system was first released in the year 2000, subsequently

modified in the years 2003 and 2008 by the same developing company (Estishari), serving and accommodating different functionality within the bank, mainly being.

2 RELATED WORK

A study conducted in Italy used a case study about the collaborative transportation system involving traditional and green couriers, to freight pooling with an algorithm for the optimization planning of routes supported by a Decision support system (DSS) [4]. The Odoo ERP system has been chosen as a development platform because of its advantages. The usability advantage of using the Odoo ERP system proved its efficacy, by speed-up the integration with accounting and CRM, as well as the reporting tasks. The study found that these usability advantages reduce the information & communications technology (ICT) maintenance costs of the PonyZero S.r.l. The company, which let them move to the Amazon Cloud in a short time [4].

Another study was conducted in South Africa indicates the importance of usability evaluation and information literacy, and performed the process on an e-dictionary [5]. The usability evaluation findings show that not all users and designers necessarily share the same opinions and not all users found the system easy to use. The designers of the system did not expect users to have problems with the advanced search and display functions. It has been observed that the point that users struggle with some functions does not mean the functionality is unwanted. This means that there is a need for system maintenance according to the users' needs [5].

The implementation of the Odoo on the Marketing division of PT Ecosains Hayati is reviewed in [6]. The Implementation of the system improves the efficiency of the quotation business process in the sales division by 63% in terms of activity, and by 50% in terms of actors involved in the business process. As a result of the User Acceptance Test (UAT), it is demonstrated that the features of the Odoo are in harmony with the needs of the sales and able to accelerate the process of making the quotation. The overall attribute found has an average value of 3.7 so that the implementation of the system in PT Ecosains Hayati meets a usability quality, and it has a well level of understanding by the users and meets their needs [6].

Research conducted in Tehran has evaluated the usability of nursing information systems (NIS) by the nurses who had used the system [7]. The data was collected by a questionnaire of 35 questions based on ISO 9241 seven standards that were distributed to 184 nurses. The response rate was 64.6%. Data were analyzed using SPSS software. The results show that the highest mean value related to the suitability for learning, and the lowest mean value was for the suitability for individualization (nearly 50% of the nurses). Nurses were unable to adjust the response time according to their working speed. Therefore, it has been reported that systems should enhance the format of displayed information to achieve user-friendliness of NIS [7].

The usability of the hospital information system at Qom University of Medical Sciences has been assessed in described in [8]. The data was collected by a questionnaire of 77 questions based on ISO 9241 seven standards that were distributed to a sample of users to evaluate the usability of the system in medical and academic centers affiliated with the University. The finding demonstrates that the highest mean score obtained was suitable for the task, and the lowest mean score was suitable for individualization. Even though the user's opinion about hospital information systems was relatively good, nonetheless, it is necessary to pay more attention to ISO principles (individualization) to reach the best results [8].

The effects of the electronic death registration (issuance, updating, and approval) system were evaluated in a study conducted in Iran [9]. The data was collected by a questionnaire of 75 questions and distributed to the users of the health department of Hormozgan, to evaluate the usability of the system. According to the statistical results,

the lowest percentage of user feedback was for suitability for individualization (40%), the highest percentage was for suitability for learning (97.5%), and controllability (97.5%). Therefore, some suggestions have been proposed to improve the system usability according to their research results [9].

In India, the usability of the in-house hospital information system was measured, to identify problems and compare the program with other similar software programs [10]. The data was collected by a questionnaire that was adapted from the IsoMetrics usability inventory and distributed to 38 medical professionals. The highest mean value was for Suitability for learning, and the lowest mean values were for Suitability for the task and conformity with user expectations. The mean and standard deviation results were compared of in-house software (n=38) with similar programs such as SAP Human Resource program (SAP-HR) (n=28), Microsoft Word (MS Word) (n=55), and a hospital information system (IS-H*med) (n=29), to explore if there is a significant difference among them according to usability quality. The comparison reveals that the mean values of the IsoMetrics parameters were not different and gave a matching usability performance. However, the result was not the same when comparing the In-house system with MS Word, and that there is a large difference in effect size between mean values, which indicates that the In-house system has a different usability performance than MS Word [10].

The evaluation results of a hospital information system (HIS) in Iran were compared with other software results, which were already evaluated using a questionnaire based on IsoMetric 9241 as the HIS [11]. The HIS software questionnaire collected contains 75 questions and 285 user responses (n=285). The comparison was between HIS software and the other software, i.e., SAP-HR (n=28), MS Word (n=55), and IS-H*med (n=29). The comparison results show that the HIS is significantly more usable than IS-H*med, and more usable than SAP-HR according to isometric principles such as “suitable for task”, "suitable for learning", and "Error tolerance". Moreover, the HIS is significantly less usable than MS Word and considered average level in terms of ergonomic software quality [11].

The usability of the Indian e-governance software program was evaluated to compare if there is a significant difference in the quality of use between the software program with SAP Human Resource program (SAP-HR) (n = 28), and MS Word for Windows (n = 84) [12]. A questionnaire of 20 questions was distributed to a sample of software users, where the total number of respondents was 112 (officers 14.3% and clerical 85.7%). The results showed that the e-governance software is rated almost the same from the user’s point of view as of SAP-HR; no significant differences, differently from MS Word, e-governance software rated lower than MS Word and does not meet the ergonomic quality as much as MS Word. Furthermore, there is no significant difference in clerical and officer categories concerning IsoMetrics mean for the various design principles [12].

The usability of a Hospital Information system (IS-H*med software system) in the University of Heidelberg, Germany has been evaluated to investigate the equivalence between an online and a paper-and-pencil layout of questionnaires based on ISO 9241-10 standards of two matched groups (n=29) [13]. The ergonomic quality of usability of the analyzed data of the system was compared with two other systems, i.e., SAP-HR (n=28) and MS Word (n=55), and the difference between user types (doctors, medical secretaries, and nursing staff) was evaluated. The results revealed that there are no differences between the two matched samples using the online or the paper-and-pencil format of the questionnaire. Moreover, the comparison reveals that on the scale “suitability for the task” IS-H*med was significantly rated higher than SAP-HR, but rated lower on the “controllability” scale. Furthermore, the usability of ISH*med is rated low at all scales from the user’s point of view. Besides, the outcomes of data analysis present a notable overall difference on all scales, except for the “Conformity with user expectation” scale [13].

3 THE METHODOLOGY

To achieve the desired aim of this study, the methodology has been adapted from [10]. As shown in Figure 1, the general steps of this are firstly started with the questionnaire preparation and description. Secondly with the sitting, which addressed the type of targeted population and the place of distribution of the questionnaire. The third step was data collection, followed by the result extraction and discussion.

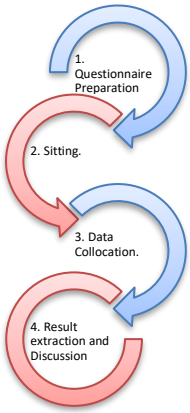

Figure 1: The General Steps in This Research.

3.1 Questionnaire Preparation and Description

The instrument for collecting data in this research was IsoMetrics Questionnaire [3]. The questions selected were 20 questions, which are the same questions available in the literature. The selected questions enable the developers to identify and determine the shortcomings of the system, which in return would allow the developers to improve the functionality of user interfaces of the system, and achieve the desired level of user-friendliness. Furthermore, the feedback obtained from the selected questions allows us to compare the results obtained from the study with another similar study in terms of ergonomic quality concerning the context of usability, which is described in [10, 13]. The second part of the study includes 20 questions based on ISO 9241/10 represented in Seven Principles as shown in Figure 2. The questionnaire was translated to Arabic and reviewed by experts. The responses for the 20 questions are categorized into five Likert scales. The questionnaire was communicated to the targeted population by two methods; paper-based and online format.

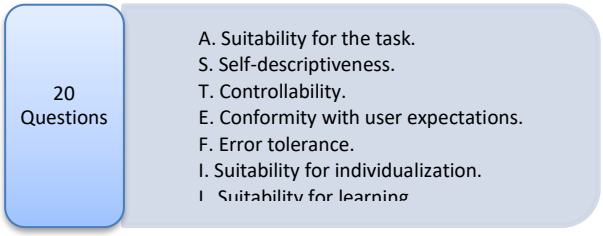

Figure 2: Twenty Questions Based on ISO 9241/10 Seven Principles.

3.2 Sitting

This research was focusing on the users of the Current Accounts Function (the account handlers within the bank) of Almezan Banking Software System. The survey was distributed to Mediterranean Bank (customers/users of the Software), which are situated in Libya (Tripoli, Benghazi, and Misrata). A sample of 80 users was distributed accordingly.

3.3 Data Collection

The time frame of preparation of the survey, as well as the collection of the feedback of the questioner, took around three months. Then, all the received data from the questionnaire are transferred into an electronic format to obtain a softcopy of the data. The processed data is analyzed using SPSS (version 25) software, of which descriptive statistics are used. The statistical calculations used include percentages, frequency distribution tables, and statistical indices such as mean and standard deviation to describe the variables. Moreover, an independent t-test was used for the comparison and Cohen's d to see the effect size.

4 THE RESULTS

This research targeted 80 users, where 71.25% of them are responded to the distributed questionnaire. After the exclusion of the questionnaire with missing data, 56 responses have remained. Two third of the responses did not fill part of the personal data area. Therefore, age and gender columns were eliminated. The analysis conducted was on every principle independently, and then on each question separately. These questions give detailed information about negative and positive usability aspects. Followed by comparing the results of Almezan software of this study with another similar study, in terms of ergonomic quality for the context of usability.

4.1 Principle Analysis

The collected data were analyzed using descriptive analysis to acquire the Mean and the Standard Deviation (SD) of each principle as shown in Table 2.

Table 2: IsoMetrics Principals mean values of Almezan Software.

IsoMetrics Principals (n=56)	Almezan	
	Mean	SD
Suitability for the task	3.3973	0.48798
Self-descriptiveness	3.2262	0.41247
Controllability	3.6905	0.41613
Conformity with user expectations	3.1607	0.39691
Error tolerance	2.7619	0.43445
Suitability for individualization	2.6429	0.4443
Suitability for learning	2.9107	0.43804

4.2 Questions Analysis

This subsection illustrates an analysis approach of the single item (question) belonging to the different IsoMetrics principle. It provides more detailed information about the ratings and the negative and positive usability aspects of Almezan software system. As an example, the first principle "Suitability for the task", four questions were used to represent this principle. Figure 3 shows the mean of Five Likert scales for each question.

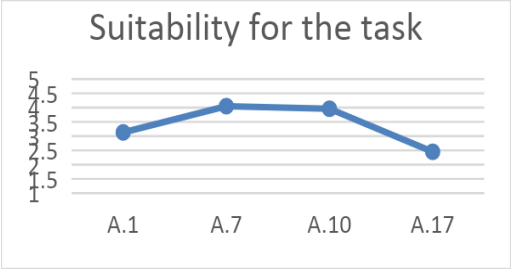

Figure 2: Twenty Questions mean values of Suitability for the task

Relatively positive rated items are as follows:

A.1: "*The software forces me to perform tasks that are not related to my actual work*", where M = 3.13 and SD = 1.176. Table 3 shows the result collected on five points Likert scale, and it has been observed that the majority of the responses agree with this question.

Table 3: IsoMetrics Principals mean values of Almezan Software.

A.1	Frequency	Percent
Strongly disagree	5	8.9
Disagree	13	23.2
No opinion/Neutral	15	26.8
Agree	16	28.6
Strongly agree	7	12.5
Total	56	100.0

A.7: "*I perceive the arrangement of the fields on-screen as sensible for the work I do with the software*", where (M = 4.05 and SD = 0.616.

A.10: "*The software is well suited to the requirements of my work*", where M = 3.96 and SD = 0.762.

A.17: "*I am able to adjust the presentation of results (on the screen or printer) to my various work requirements*", where M = 2.45 and SD = 0.737.

The same approach was performed on the 20 questions of the questionnaire and the results are given in Table 4.

5 DISCUSSION AND COMPARISON

The positively rated items mean values (A.7, A.10, S.10, S.12, T.3, T.5, E.4, E.7, F.2, I.1, L.1, and L.8) show that the tasks meet users' expectations and appear to conform sufficiently with design requirement of the principles, especially principles of Controllability, and Suitability for learning, which considers the best-rated feedback of the system from a user point of view. Although the system has shown quite good-rated items results, it is still not free of flaws. Negatively rated items revealed that the most tasks that got low rated feedback according to users' expectations were most concentrated in Error tolerance (F.7 and F.8) and Suitability for individualization, even though (I.1) was considered positive but its rating was not better than (3).

Table 4: Result for Questions of Questionnaire

Q	Name	M	SD
A.1	The software forces me to perform tasks that are not related to my actual work	3.13	1.176
A.7	I perceive the arrangement of the fields on-screen as sensible for the work I do with the software.	4.05	0.616

A.10	The software is well suited to the requirements of my work	3.96	0.762
A.17	I am able to adjust the presentation of results (on the screen or printer) to my various work requirements.	2.45	0.737
S.2	I can call up specific explanations for the use of the system, if necessary.	2.54	0.738
S.10	The software provides me with enough information about which entries are permitted in a particular situation	3.11	0.528
S.12	The terms and concepts used in the software are clear and unambiguous.	4.04	0.503
T.3	The software makes it easy for me to switch between different menu levels.	4.32	0.69
T.5	I can interrupt any dialog at any time.	4.23	0.786
T.6	It is always easy for me to invoke those systems procedures that are necessary for my actual work.	2.52	0.738
E.2	I have no difficulty in predicting how long the software will need to perform a given task.	2.38	0.558
E.4	I find that the same function keys are used throughout the program for the same functions	3.13	0.574
E.7	The messages output by the software always appears in the same screen location.	3.98	0.751
F.2	Even if I make a mistake, the information (e.g. data, text, and graphics) which I have entered is not lost.	4.36	0.616
F.7	No system errors (e.g. crashes) occur when I work with the software.	1.59	0.733
F.8	If I make a mistake while performing a task, I can undo the last operation.	2.34	0.721
I.1	The software lets me adapt forms, screens and menus to suit my individual preferences.	2.93	0.499
I.6	I am able to adjust the amount of information (data, text etc.) displayed on the screen to my needs.	2.36	0.724
L.1	I needed a long time to learn how to use the software.	1.59	0.757
L.8	I find it easy to use commands.	4.23	0.66

In the following, the compression of the mean values results from the system under study with another software, i.e., In-house hospital information systems described in [10]. As seen in Figure 3, the results demonstrate the comparison of the IsoMetrics scales of Almezan with the In-house hospital. It can be seen from the graph that there are differences in results of Suitability for the task, Self-descriptiveness, Controllability, and Conformity with user expectations of the software understudy with the other compared study results. Unlike, in Error tolerance, Suitability for individualization, and Suitability for learning they have similar results.

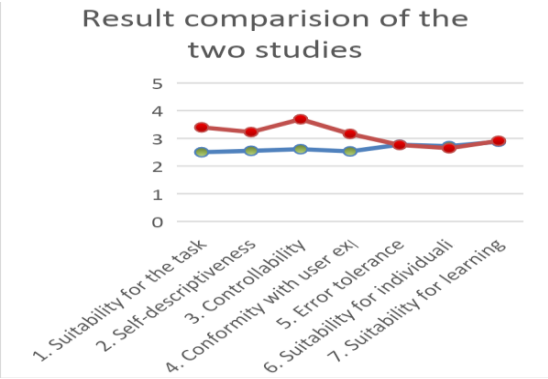

Figure 3: Isometrics Mean Values of Almezan In Comparison With In-House Hospital.

More details of the mean values and standard deviation of each IsoMetrics principal for Almezan and In-house Hospital results is shown in Table 5. It is observed that the standard deviation results of Almezan are lower than

In-house Hospital results, which indicates that the feedback data of this study are generally close to the mean. Aside from visual judgment, we carried out a sample t-test to compare the mean values including the use of Cohen's d to measure the effect size. Furthermore, it can be seen on In-house hospital IS software and Almezan, for the t-test that Suitability for the task, Self-descriptiveness, Controllability, and Conformity with user expectations that the mean values are significantly different, so the Null hypothesis (H0) that the mean values are same are rejected. Moreover, it can be seen that there is a large effect from Cohen's d that the reported differences could not have occurred by chance. Unlike in Error tolerance, Suitability for individualization, and Suitability for learning, which there are not significantly different, so the (H0) is accepted, and the size effect from Cohen's d is small.

Table 5: IsoMetrics Principals mean values of Almezan Software.

IsoMetrics Principals	In-house Hospital IS n=38		Almezan n=56		t-cal	Sig.	Cohen's d	Cohen interpretation
	Mean	SD	Mean	SD				
Suitability for the task	2.5	0.98	3.3973	0.48798	-5.873	0.000	1.16	Large effect
Self-descriptiveness	2.55	1.02	3.2262	0.41247	-4.461	0.000	0.88	Large effect
Controllability	2.61	0.95	3.6905	0.41613	-7.524	0.000	1.34	Large effect
Conformity with user expectations	2.53	0.82	3.1607	0.39691	-4.967	0.000	0.87	Large effect
Error tolerance	2.77	0.99	2.7619	0.43445	0.06	0.952	0.02	
Suitability for individualization	2.72	1.01	2.6429	0.4443	0.511	0.611	0.1	Small effect
Suitability for learning	2.88	1.08	2.9107	0.43804	-0.187	0.852	0.036	

6 CONCLUSION

Due to the common lack of usability feedback in locally developed systems in Libya, which developed mostly from the perspective of the developer, an evaluation of the usability of locally developed software was performed. This research was conducted on Current Accounts Function users (the account handlers within the bank) on Almezan Banking Software System, in Libya. The aim is to measure the usability of Almezan software from the user point of view, using international IsoMetrics (ISO) standards.

A summative questionnaire adapted from the IsoMetrics usability inventory based on ISO 9241/10 (applied as general guidelines) has been used. This questionnaire was distributed to the Mediterranean Bank (customers/users of the Software) who were situated in Libya (Tripoli, Benghazi, and Misrata). Then, all the received data from the questionnaire have been analyzed. The results of this data analysis show that the principles of Controllability and Suitability for learning from a user point of view, have received the best-rated feedback of the system. Unlike, in Error tolerance and Suitability for individualization, which got lower-rated feedback according to users' expectations.

After conducting the result of this research, comparisons have been made between the software under the study's results and another source of study. The results of this comparison have revealed that the Almezan Software got higher usability of users' expectations in Suitability for the task, Self-descriptiveness, Controllability, and Conformity with user expectations, which their mean values were significantly different. Furthermore, Error tolerance, Suitability for individualization, and Suitability for learning results were similar, while their mean values showed that they were not particularly different.

According to the obtained results, the locally developed system (Almezan Banking Software System) with the comparison with another software system that is not locally developed was acceptably good according to the user's expectations. However, according to the ergonomic quality of user's usability based on ISO 9241/10, it is barely satisfying, but the system should be enhanced more, particularly in terms of Error tolerance and Suitability for individualization to achieve user's satisfaction of the system, and in general, terms to achieve the international ergonomic quality in the context of usability.

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