International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:5, No:11, 2011

Usability and Functionality: A Comparison of Key Project Personnel's and Potential users' Evaluations

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***Abstract*—**Meeting users' requirements is one of predictors of project success. There should be a match between the expectations of the users and the perception of key project personnel with respect to usability and functionality. The aim of this study is to make a comparison of key project personnel's and potential users' (customer representatives) evaluations of the relative importance of usability and functionality factors in a software design project. Analytical Network Process (ANP) was used to analyze the relative importance of the factors. The results show that navigation and interaction are the most significant factors,andsatisfaction and efficiency are the least important factors for both groups. Further, it can be concluded that having similar orders and scores of usability and functionality factors for both groups shows that key project personnel have captured the expectations and requirements of potential users accurately.

***Keywords*—**Functionality, software design, usability.

I. Introduction

FUNCTIONALITY and usability are the sub-features of usefulness, which is a critical factor for acceptability of a system [1]. Usability assesses the extent a software facilitates users utilize the offered functions easily and appropriately. Functionality estimates the extent the software operates in the way it is structured and is expected to perform as users desire [2], [3].

Users tend to use functional and usable products more frequently. Reference [4] states that the majority of the users prefer products that are "simple and easy to use" and it is adequate if they merely function, as they are expected to or slightly better.Reference [3] states that usability and functionality are quality characteristics that evaluate an interface design.It is also possible that a functional software is not usable or vice versa [1], [3], [5]. The functionality of a software package becomes obvious to users through its interface and users interact with the system via this interface. Although it would appear that the usability feature is related only to the interface and not to the logic of available functions, Reference [6] asserts attributes of a system can affect the usability of the whole system. Successful usage of a software package depends on the ability of users to understand the functionality of the system. Functionality can have positive impact on the usability of the system, such as a "back" function [7]. After all, evidence shows that the majority usually uses only a small part of the available functions of a system [8]. At some point, the greater the functionality offered to the users the more skilled users must cope with the complex and time-consuming structure of the system [9]. Therefore, superfluous functionality can actually bring about a decrease in the usability of the software [8], [10]. To ensure users' needs are met, it is critical to balance functionality and usability in the design of the software. A user-centered design should consider both aspects — the interaction between user and the software as well as the operations performed by the system [11].

Since meeting users' requirements is one of the project success factors [12]-[14], understanding the user expectation of balance between functionality and usability is crucial for project team to implement a user-centered design. A mismatch between the expectations of the users and the perception of the project managers on what is required can be counted as one of the leading software project risks [15].

The aim of this study is to make a comparison of the information technology (IT) employees and potential users'evaluations of the relative importance of usability and functionality factors in software designed.

II. Functionality And Usability Factors Used In This Study

Literature review was performed to determine the usability and functionality factors that are important for the software we analyzed. The literature reviewed on usability and functionality included studies on web sites and software packages designed for organizations such as libraries. The list of usability and functionality factors is presented in Table I.

The usability factors are navigation, interaction, learnability, ease of use, response time, memorability, efficiency, and satisfaction.

- *Navigation:* It refers to finding one's way to the desired information through menus, graphical components, links and page sequence, and layout [16] as well as, even while doing this, knowing where one is at the instant [17].

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- *Interaction:* Responses to the user's actions are produced by the system [16]. Along with navigability, interaction with system helps users to find easily the desired information [18].
- *Learnability:* It is associated with the skill levels of a user and thereby the level of effort needed to learn how to operate the system [19]. For success of a system, the time a user needs to learn how to operate the system should be very small [20].
- *Ease of use:* It refers to being able to operate a web site without experiencing any difficulty and trouble.According to Reference [21], ease of use is one of the most important components along with navigation for usability and plays a significant role in the adoption of a system by users.
- *Response time:* It is the time needed by the system to respond to the activity of a user [16].
- *Memorability:* It is the ease of recall of the main functions and their presentation on the web site when a user revisits the page [3]. Reference [6] points out that an inconsistent interface structure raises the memory load on users.
- *Efficiency:*It is the ability of the web site to allow users to work quicklyto attain their desired goal with the minimum number of clicks [3], [22].
- *Satisfaction:*It is thegeneral pleasure a user feels making use ofthe software. Satisfaction is primarily affected by the perceived efficiency and effectiveness, and emotions and thoughts arisingfromthe usage [23].Functionality factors are security, search options, information provision, services/facilities, user guidance or support, customizability, and autorun.
- *Security:* The security features provided by the system protect users' privacy.Security is accounted as a functionality factor in the studies [19], [24], [6].
- *Search Options:* Systems offer both simple- and advanced search strategies and enable additional eliminations in retrieved results [2], [25]. That the search function helps users quickly and precisely finds what they are looking for.
- *Information Provision:* It supplies users with adequate information about company, products and services [26].
- *Services/Facilities:*Theyare purposive services/facilities offered to the user to assist in achieving the related goal of the system. Reference [25] mentions this functionality factor in their research on online public access catalogues, e.g. renewal and reservation services.
- *User Guidance or Support:* Web sites offer customers uncustomizable (such as FAQ) or/and customizable help (such as online help) [26], and describe the necessary information about these steps which users can follow when they have a request or when they encounter a problem. According to Reference [17], an adequate user guidance and support feature would reduce their cognitive load and pave the way for them to learn how to operate the web site.
- *Customizability:* It is the flexibility to change system navigation to a level that meets users' needs or preferences. Reference [27] suggests that customization increases user satisfaction by limiting information overload on users with respect to their preferences [21]. Reference [16] points out that customization is an extension of the interaction provided by the web site.
- *Autorun:*It enables the system to run some operations automatically.

TABLE I
USABILITY AND FUNCTIONALITY FACTORS USED IN THE EVALUATIONS

Usability Factors	Functionality Factors
U1. Navigation	F1. Security
U2. Interaction	F2. Search options
U3.Learnability	F3. Information provision
U4. Ease of use	F4. Services/ Facilities
U5. Response time	F5. User guidance or support
U6. Memorability	F6. Customizability
U7. Efficiency	F7. Autorun
U8. Satisfaction	

As seen above, not only functionality and usability of a system, but also some of their other factors are related to each other. Hence, these interactions go to create a complex model composed of dependence and feedback among the factors. In evaluating software, such a model can be treated with the Analytic Network Process (ANP) proposed by [28] in order to determine the relative importance of both usability and functionality factors.

III. ANP

When the factors in a complex structure of a decision making process are interrelated to each other, which means there are dependence and feedback among the factors, then this setting can be patterned only as a network. ANP enables decision makers as individuals or groups to cope with the factors interconnected with each other in the decision making problem [28], [29].

ANP can deal with the complexities of real-world problems of making societal-, governmental-, and corporate decisions because it takes complex interrelationships among factors into account [30]-[33].

ANP has three stages: structuring (design), assessment (comparison), and synthesis (computation).

At the structuring stage, pertinent factors andalternatives, if necessary, are determined. Next, associations between pairs of factors are identified by experts. As a result, a network model, which consists of factors and relations among them, is constructed.

At the assessment stage, a nine-point scale suggested by [28] is used by the decision makers to make pairwise comparisons of the factors in the network.Saaty's scale asks, "of the dependent factors, which one influences the common factor more and how much more?" According to this scale, a value of 1 shows that both factors compared have equal influence levels on the affected factor, while a value of 9 shows that one factor hasextremely more influence than that of

the other on the affected factor. To obtain the aggregated group judgment, the geometric means of all individual paired-comparison judgments for each question are calculated. Using these aggregated group judgments, pairwise-comparison matrices are generated.

At the synthesisstage the relative importance of the factors is computed. Importance isviewed as the influence of the factors on a common goal. To synthesize aggregated judgments to compute the relative importance of the factors, the computation of the eigenvector for each pairwise-comparison matrix, the generation of a supermatrix and a weighted supermatrix (if necessary), and the computation of the convergence of the supermatrix (limit matrix) are requisite.The relative weights (desired priorities) of the factors in the decision network are the values of the limit matrix.

IV. Evaluation Of The Software

First, the structuring stage was performed; the usability and functionality factors were determined as described in Section 2. After the determination of usability and functionality factors, the group of experts whose working areas are usability engineering filled in a pairwise relationship matrix separately. To aggregate these matrices into groups matrix majority rule was used (Fig. 1). The asterisk (*) entered in this matrix indicated that there is a direct relationship of factor i to factor j: If factor i affects factor j, the cell aij was filled with an asterisk (*). Where there was no relationship, the cell was not filled. Then the ANP model representing the associations between factors is generated using the Super Decisions software.

	U1	U2	U3	U4	U5	U6	U7	U8	F1	F2	F3	F4	F5	F6	F7
U1	-	*	*	*		*	*	*		*	*	*			*
U2	*	-	*	*				*	*	*			*		*
U3			-	*		*	*	*	*	*				*	
U4			*	-		*	*	*		*				*	
U5	*		*		-		*	*	*						
U6	*		*	*		-	*	*					*	*	
U7						*	-	*							
U8								-	*						
F1	*	*			*		*	*	-			*			
F2	*	*	*	*	*	*	*	*		-		*		*	
F3	*	*	*	*		*	*	*			-		*		
F4	*	*	*	*		*	*	*				-			
F5	*	*	*	*		*	*	*					-		*
F6	*		*	*		*	*	*					*	-	
F7	*	*		*	*		*	*				*	*		-

Fig. 1 Aggregated pairwise relationship matrix

In the judgment assessment stage, the second stage of the process, 22 potential users and 10 key project personnel filled a pairwise comparison questionnaire. The questionnaire mainly consists of two main parts. The first part designed to solicit information about the respondents. Table II presents asummary of the demographic profiles of the respondents. Amongpotential users, the average age is 27 and 14 of them were female; most of them possessed at least an undergraduate degree; the number of respondents with more than 5 years full time professional experiencewas 8; the average computer use per week was 65 hours and the average duration of computer use was 9 years.Among key project personnel, the average age is 34 and only 3 of them were female; all of them possessed at least an undergraduate degree; the number of respondents with more than 5 years full time professional experiencewas 9; the average computer use per week was54 hours and the average duration of computer use was 16 years.

In the second part, a pairwise comparison was conducted by key project personnel and potential users. An example question from the questionnaire can be seen in Fig. 2.

TABLE II
DEMOGRAPHIC PROFILES OF KEY PROJECT PERSONNEL AND POTENTIAL USERS

Potential users		
Gender (number of respondents)		
Female: 14	Male: 8	
Age		
Min: 22	Max: 36	Average: 27
Education level (number of respondents)		
High school: 9	Undergraduate: 12	MSc: 1
Work experience in full time position (number of respondents)		
<6 months: -	6 months<…<1 year: -	1-2 years: 4
2-5 years: 10	>5 years: 8	
Computer use (year)		
Min: 4	Max: 15	Average: 9
Computer use in a week (hour)		
Min: 12	Max: 90	Average: 65
Key Project Personnel		
Gender (number of respondents)		
Female: 3	Male: 7	
Age		
Min: 29	Max: 40	Average: 34
Education level (number of respondents)		
High school: -	Undergraduate: 6	MSc: 4
Work experience in full time position(number of respondents)		
<6 months:-	6 months<…<1 year: -	1-2 years: -
2-5 years: 1	>5 years: 9	
Computer use (year)		
Min: 10	Max: 21	Average: 16
Computer use in a week (hour)		
Min: 35	Max: 70	Average: 54

Of the factors given below which one influences "navigation" more and how much more?

1=Equally 3=Moderately more 5=Strongly more 7=Very strongly more 9=Extremely more

Interaction	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Response Time
Response Time	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Memorability
Memorability	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Interaction

Fig. 2 A part of pairwise comparison questionnaire

The respondents judged the relative importance of the affecting factors on the affected factor for all possible pairs. Then, the geometric means of all paired comparison judgments for each question were computed for each group (key project personnel and potential users) in order to arrive at the aggregated group judgments. Utilizing the Super Decisions software, these responses were formed into pairwise comparison matrices.

In the synthesis stage of the process, the relative importance of the factors was computed using the Super Decisions softwarefor both groups, which performed all the algebraic computations of the matrix. As pointed out before, the output of the limit matrix can be converted to the descending priority order: the relative importance of the factors (Table III and IV) for both groups.

V. Conclusion

As it can be seen in Table III and IV, the most important factor in terms of usability and functionality for both groups is "navigation" with a relative importance of 22%. This shows that finding the relevant information with the least effort through menus, graphical components, sequences, and layout was considered as the important factor by potential users and key project personnel. In addition, the second most important factor for both evaluation groups is "interaction". It seems that "interaction" has a slightly more relative importance for key project personnel than for potential users. Similar to our findings, Reference [34] found that customers of online auction and shopping web sites give higherpriority to usability factors than to functionality factors, with navigation and interaction beingthe factors of highest relative importance.

For both evaluation groups, the most important functionality factors are "search options", "information provision" and "auto-run". The only difference is that "information provision" is in the third rank among potential users, whereas it is the second most important functionality factor for key project personnel. However, "information provision" has a slightly lower relative importance for key project personnel than potential users.

The least important factors are "satisfaction" and "efficiency" for both groups. "Satisfaction" was considered more important by key project personnel, whereas "efficiency" was considered more important by the potential users.

Table III
THEIMPORTANCE OF THE FACTORS FOR KEY PROJECT PERSONNEL

Sub-Factors		Priorities
U1	Navigation	0.22453
U2	Interaction	0.12069
F2	Search options	0.08508
F3	Information provision	0.07232
F7	Auto-run	0.07009
F5	User guidance or support	0.06845
U6	Memorability	0.06541
U4	Ease of use	0.05174
U5	Response time	0.05151
U3	Learnability	0.04848
F4	Services/Facilities	0.0482
F1	Security	0.04548
F6	Customizability	0.03471
U8	Satisfaction	0.0088
U7	Efficiency	0.00452

Table IV
THE IMPORTANCE OF THE FACTORS FOR POTENTIAL USERS

Sub-Factors		Priorities
U1	Navigation	0.21884
U2	Interaction	0.10385
F2	Search options	0.09384
F7	Auto-run	0.07885
F3	Information provision	0.07571
U6	Memorability	0.07103
F5	User guidance or support	0.07037
U4	Ease of use	0.06074
U5	Response time	0.05372
U3	Learnability	0.05242
F6	Customizability	0.03644
F1	Security	0.03486
F4	Services/Facilities	0.03459
U8	Satisfaction	0.00761
U7	Efficiency	0.00715

Having similar orders and scores of usability and functionality factors for both groups shows that key project personnel have captured the expectations and requirements of potential users accurately. This may have a positive impact on the project's success. The findings of this study are important from the point of view that carrying out this study in the early stages of software design process can expose a mismatch between the expectations of users and the perception of key project personnel, a late discovery of which can otherwise cause irreversible results in the project.

Acknowledgements

This study was supported by a grant from DIGITURK.

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