A Value of E-Service in Local Government: A Fuzzy Approach Evaluation

Zuleaizal Sidek[1,] Noor Hasimah Ibrahim Teo[2]

[1] Centre of Integrated Information System Universiti Teknologi MARA Selangor, Malaysia
[2] Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Selangor, Malaysia

Abstract:
Usability and utility is a necessary condition for survival on the web. It determines the effectiveness of particular website in delivering its expected use. This paper reports the results of an evaluative study of the Malaysian e-Government portal (MyEG) from the usability and utility perspectives, using a common set of performance metrics from user participation. To deal with the uncertainty and vague expressions that surround the answers options, fuzzy approach will be applied. The result is categories based on demographic study and five main criterion of usability evaluation [9]. The results shows that MyEG have an average level of usability. Therefore, enhancements need to be done on the interface of the MyEG which at the same time would increase utility as well.

Keywords: e-service, e-Government, usability, utility, fuzzy logic, rule based approach, Evaluation.

1. Introduction.
The advancement of technology provides opportunities for government to address problems in many conventional services. E-Government has taken initiative to embraces the use of modern ICT to ensure e-Government delivers for all citizens. Malaysian Electronic Government (MYEG) initiatives provide information about public services and enable the citizen to conduct online government transactional services for Malaysian Community.The issue that becomes a major concern pertinent to this e-service portal is how usable is this portal in delivering services to the citizen. User tend to leave the portal if the information dos not answer users key questions, fails to clearly state what the portal offers, time consuming and etc.   This paper provides a report on the usability evaluation of MyEG portal which address on the problem mentioned. as a medium for government to enhance their services.The major objectives for the existence of MyEG is to ease public to access services provide by the government. As a mediator between government service and public, effectiveness of the portal is an important issue to consider. These report gathered feedback by end-user which are Malaysian community. Future enhancement can be arranged for the benefit of the citizen and the nation.

2. E-Service In Public Sector: An Overview.
E-services are a component essentially provides the electronic link between the Government and citizen or businesses[2]. There are criteria have been defined[3] to identify usable e-services such as perceivable, comprehended, clearly expressed main topic, provide feedback, support error handling etc. Usable e-service on government portal is essential as it will assist reduce the effort of government in providing their services to its citizen.

Therefore, Malaysian E-Government has taken this opportunity to provide e-services by outsourcing the services to My E.G. service Berhad as a concessionaire. MyEG enable Malaysian to interact with numerous agencies within Federal, State and the local Government. The service provided ranging from information searches to license application.

3. Utility And Usability Evaluation Of E-Services.
Utility measure the functionality of the website[4]. It's simply means how practical and useful it is in term of the fitness of use. It can be measure by based on the number of user that has used the website. Utility actually depend on the usability of the usability of the website interface. If the user fined the website easier to use, it will increase the possibility of user to use the service provided by the website. Usability is a necessary condition for evaluating web portal to ensure its usefulness[1]. The word "usability" refers to quality attribute that assesses how easy user interfaces are to use[1][4]. The evaluation will enable the web portal in achieving the utility function.There is no clear consensus how to measure usability that deal with the uncertainty and vague expressions[3]. However, the uncertainty and vagueness in usability evaluation is presented in [5][6]. Other related works presented for evaluating usability are presented using statistical approach[1][4][7][8].According to [9], there are five criterions for evaluation usability on web portal which are attractiveness, control efficiency, helpfulness and learnability. In contrast with [4], the criterions are learnability, efficiency, memorability, satisfaction and errors. The criterion defined by [4] is use to evaluate regular user for particular portal as it has memorability criteria to be evaluated.

Thus, this paper proposes usability evaluation based on criterion presented by [9] as it is suitable for non-regular user of MyEG portal.

4. A Malaysia Local Government Case Study.

The usability attributes contribute to quality of use includes the style and properties of the user interface, the dialogues structure and the functionality [1]. The evaluation uses a set of criteria to determine whether the design of MyEG portal is successful in achieving usability. The criteria are measured by conducting random online survey to government servants. The collection of gathered survey respond is further analyzed using fuzzy linguistic approach.

Questionnaire has been designed that enable usability evaluation on web portal. It is to enable analysis for all five main quality criteria mention earlier. The questionnaire is divided into two parts which are demographic and web portal usability type of question [9][10].Demographic questions such as gender, age group, MyEG service commonly use and frequency of internet access will be analyzed and use as a categories of overall result in this research. Table 1 shows the sample questions for demographic.

Table 1. Demographic Sample Questions

Category	Questions
Gender	☐ Male
	☐ Female
Age	☐ 18 – 30
	☐ 31 – 45
	☐ 46 - 65
Frequency of internet access	☐ Daily
	☐ Less than 4 times a week
	☐ When necessary

Second part of the questionnaire focused on how far the usability involved. It is determine by calculating usability and score. Questions for each criterion are adopted from the combination of [6][9]. This score are obtained by using fuzzy approach. Table 2 shows sample questions design for this part.

Table 2. Sample Questions (source:[6] [9])

Evaluation Criterion	Sample Questions
Attractiveness	This web site is presented in an attractive way. You can learn a lot on this web site.
Control	Going from one part to another is easy on this web site. I feel in control when I'm using this web site.
Efficiency	You can find what you want on this web site right away. This web site works exactly how I would expect it to work.
Helpfulness	This web site has not been designed to suit its users. All the parts of this web site are clearly labeled.
Learnability	All the material is written in a way that is easy to understand. It will be easy to forget how to use this web site.

5. Usability Evaluation Using Fuzzy Approach.

The analysis is conducted using fuzzy approach[11] due to uncertain and vague terminologies in questionnaire answers' options[12][13]. The result is obtained with the aid of Matlab tool. Following are the steps undertake to obtain usability score.

5.1. Fuzzification.

Answers' options are in the form of linguistic variables which range from strongly disagree to strongly agree. Empirical scale for each of these variables is defined. The value obtain depend on user choice. It is then fuzzified into fuzzy value using sigmoid membership function. Figure 1, Figure 2 and Figure 3 show the membership function representation in Matlab for user answer option, number of occurrence of each answer's option and the usability score respectively.
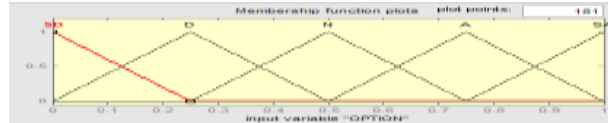
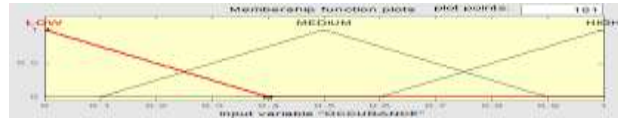Figure 1. Memberships function for Answer Option.

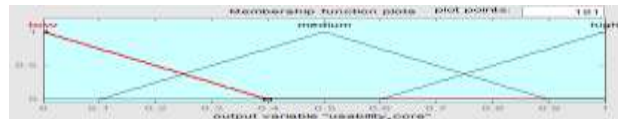Figure 2. Membership function for user answer number of occurrence

Figure 3. Membership function for usability score.

5.2. Rule Based Evaluation.
Rule base is equipped with the expert knowledge defined for every possible criterion. This rule base is store and inferred using fuzzy value in previous step. Figure 4 shows the rules defines for evaluating usability.

Figure 4. Rules defined for Usability Score

5.3. Aggregation.
Aggregation will calculate score for each of the rules inferred in the previous step. The result is based on the rules define in the knowledge base. Figure 5 shows the aggregation calculation. Figure 5 shows that only rules 7, 8 and 9 were inferred for 'Option'; rules 2, 5, 8, and 11 for 'Occurrence'. However, only rules 8 have usability score because both 'option' and 'occurrence' are inferred. If more than one rules are inferred, maximum value of usability score will be taken as final result in aggregation steps.

Figure 5: Rules aggregation for obtaining final fuzzy value.

Defuzzification: The value is defuzzified using Centroid of Gravity (COG) to form a single real value which is usability score. COG takes the average value obtain from aggregation steps. The score range from 0 – 100, which indicate usability degree; low(0-39); medium(40-75);high(76-100). Figure 6 shows the final result of the process which is obtaining crisp value. The crisp value in this case represents usability score.
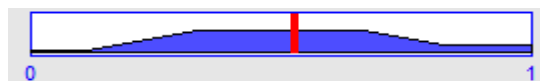

Figure 6: Crisp value obtains from defuzzification using COG.

6. Analysis of Results.

A typical questionnaire consists of a number of different type of questions are distributed and analyzed. The discussion on the analysis is divided into five main quality criterions to evaluate usability which are learnability; efficiency; attractiveness; helpfulness; control. This section will discuss the result in two-fold.

6.1. Result of Utility Evaluation.

Utility evaluation is conducted by using statistical approach. Data are collected from respondents for this survey by using online survey tool. Only 60 percent of the respondents have used MyEG and the rest are unaware and prefer to use traditional method. 75 percent from the respondents who used MyEG are female. In addition, the most popular services that use by the community are insurance renewal, road tax renewal and PDRM Summons alert.

6.2. Result of Usability Evaluation.

Usability evaluation is evaluated from the 60 percent of the respondents that used MyEG. Results for usability score is presented by each of the user and by criterion. Table 4 shows usability score by and Table 5 shows criterion the results of usability score for each user.

Table 4. Usability score by criterion

Criterion	Usability Score
Attractiveness	53.0
Control	53.0
Efficiency	53.0
Helpfulness	53.0
Learnability	53.0

Table 5. Usability score for each user.

USER	Usability Score
User 1	53.3
User 2	55.6
User 3	75.1
User 4	13.5
User 5	63.3
User 6	63.3
User 7	50.0
User 8	48.1
User 9	53.0
User 10	42.7
User 11	75.1
User 12	55.6

The result in Table 4 shows that all criterion having the same usability score of MyEG which are 53.0. The results in Table 5 shows most of the user evaluate usability under medium level. This has shown that MyEG have medium range of usability. Therefore, more improvement and adjustment need to be done on these criterions.

The result in Table 6 and Table 7 shows usability evaluation by demographic studies which are gender, age and Frequency of internet access.

Table 6. Usability Score by Gender

Gender	Usability Score
Male	53.3
Female	53.0

Table 6 shows that both male and female evaluating usability also on average score. Therefore, it shows that MyEG having an average score of usability. More improvement and enhancement need to be perform in order to maximize the usability and increase the probability of used by Malaysia community.

7. Conclusion

The Malaysian Government introduced e-Government under Multimedia Super Corridor (MSC). One of the flagships under eGovernment initiative is e-Services. The main idea of this paper is to reports the usability of MyEG web portal from user perspectives. The evaluation based on the attractiveness, control, efficiency, helpfulness and learnability. The evaluation is done through the questionnaire disseminated among government servants. Future work will is to evaluate the user interfaces in detail, utility and its reliability.

Acknowledgement

References

[1] N. Bevan, "Usability is Quality of Use," In proceedings of the 6th International Conference on Human Computer Interaction, Yokohama, July 1995. Anzai & Ogawa (eds), Elsevier.

[2] A. Ancarini,"Towards quality e-service in public sector: The evolution of web sites in the local public service sector," Managing service Quality, Vol. 15 (1), pp 6 - 23

[3] A. Rstlinger and S. Cronholm, "Design Criteria for Public E-Services," ECIS 2008 Proceedings. Paper 28

[4] J. Neilsen, "Usability Engineering," 13th ed. San Francisco : Morgan Kaufmann Publishers Inc., 1994. P.362. ISBN 0-125184-06-9.

[5] M. Hub and M. Zatloukal, "Model of Usability Evaluation of Web Portals Based on the Fuzzy Logic," WSEAS Transaction on Information Science and Applications. 2010. Vol 7, Issue 4, pp.522-531

[6] M. Hub and M. Zatloukal, "Methodology of Fuzzy Uability Evaluation of Information Systems in Public Administration," WSEAS T ransactions on Information Science & Applications. 2008, Vol 5, Issue 11, pp. 1573-1583.

[7] J.Withrow, T. Brinck and A. Speredelozzi, "Comparative Usability Evaluation for an e-Government Portal," Diamond Bullet Design Report #U1-00-2, Ann Arbor, MI. Dec 2000

[8] Xin C. Wang, B. Yadamsuren, A. Paul, D. Adkins, G. Laur, A. Tawfik and S. Erdelez,"Iterative Usability Evaluation for an Online Educational Web Portal," International Journal of Multimedia Data Engineering and Management (IJMDEM, 2010. Vol 1, issue 4, pp. 19

[9] J. Kirakowski, N. Claridge and R. Whitehand, "Human Centered Measures of Success in web Site Design," In Proceeding of 4th Conference on the Human Factors on the web, 1998.

[10] M. Hub and M. Zatloukal, "Methodology of Fuzzy Usability Evaluation of Information Systems in Public Administration," WSEAS Transactions on Information Science & Applications. 2008, Vol 5, Issue 11, pp. 1573-1583.

[11] L. Zadeh, " Fuzzy Sets," Information and Control. 1965, Issue 8, pp. 333-353.

[12] M. Zatloukal, "Usability evaluation of information Systems in Public Administration based on the fuzzy approach," Department of System Engineering and Informatics, University of Pardubice, 2009. P. 100, Master Thesis.

[13] Siler, William and Buckley, James J. "Fuzzy Expert System and Fuzzy Reasoning." 1st ed. Hoboken : John Wiley & Sons, Inc., 2005. P. 424. ISBN 0-471-38859-9 [9]   W. Cheney and D. Kincaid. Numerical Mathematics and Computing.Brook-s/Cole, 1985.