Investigating the Usability of Electronic Document Management Systems in Government Organizations from a Human Factor Engineering Perspective

Te-Jen Su, Shih-Mine Wang, Yi-Feng Chen, Tung-Yeh Tsou, and Jui-Chuan Cheng

National Kaohsiung University of Applied Science, Taiwan

Email: sutj@cc.kuas.edu.tw, wwang16@gmail.com, 2102305123@gm.kuas.edu.tw, traytsou@gmail.com,

eagle@cc.kuas.edu.tw

Abstract—In recent years the government has been endorsing the digitalization of documents to promote communication between government organizations as well as between these organizations and private enterprises. Under the direction of the National Development Council, document management systems have been developed, and integrated document exchange systems and integrated document creation systems along with other systems have been revamped. Currently used by 19 cities and counties along with 3,419 agencies and schools are using these systems. This study investigates the usability of document management systems in government organizations from a human factor engineering perspective. An experiment based on a user-focused design model and a human interface design standard was set up, and QUIS questionnaires were used to compare and analyze the current system and the new system that has a redesigned interface.

Index Terms—electronic document management systems, human factor engineering, HCD model, usability

I. INTRODUCTION

The electronic document management system of the test subject, Unit A, has been in use for 6 years. The specific needs of the organization's staff were not considered during the development of the system interface, consequently users found it difficult to use the operation screens. A system needs to have an interface that is user-friendly, easy to comprehend, and efficient. Hence, in this study the information system human-machine interface (HMI) usability evaluation standard is used to investigate and analyze the usability, user satisfaction, and related factors of the HMI based on the user experience of the staff of the government organization. This is used as the criteria for the modification of Unit A's system interface.

II. STUDY METHOD

The questionnaire used was based on the User Interaction Satisfaction (QUIS) tool developed by the Human-Computer Interaction Lab from the University of Maryland. It uses defined criteria of human-computer interface to evaluate the user's subjective satisfaction, and is a reliable and valid method. The designed questionnaire consists of three dimensions, namely "system interface", "system function" and "system usability". Questionnaires for the old and new systems were given to the staff of Unit A to assess user satisfaction in their interaction with the systems. SPSS software analysis tool and statistical methods were used, including: descriptive statistics, scaled reliability and validity analysis, K-S test, t test, paired sample analysis, *et al.*

III. SYSTEM INTERFACE DESIGN AND ANALYSIS

The system was modified; the item that caused users from Unit A the most dissatisfaction in the document management system interface design was "I think that there is sufficient assistance provided in the document management system." With respect to system function, the item that caused the most dissatisfaction was "I think the query function in the document management system is great." In terms of system usability, "Under the assistance of the system, I am reminded of my unfinished document management tasks" scored the lowest shown in Table I.

In this study the "System Interface" and "System Function" dimensions were modified using the "Prototype Development Method" to develop an interface prototype.

The biggest advantage to prototyping is that feedback and opinions from the user can be instantly known, and user requirements can be met [1].

From the questionnaire results, the most commonly used functions in the document management system are "Query" with 34.2% and "Document Processing Operations" with approximately 63.2%. It can be seen that "Query" and "Document Processing Operations" are the most frequently used functions. This study added functions and altered the "System Login Screen", the "Document Management System Main Screen", "Query", and "Document Processing Operations" interfaces. An analysis for the following old and new screen layouts were carried out:

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1. Login screen: The old document management system user login screen is likely to cause visual confusion, the new document management system in general the more pastel series of background to help the overall layout of harmony. Users do not like too many images or text page, blank screen like the amount of 31% to 60% shown in Fig. 1. [2].



Figure 1. Login screen of the new and old systems.

2. Operation screen division: The new document management system allowing users to choose according to personal needs to open or close the left options bar, make the forum read a larger area, allowing users to read visual layout more comfortable.

3. Browsing assistant tool: Added "Back" feature allows users to easily return to the previous screen, and joining the "Novice (Help)" function. Allows users to find the right way to the operating system, a good on-line help operational issues HELP. Increase over the forum "Restore job" feature that allows the user to start over. Referring to so-called "user affinity" and "computer system soundness" is often based on forgiveness and restoration functions to achieve shown in Fig. 2 [3] - [4].



Figure 2. Browsing assistant tool of the new and old systems.

4. Query function: Should not be only one kind of inquiry, it should provide users with a rich multi-query. Let the old data message more easily query to get viewers shown in Fig. 3 [5].



Figure 3. Query function of the new and old systems.

5. In order to reduce the burden on the user's memory, color coding is used in this study to show users the sections that are already visited. For example: blue indicates clickable links, and purple indicates links that are already visited. The user should be able to clearly differentiate

between texts which have been selected before and those that have not shown in Fig. 4 [6].

	ţ	北頁3筆 資	料/到第一	三頁/
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收創文別		主	冒	
0989000003	098/06/09	098/06/17	承辦-辦理中	王士銘
創稿	公文管理系	統測試-01		
09890000 <mark>0</mark> 4 創稿	098/06/09 <u>系統修改開</u>	098/06/17 <u>會通知</u>	承辦-辦理中	王士銘
09890000000 收交		090/00/17 砲文测武	承辦-辦理中	王士銘

Figure 4. Color coding of the new systems.

6. The new system has an added function for notifications in the form of pop-up windows that will certainly catch the attention of users who have yet to input the file number. Pop-up windows are the best method for displaying notifications shown in Fig. 5 [7].



Figure 5. Notifications in the form of pop-up windows of the new systems.

TABLE I.	AVERAGE SCORES FROM THE USER QUESTIONNAIRES FOR
	THE NEW AND OLD SYSTEMS

Dimension	Question Number	Response item	Average score	Standard deviation
	4	I think the "Document Management System" To go back to the previous screen is simple	2.95	1.54
System Interface	5	I think that helps, "document management system" provided by the (Help) is sufficient	2.64	1.29
	10	I think the "document management system" page segmentation appropriate field	3.02	1.51
System Function	12	I think the query function document management system provided is a good	2.93	1.53
System Usability	23	I think the document management system is easy to use	3.16	1.52
	25	Under the assistance of the system, I am able to finish my document management tasks quickly.	3.09	1.43
	26	Under the assistance of the system, I am reminded of my unfinished document management tasks.	3.07	1.44

IV. RESULT ANALYSIS

For both the new and old document management systems, the Cronbach's α value of system interface, function, and usability met the suggested value of 0.7 [8]. In this study, based on the results of Kolmogorov-Smirnov test for a single sample, and under the condition of the old and new systems complying with normal distribution, paired sampled t-test was used to test for significant difference. Experiment analysis shows, under a one-tailed test with α =0.05, the old and new system's "interface design" and "usability" showed significant difference, while significant difference was not found with "function design", as shown in Table II-Table IV as described follows:

Dimension	Variables name	Z-value	P-value
System interface	old systems	0.483	0.974*
	new systems	0.519	0.950*
System function	old systems	0.570	0.901*
	new systems	0.458	0.985*
System usability	old systems	0.661	0.774*
	new systems	0.731	0.660*

TABLE III.	T TEST FOR THE NEW AND OLD SYSTEMS
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Dimension	Paired variable difference			degrees	
	Average score	Standard deviation	L	freedom	significant
new-old systems (interface)	3.13	8.85	2.18	37	0.036*
new-old systems (function)	2.65	8.43	1.94	37	0.060
new-old systems (usability)	4.05	5.20	4.79	37	0.000*

1. The first dimension of the questionnaire is the document management system interface design, and has 11 response items. Results: p=0.036<0.05, indicating a statistically significant level. This indicates that there is a significant difference between the old and new system interface design.

2. The second dimension of the questionnaire is the document management function design, and has 11 response items. Results: p=0.06<0.05, indicating a statistically non-significant level. This indicates that there is no significant difference between the old and new function design.

3. The third dimension of the questionnaire is the document management system usability, and has 6 response items. Results: p=0<0.05, indicating a statistically significant level. This indicates that there is a significant difference between the old and new system usability.

4. From the above, we find that in the dimension of document management system function design, the experiment shows no significant difference between the old and new system. But with respect to interface design and usability of the document management system, the new system's average scores are higher than that of the old in every aspect indicating that there are improvements in all aspects in the new system.

Dimension	Variables name	number	Average score	Standard deviation
System interface (N=11)	old systems	38	40.92	8.16
	new systems	38	44.05	4.67
System function (N=11)	old systems	38	41.23	7.74
	new systems	38	45.07	4.15
System usability (N=6)	old systems	38	21.03	6.64
	new systems	38	25.08	4.89

V. CONCLUSION

Most of the academic literature of document management systems investigate the electronic document exchange or the performance of document management system within an organization, and rarely investigates or verifies the influence of human factor engineering on the system. In this study, an analysis of the combination of variables in human factor engineering was performed, and based on the level of significance, determined the relative degree of influence of the various variables on the old and new systems. Through experiment design, we completed tests relating to human-machine interaction and interface usability in order to understand how HMI can improve the usability of document management systems, providing the user with an easy-to-use and easy-to-learn interface, increasing the desire to use the system, and increasing the user satisfaction. The following definite results were obtained by the experiment:

1. Improvements in the new system include User Help function, Undo function, Feedback function, and overall aesthetics. These improvements help increase user satisfaction with respect to system interface and usability, and help meet the requirements of comprehensiveness and user-friendliness in the design of system interfaces.

2. The improvements of the document management system interface were investigated and validated using the human factor engineering, and a system with a compliant HMI standard was established.

3. When setting up a document management system, the use of human factor engineering for system interface design will help to achieve efficient use of the system, and meet the objective of establishing a successful document management system for government organizations.

The results from this study can be used as reference or basis for system designers in the future.

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Shih-Mine Wang received the Ph.D. student from the Department of Electronic Engineering, National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan, in 2015, and the M.S. degree from the Department of Information Management, National Kaohsiung First University of Science and Technology, Kaohsiung, Taiwan, in2007. His research interests include human factor engineering, System Analysis and

Design, Computer Networks and Internets, Enterprise Resource Planning.



Yi-Feng Chen received the Ph.D. student from the Department of Electronic Engineering, National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan, in 2015, and the M.S. degree from the Department of Electronic Engineering, National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan, in 2015. His research interests include IC assembly process and Semiconductor materials.



Tung-Yeh Tsou received the M.S. degree from the Department of Electronic Engineering, National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan, in 2012. He currently serves on the Chunghwa Telecom Company, engaged in the planning and design work. His research interests include communication theory and application, ASP.NET programming language

development and cloud computing database.



Te-Jen Su received the Ph.D. degree in electrical engineering from National Cheng-Kung University Tainan Taiwan, in 1989. He is currently a Professor with the Department of Electronic Engineering, National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan. His research interests include intelligent control systems, embedded processor design and satellite communication systems.



Jui-Chuan Cheng received the Ph.D. graduate from the Department of Electronic Engineering, Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan, and he is an associate professor in the Department of Electronic Engineering, National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan. His research interests include Intelligent Algorithm and Digital Signal Processing.