Investigating the Success of "Asklepieio Voulas" Hospital Information System

Loukas THANOS[a,1], Parisis GALLOS[a], Emmanouil ZOULIAS[a] and John MANTAS[a]

[a] *Health Informatics Laboratory, Faculty of Nursing, National and Kapodistian University of Athens, Greece*

Abstract. Hospital Information Systems assessment is important to ensure the quality of provided healthcare services. This research evaluates the success of the clinical information system used in the General Hospital "Asklepieio Voulas". A questionnaire was developed based on the DeLone & McLean information systems success model, and used on February 2020, to record the users' opinions regarding the information system. The reliability of the questionnaire was tested by applying Cronbach's alpha analysis, descriptive statistics was calculated for all variables of the questionnaire, and new variables was created to investigate the relationships between the model's factors. Correlation analysis between the factors and linear multiple regression analysis between some of the factors of the DeLone & McLean success model were conducted 218 users responded to the survey, 56.3% of them were medical doctors, 24.1% nurses, and 19.6% other staff of the hospital. Results highlight that the users of the system are satisfied with it. A77.3% of the participants believe that they perform their work more easily when using the system, while 89.3% of the participants believe that the system is useful in their work. According to the results of the model, system quality and information quality seems to be related with the system usage. Information quality plays the most important role in the use of the system while the system quality plays the most important role in user satisfaction. Based on the users' opinions, the "Asklepieio Voulas" Hospital Information System can be assumed as successful.

Keywords. Information System, Success, DeLone & McLean, General Hospital Asklepieio Voulas, System Quality, Information Quality, Use, User Satisfaction, Perceived Benefits

1. Introduction

Health information systems are being used to analyze and manage sensitive and crucial data about the health of citizens [1]. It is important for healthcare organizations, such as hospitals, to evaluate their information systems to ensure the system quality and the quality of the healthcare services provided to citizens [2]. High system and information quality, high availability of the system, user satisfaction and the benefits of using a system are some important factors related to the success of a system [3]. A lot of recent studies focus on the success or failure of the information systems in several domains of the everyday life [4-6] in public [7] or private sector [8]. The purpose of this paper is to investigate the success of the information system used in the General Hospital "Asklepieio Voulas", Athens, Greece.

---

[1] Corresponding Author, Loukas Thanos, MSc, Health Informatics Laboratory, Faculty of Nursing, National and Kapodistian University of Athens, Greece; E-mail: loukasth@yahoo.gr.

2. Methods

To achieve the aim of this research, a questionnaire was distributed among the users of the "Asklepieio Voulas" Hospital Information System, on February 2020, to record the users' opinions. The questionnaire used in the research was developed based on the information systems success model of DeLone & McLean [3]. Other related studies were used in order to find translated questions in Greek language regarding the model's factors [9-11]. In this questionnaire, four questions were related to demographics (gender, age, level of education, specialty of the user) and 22 questions were used to assess five factors of DeLone & McLean's information systems success model. The questions that measure the factors of the success model of DeLone & McLean were selected from various questionnaires of previous studies [2, 9-14]. The "system quality", "information quality", "system usage" ("use"), "user satisfaction" and the "perceived benefits from using the system" ("benefits") were examined. To measure the aforementioned factors, a seven-point likert scale was used, consisting of 7 predefined answers which correspond to participant's agreement with the question/statement. Specifically, the answer 'strongly disagree' corresponds to the numerical value 1, and the answer 'totally agree' corresponds to the numeric value 7. The questionnaire was distributed to "Asklepieio Voulas" hospital employees who are users of the information system. The research was carried out after the permission of the scientific committee of the hospital. 224 users of the system responded to the survey. SPSS version 22 software was used for the statistical analyses, to test the reliability of the questionnaire by applying Cronbach's alpha analysis, as well as to calculate descriptive statistics for all variables of the questionnaire. In order to examine the relations between the factors seven new variables (one for each factor) was created based on the means of the values of the items for each factor. Correlation analysis between the factors and multiple linear regression analysis between some of the factors of the DeLone & McLean success model were conducted.

The following research questions were examined:

- Q1: Is "system quality" associated with "use".
- Q2: Is "system quality" associated with "user satisfaction".
- Q3: Is "information quality" associated with "use".
- Q4: Is "information quality" associated with "user satisfaction".
- Q5: Is "use" associated with "user satisfaction".
- Q6: Is "use" associated with "benefits".
- Q7: Is "user satisfaction" associated with "benefits".
- Q8: How "system quality" and "information quality" are associated with "use".
- Q9: How "system quality" and "information quality" are associated with "user satisfaction".
- Q10: How "use" and "user satisfaction" are associated with "benefits".

3. Results

From the 224 questionnaires completed, 218 were valid. 6 responses were considered invalid because users did not complete demographic and other questions. The 40.2% of the sample are men and 59.8% women. The 56.3% of the sample are medical staff,

24.1% nursing staff, 11.2% administrative staff, 5.8% paramedical staff and 2.7% pharmacists. The 13.4% of the users are secondary education graduates, 49.1% are higher education graduates, 23.7% have postgraduate studies, and 13.8% have doctoral studies. Most participants were middle-aged with a median age of 45.00 years. Regarding the reliability of the questionnaire, the Cronbach's Alpha score for all items was 0.96, for "system quality" items was 0.85, for "information quality" items was 0.89, for "use" items was 0.81, for "user satisfaction" items was 0.95, and for "benefits" was 0.94. For example, 77.3% of the participants believe that when using the clinical information system, they perform their work more easily, while 89.3% of the participants believe that the clinical information system is useful in their work. The mean of the items for the "system quality" is 4.9 out of 7, for "information quality" is 5.2, for "use" is 5.5, for "user satisfaction" is 4.8 and for "perceived benefits of using the system" is 5 out of 7, as well as all the medians of the items and the new variables are 5 or 6 revealing the positive attitude of the users towards the information system. To investigate the aforementioned research questions, Q1 to Q7, spearman correlation was calculated. All the above research questions found to be statistical significant (p-values < 0.01). Regarding Q8 to Q10 multiple linear regression analysis produced the following results: for Q8 the $R^2 = 0.436$ and the p-value < 0.01. Q8 equation is "use" $=2.234+(0.263x$ "system quality") + (0.359x "information quality"). For Q9 the $R^2 = 0.682$ and the p-value < 0.01. Q9 equation is "user satisfaction" = $-0.5+(0.636$ x "system quality") + (0.415 x "information quality"). And for Q10 the $R^2 = 0.684$ and the p-value < 0.01. Q10 equation is "benefits" = $-0.428 +(0.724$ x "use") + (0.318 x "user satisfaction").

4. Discussion

The results of the research reveal that there are statistically significant relations between the factors of the DeLone & McLean information systems success model. System usage is related with system quality and information quality. Information quality plays the most important role in the use of the system while the system quality plays the most important role in user satisfaction. The use of the system depends on the satisfaction that users have of it. Also, based on the results, as the system usage increases, an increment on the perceived benefits of the system is observed. Additionally, the factor "use" is affected by the factors "system quality" and "information quality". This finding is consistent with other previous studies such as the study conducted in 2019 in four Riyadh-KSA hospitals and evaluating the quality of the information system of these hospitals [15], the study conducted in 2017 in Nigerian hospitals for evaluation of the success of the information system [16], the study was conducted in 2015 and concerned the evaluation of a new hospital information system implemented in July 2014 in 3 public hospitals in Korea [2]. In contrast, another study conducted in 2016 measuring the success factors of the PMO information system used by various clinics and health centers in the Klang Valley, Malaysia [17] found that the "use" factor was not affected by the "system quality" factor but is affected by the "information quality" factor.

The current research also found that the factor "user satisfaction" is influenced by the factors "system quality" and "information quality". This finding is consistent with the findings of previous studies such as the study conducted in 2019 in four Riyadh – KSA hospitals and evaluating the quality of the information system of these hospitals

[15], the study conducted in 2017 in Nigerian hospitals for the evaluation of the success of the information system [16], the study conducted in 2016 and measuring the success factors of the PMO information system used by various clinics and health centers in the Klang Valley, Malaysia [18], and the study conducted in year 2015 and concerned the evaluation of a new hospital information system implemented in July 2014 in 3 public hospitals in Korea [2].

This research also found that the factor "user satisfaction" is influenced by the factor "use". This finding is consistent with the findings of previous studies such as the study conducted in 2019 in four hospitals of Riyadh – KSA and evaluated the quality of the information system of these hospitals [15], and the study conducted in 2016 and measured the factors success of the PMO information system used by various clinics and health centers in the Klang Valley, Malaysia [18]. This finding contradicts an earlier study conducted in 2017 in Nigerian hospitals to evaluate the success of the information system [16] which showed that the "use" factor did not affect the "user satisfaction" factor.

Finally, this research found that the factor "perceived benefits from the use of the system" is influenced by the factors "use" and "user satisfaction". This finding is consistent with the findings of previous studies such as the study conducted in 2019 in four hospitals of Riyadh – KSA and evaluated the quality of the information system of these hospitals [15], and the study conducted in 2016 and measured the factors success of the PMO information system used by various clinics and health centers in the Klang Valley, Malaysia [18]. Another study conducted in 2017 in Nigerian hospitals to evaluate the success of the information system [16] found that the "use" factor affects the "perceived benefits of using the system" factor but the "user satisfaction" factor does not affect the "perceived benefits of using the system" factor. Another study conducted in 2015 on the evaluation of a new hospital information system implemented in July 2014 in 3 Korean public hospitals [2] found that the "perceived benefits of using the system" factor was not affected by the "use" factor but is significantly affected by the "user satisfaction" factor.

5. Conclusions

Healthcare organizations should evaluate the successful implementation of the information systems, to ensure the system quality and the quality of the healthcare services provided to citizens. The results of the research validated the information systems success model of DeLone & McLean and the clinical information system used in the General Hospital "Asklepieio Voulas" is considered reliable, easy to use, easy to learn and effective. Most of the users are satisfied by the system and they believe that the clinical information system meets their needs and has all the functions they need to accomplish their daily work. This research had some limitations. A major constraint was the heavy workload of the staff combined with the limited time available to conduct the survey. As a result, not all users responded to the survey. A second equally important limitation is the age of the hospital computer systems that can affect the perceived performance of the system. Future work may include additional evaluation of the hospital information system used in the General Hospital "Asklepieio Voulas" using factors such as the service quality, computer literacy or professional specialty. In conclusion, the research validated the success model of information systems of DeLone

& McLean and the hospital information system used in the General Hospital "Asklepieio Voulas" is considered "successful".

Acknowledgements

References

[1]   Ammenwerth E, Kaiser F, Wilhelmy I, Höfer S. Evaluation of user acceptance of information systems in health care - The value of questionnaires. Stud Health Technol Inform. May 2003;95:643–8.

[2]   Cho KW, Bae SK, Ryu JH, Kim KN, An CH, Chae YM. Performance evaluation of public hospital information systems by the information system success model. Healthc Inform Res. 2015;21(1):43–8.

[3]   DeLone W., McLean E. The DeLone, McLean. Model of Information Systems Success: A Ten-Year Update. J Manag Inf Syst [Internet]. 2003 Jan;19(4):9–30. Available at: http://eli.johogo.com/Class/p7.pdf.

[4]   Roky H, Meriouh Y Al. Evaluation by Users of an Industrial Information System (XPPS) Based on the DeLone and McLean Model for IS Success. Procedia Econ Financ. 2015;26(0):903–13.

[5]   Floropoulos J, Spathis C, Halvatzis D, Tsipouridou M. Measuring the success of the Greek Taxation Information System. Int J Inf Manage. 2010;30(1):47–56.

[6]   Armstrong B, Fogarty G, Dingsdag D, Dimbleby J. Validation of a Computer User Satisfaction Questionnaire to Measure IS Success in Small Business. J Res Pract Inf Technol. 2005;37(1):27–41.

[7]   Tona O, Carlsson SA, Eom SB. An empirical test of Delone and McLean's information system success model in a public organization. 18th Am ConfInfSyst 2012. AMCIS 2012. 2012;2:1374–82.

[8]   Alzahrani AI, Mahmud I, Ramayah T, Alfarraj O, Alalwan N. Modelling digital library success using the DeLone and McLean information system success model. J Librariansh Inf Sci. 2019;51(2):291–306.

[9]   Gallos P, Minou J, Routsis F, Mantas J. Investigating the Perceived Innovation of the Big Data Technology in Healthcare. Stud Health Technol Inform. 2017;238:151-153.

[10] Gallos P, Daskalakis S, Katharaki M, Liaskos J, Mantas J. How do nursing students perceive the notion of EHR? an empirical investigation. Stud Health Technol Inform. 2011;169:243-7.

[11] Stylianides A, Mantas J, Roupa Z, Yamasaki EN. Development of an Evaluation Framework for Health Information Systems (DIPSA). Acta Inform Med. 2018;26(4):230-234.

[12] Saghaeiannejad-Isfahani S, Saeedbakhsh S, Jahanbakhsh M, Habibi M. Analysis of the quality of hospital information systems in Isfahan teaching hospitals based on the DeLone and McLean model. J Educ Health Promot. 2015;4(February):5.

[13] Alipour J, Karimi A, Ebrahimi S, Ansari F, Mehdipour Y. Success or failure of hospital information systems of public hospitals affiliated with Zahedan University of Medical Sciences: A cross sectional study in the Southeast of Iran. Int J Med Inform 2017;108(August):49–54. Available at: http://dx.doi.org/10.1016/j.ijmedinf.2017.10.005.

[14] Arana L, Medina L, Pol E, Tun N. Measuring the Success of Hospital Information System (HIS) at La Loma Luz Adventist Hospital. p. 1–13.

[15] Elsadig M, Nassar DA, Menzli LJ. Healthcare Information System Assessment Case Study Riyadh's Hospitals-KSA. In: First International Conference on Computing, ICC 2019 Proceedings, Part II [Internet]. 2019. p. 252–62. Available at: http://www.springer.com/series/7899.

[16] Ojo AI. Validation of the delone and mclean information systems success model. Healthc Inform Res. 2017;23(1):60–6.

[17] Mamma E. Evaluation and Quality of Information Systems in Institutional Organizations. 17th Hell ConfAcabemicLibr [Internet]. 2008; p. 1–14.
      Ibrahim R, Auliaputra B, Yusoff RCM, Maarop N, Zainuddin NMM, Bahari R. Measuring the Success of Healthcare Information System in Malaysia: A Case Study. IOSR J Bus Manag. 2016;18(4):100–6.