Babylonian Journal of Machine Learning
Vol.2024, **pp.** 102 – 111
DOI: https://doi.org/10.58496/BJML/2024/010; ISSN: 3006–5429
https://mesopotamian.press/journals/index.php/BJML

Research Article

Data Analysis of An Exploring the Information Systems Success Factors for Early Warning Systems Adoption

Waleed A Hammood[1]*, Omar Abdulmaged Hammood[2], Salah A. Aliesawi[1], Ejiro U. Osiobe[3], Raed Abdulkareem Hasan[4], Safia Malallah[5]

[1] *Faculty of Computer Science and Information Technology, University of Anbar, Ramadi, Iraq*

[2] *Business Administration Department, Faculty of Administration and Economics, University of Fallujah, Fallujah, Iraq*

[3] *Department of Business and Economics, Baker University, Baldwin City, KS, USA*

[4] *Renewable Energy Research Unit, Northern Technical University, Mosul, Iraq*

[5] *Department of Computing and Information Sciences, Kansas State University, Manhattan, KS, USA*

ARTICLE INFO

Article History
Received 25 Mar 2024
Accepted 28 May 2024
Published 20 Jun 2024

Information systems Success model
Data Analysis
Service quality
Flood mitigation
Flood management

ABSTRACT

Naturally occurring floods are an essential part of life in many parts of the world. Floods, of all the natural dangers, have the greatest effect on society because they cover large geographic regions, happen often, and have a lasting negative socioeconomic impact. Thus, it becomes necessary to design a comprehensive and successful strategy for preventing floods, which will require technical advancements to improve the operational efficacy of government organizations. The Flood Early Warning and Response System (FEWRS), which gives pertinent stakeholders fast information and practical reaction guidelines, emerges as a critical instrument in reducing the loss of lives and property. Unfortunately, current FEWRS frequently fall short of providing enough information on flood disasters, which reduces their ability to mitigate local-level effects and impedes attempts to save lives. Assessing the effectiveness of information systems (IS) within this particular setting is a noteworthy obstacle for scholars, professionals, and administrators. The objective of this research is to tackle this difficulty by exploring the factors that lead to the success of FEWRS. This involves incorporating risk knowledge and response capabilities into the standard IS success model. The present study employs the DeLone and McLean (D&M) models due to their efficaciousness in meeting the designated requirements that are essential for mitigating the impact of flooding disasters.

1. INTRODUCTION

Floods are also part of the cycle of nature; they bring nutrients that fertilize flood plains, and these plains are the spawning ground for many species of fish. The challenge is to reduce human exposure to the detrimental impacts of floods while maintaining its positive environmental effects [1]. People live in different places and are accustomed to natural floods at different rates and magnitudes throughout millennia [2, 3]. For some regions of the world, such floods are usually predicted and accepted because they improve the land and provide water and livelihoods. In comparison, floods from extreme hydroelectricity. Meteorological occurrences and what occurs [4]. Floods are perhaps the most frequent and dangerous natural occurrence, impacting 520 million people annually. In recent decades, almost half of the people killed in coastal regions of the world as a consequence of natural disasters have been the perpetrators of floods, which often compensate for around one-third of the worldwide economic casualties incurred by such disasters [5]. The Flood Early Warning and Response System (FEWRS) is a vital tool in lowering the loss of life and property by providing relevant stakeholders with quick information and actionable guidance. Service quality, system quality, and information quality are the critical success factors of an Information Systems (IS), according to the IS success model put forward by DeLone and McLean in 2003 (D&M) [6]. The usage and satisfaction of users are significantly impacted by these three criteria [7, 8]. In the context of FEWRS, the IS success model has garnered considerable attention. However, it has seldom been used to explain why FEWRS, an emerging information technology, has succeeded. Therefore, to explore the success elements of FEWRS, the IS success model must be utilized [1]. The present FEWRS's incapacity to deliver accurate, timely, and useful information is

*Corresponding author. Email: a964585@gmail.com

one of its main flaws. This lack of knowledge may result in insufficient planning and localized reaction, worsening the damage caused by floods. A FEWRS's effectiveness is contingent upon several factors, including the technology employed, the degree to which it meshes with regional emergency response systems and the clarity of the communication channels. The differences in the quality and availability of information draw attention to the necessity for a more thorough and complete approach to FEWRS. By analyzing the elements that make FEWRS successful, the research seeks to remedy these shortcomings. The DeLone and McLean (D&M) models are used in this situation. The D&M models, which are well-known for taking a thorough approach to evaluating the effectiveness of information systems, concentrate on several important factors, such as system quality, information quality, service quality, utilization, user happiness, and net benefits. Through the integration of these characteristics, the study aims to determine the efficacy of FEWRS and identify areas in need of development. Integrating risk knowledge and response capabilities within the current IS success framework is essential to improving FEWRS. Understanding and sharing the possible hazards of flooding is known as risk awareness, and it has a big impact on reaction and preparation strategies. Proficient reaction capacities guarantee that the data furnished by FEWRS results in prompt and suitable measures to alleviate the consequences of flooding. As a result, a good FEWRS should improve the users' capacity to comprehend and apply the information in addition to providing precise and fast information. The D&M models offer an organized method for assessing these factors, with an emphasis on how system and information quality affect user satisfaction and net benefits. High-quality information for FEWRS has to be fast, reliable, and relevant so that stakeholders may decide wisely when there is flooding. Comparably, system quality includes the FEWRS's dependability, efficiency, and usability, guaranteeing that users can easily obtain and comprehend the data. Another important component of the D&M models is service quality, which is related to the assistance given to FEWRS users [9]. This covers continuous maintenance, technical assistance, and all crucial for making sure the system runs well and that users can make the most of it. A system's overall success depends on user satisfaction and trust, both of which may be increased by providing high-quality services. The efficacy of the system may be directly measured by looking at how FEWRS is used and how satisfied users are with the results [10]. Stakeholders use the system efficiently and often show that it fulfills their needs and provides useful information. The perceived advantages of the system, such as its usability, the applicability of the information offered, and its overall influence on flood preparedness and response, are reflected in user satisfaction [11].

2. RELATED WORKS

Floods are major natural disasters that have a profound influence on many parts of the world. Because of their frequent occurrence, extensive impact, and huge social ramifications, floods pose serious issues. This emphasizes how important it is to have efficient flood response and prevention plans of the instruments created to meet this demand, Understanding the processes behind the dynamics of such severe occurrences and being able to predict them is one of the biggest problems facing science today. Improving flood mitigation, boosting readiness, and ultimately adjusting to these novel situations brought about by climate change all depend on this. These responsibilities span a wide range of disciplines. All of these disciplines of research from hydrology to meteorology, including soil, topography, and climatic analysis contribute to and are required to accomplish the previously described goals. The FEWRS is one of the most important inventions. Nevertheless, despite their significance, current FEWRS sometimes fall short of providing sufficient information regarding flood catastrophes, impeding their ability to lessen local effects and save lives. Four elements form the foundation of an exhaustive and full FEWRS: (i) preparedness to respond; (ii) detection, monitoring, and analysis; (iii) flood risk knowledge; and (iv) warning dissemination and communication [12]. The FEWRS is a significant, dynamic, and non-structural mitigation option that may be upgraded to lower the danger to human life associated with hazardous event occurrence [4]. FEWRS is a system that allows communities at risk or organizations participating in emergency response operations to get information from specialized observations of natural phenomena so that specific activities may be completed before a catastrophic disaster strikes. Currently, existing FEWRS do not successfully and effectively provide information on flood disasters to reduce the impacts at the local level [2, 3]. However, prior studies argued that the Success or failure of IS implementation highly relies on the level of success and user acceptance [1, 2, 5, 13]. Furthermore, measuring IS success remains a top concern for researchers, managers, and practitioners; therefore, it is necessary to identify and specify the factors that determine the success of FEWRS in mitigating flood disasters. The D&M model has been adopted and extended in many research fields because it mainly focuses on the system's effectiveness and success rather than user acceptance of new technology, such as the Technology Acceptance Model (TAM) [14]. Accordingly, this study proposes a conceptual model for FEWRS by extending the D&M with extended factors, which are risk knowledge and response capability, where previous studies revealed that D&M can be adapted to address the factors that contribute to the success model of FEWRS. A well-known framework for assessing the success of IS is the D&M. Researchers can evaluate and comprehend the elements influencing the efficacy and efficiency of IS implementations to integrate many success dimensions into a coherent model. The D&M model's extensive approach to assessing IS success has led to its widespread adoption in the IS field. This approach has been used by researchers to evaluate and enhance IS implementations in a variety of contexts, including corporate systems, e-commerce, healthcare, and education. Although more research is required to refine and further improve the proposed model, this study's primary contribution to flood(s) management literature is theoretically creating an advanced

D&M with FEWRS model. Hammood, et al. [3] After analyzing 40 articles, the authors have identified the 16 most important of the 66 factors that have an impact on FEWRS success, emphasizing the D&M model has been the most theory-used and appropriate for evaluating the success of FEWRS. In addition, the study results from Samansiri, et al. [12] do not provide clear knowledge of the failure factors of FEWRS since they point to more general influencing aspects for "information systems" rather than flood warning systems specifically.

3. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

The proposed model comprises variables adopted from the success model, consisting of two main components. Thus, this study opted to employ the D&M model because the model can accommodate the factors to be considered in developing the conceptual model. In addition, the D&M model has been successfully adopted several times by prior researchers in the IS domain [15-17]. Moreover, prior studies such as [18, 19] recommended that to assess the net benefit measures, there is a need to incorporate and investigate field-study research into the model. Besides, [20-23] argued that the success model proposed by D&M aimed to identify the technical and social factors to be assimilated. Thus, the success model offers an approach to explore the successful contingent related to stakeholders and IT implementation [7, 24, 25]. Accordingly, Figure 2 presents the selected factors from the D&M model with the extended FEWRS components for the proposed model based on D&M variables, which include Information Quality (IQ), System Quality (SQ), Service Quality (SERQ), User Satisfaction (US), and Intention to Use (IU). The extended factors include Risk Knowledge (RK) and Response Capability (RC).

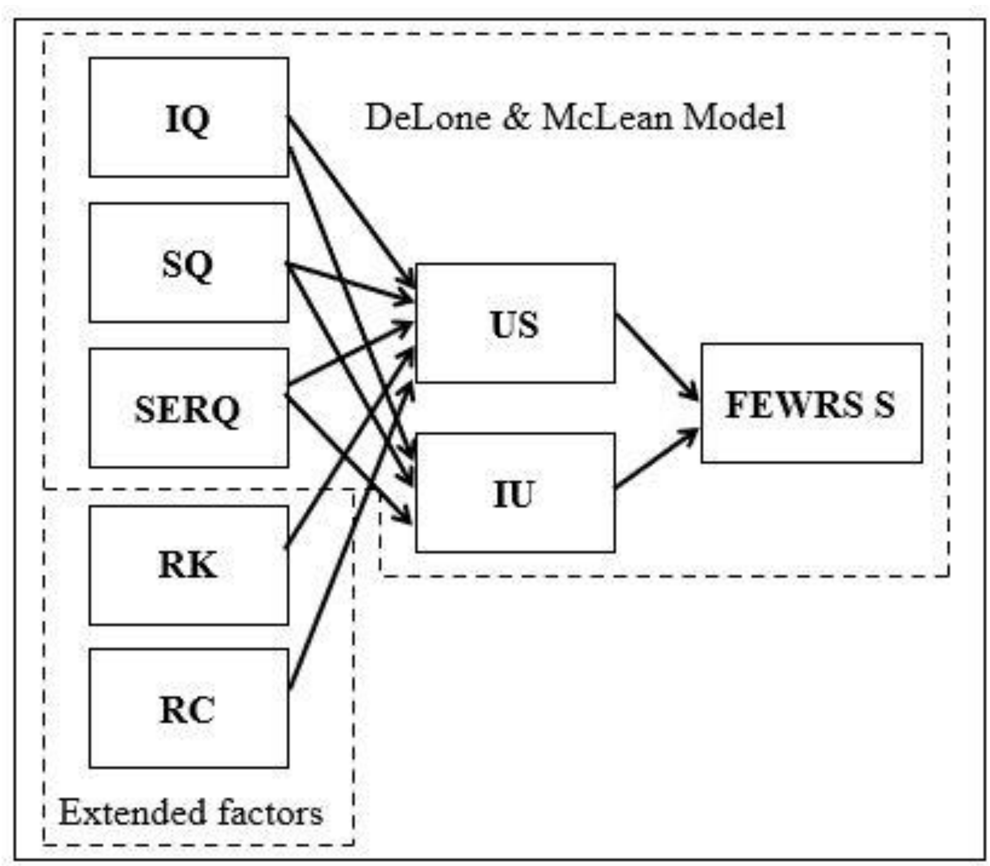

Fig. 1. The Conceptual Model

Figure 1 depicts conceptualizing the FEWRS model based on the D&M and IS success model.

TABLE I. A CONSTRUCTS, DEFINITIONS, AND SOURCES.

Constructs	Definition	Source
Information quality	Providing information dissemination and communication to users.	[6]
System quality	Characteristics and features of the system.	[6]
Service quality	Quality of support that the end users receive from the system	[6]
Risk knowledge	Risk in the system such as knowledge map	[26, 27]
Response capability	Response capability and information provided by the system.	[26, 27]
User satisfaction	Measures the extent to which user believe that their desires, needs, and goals using the system.	[6, 19]
Intention to use	These variable measures the likelihood that end users will continue to use the technology.	[6, 19]

Table 1 depicts the factors and their definitions with resource for each factor. Next, each of the factors and developed hypotheses are presented.

3.1 Information Quality

In IS success model, information quality is suggested by D&M [6], to measure the quality of information that the system creates and its usefulness for end users. The information quality is measured based on different semantic attributes such as conciseness, reliability, feedback, completeness accuracy, up-to-date information, and timeliness [28]. Moreover, information quality provides information dissemination and communication to users, decision makers and stack holder in the context of FEWRS [27]. Information quality is also based on the success dimension content which represents the desirable characteristics of output derived from IS [29, 30]. Accordingly, in this study, information quality is assumed to have a positive impact on both user satisfaction and their intentions to use. Thus, the hypothesis as follows:

H1: Information quality will positively influence satisfaction.

H2: Information quality will positively impact intention to use.

3.2 System Quality

System quality constitutes the quality of support that users receive from the system [18]. It refers to technical success and the accuracy and efficiency of information produced by the system. Besides, system quality constitutes the measures and desirable characteristics of an IS and it relates to the absence and presence of a bug in the system [23, 24]. Findings from prior studies suggested that system quality has been found to have a significant positive effect on satisfaction [18, 25-27] and on intention to use [15, 28, 29]. In this study, system quality has a positive effect on both satisfaction and their intentions towards use of system. Thus, the hypothesis as follows:

H3: System quality will significantly influence affects satisfaction.

H4: System quality will significantly influence intention to use.

3.3 Service Quality

Service quality constitutes the quality of support that users receive from the system such as helpdesk and training [31]. Usually, the quality of service is utilized in evaluating information system quality by assessing if the system can deliver the required services to end users. Thus, the incorporation of success dimension in a model is encouraged because it is normally considered as subordinate to system quality in a model. However, some scholars believe that service quality should be assessed individually based on technological changes experienced in IT domain. Moreover, findings from the literature suggested that service quality has been found to positively influence satisfaction and intention to use [32-34]. Thus, it is apparent that service quality has a positive influence on both user satisfaction and users' intention to use. Based on the literature, we propose the following hypotheses that:

H5: Service quality will significantly influence user satisfaction.

H6: Service quality will significantly influence intention to use.

3.4 Risk Knowledge

Risk knowledge is an important variable that provides knowledge of the risk in the system. Risk knowledge consists of assessing and mapping main exposures, hazards, and vulnerabilities [26]. The information from risk knowledge can be useful at the community level and stored in the system and used for community risk assessments. Also, risk knowledge is focused on providing community actors with information on awareness and understanding of risks exposure, hazards, vulnerability, and capabilities [35]. Moreover, risk knowledge identifies and provides information on safe locations and evacuation routes to be utilized by the communities during floods using participatory methods derived from data input to the system. Risk knowledge provides a combination of scientific and community knowledge, and helps communities gain a better understanding of risks associated with flooding and how to act during flooding situations. But one of the issues associated with risk knowledge entails how to guarantee the continued correspondence of danger and warning levels in relation to actual impact. It is clear that low-risk knowledge and low awareness among participating community and stakeholder agencies have a significant impact on FEWRS's success [12]. Research indicates that among stakeholder agencies, there is a notable deficiency in information regarding flood preparedness and a poor comprehension of risk mitigation methods. Policies exist; however, they are not effectively implemented at the local level. Because of this, many members of a community miss the context of a warning when they get one. Therefore, the success of FEWRS is mostly dependent on the recognition and acceptance of the fact that community input is needed at the initial setting and in revision of risk levels to disseminate flood alerts and warnings. Furthermore, risk knowledge also provides knowledge about the warning situation [36], incorporated from flood early warning and response which leads to the success of the system [37, 38]. In this context of the study, risk knowledge is assumed to have positive impact on user satisfaction rather than intention to use as the model mainly focuses on successful of the model rather than intention of using the new technology. Thus, we propose that:

H7: Risk knowledge will positively impact user satisfaction.

3.5 Response Capability

Response capability is the second factor that is extended in the original D&M model as it involves the capability of system response based on the information that is provided from the system [5, 26]. Thus, response capability mainly focuses on the establishment of the appropriate local and national capacities that will effectively respond to early warnings through the development of well-defined response plans and extension of both local knowledge and capacities. Response capability can be deployed when the system provides information to the communities as map during and after the flood event to reduce the effect of flood damage. It is especially important to be able to anticipate floods and put mitigation plans into place in light of climate change, which is predicted to affect precipitation patterns and increase the frequency and intensity of extreme weather events. Improving flood mitigation and preparedness requires long-term environmental condition adaptability in addition to quick reaction techniques. Research on flood response and prevention comes from a variety of fields, each of which offers special techniques and insights. Basic information on water cycle processes, such as runoff, precipitation, and river flow dynamics, may be found in hydrology. Understanding weather patterns and forecasting storm occurrences that may cause flooding are two benefits of meteorology. The study of soil science looks at how various soil types and attributes impact runoff and water absorption. Topographic analysis uses the physical characteristics of the terrain to identify locations that are vulnerable to flooding. Long-term weather trends and their effects on flood hazards are examined in climatic analysis. By integrating these domains, scientists want to create all-encompassing models that can precisely forecast flood occurrences and guide practical prevention techniques. In order to give populations at risk timely information, these initiatives involve upgrading early warning systems, improving real-time monitoring systems, and developing prediction models. Furthermore, the development of integrated flood management strategies that address both rapid reaction and long-term resilience requires interdisciplinary teamwork.

Besides, response capability provides action solutions that focus on supporting communities in mitigating risk by receiving, analyzing and acting on flood warnings [39]. The response capabilities will be reinforced by predefining the response options, roles and responsibilities which includes the identification of safe areas and evacuation routes to ensure that rescue teams can have access to response and dissemination materials based on a wider contingency plan that encompasses both local and national levels [40, 41]. According to a Samansiri, et al. [12] research, the average yearly flood damage may be lowered by up to 35% with an efficient prediction and warning system based on precise real-time information on disasters. Seng [42] further claims that this kind of strategy can lower mortality and vulnerability rates. It is believed that problems with the digital divide and bureaucratic water management are to blame for the ongoing usage of inefficient early warning systems that lead to greater fatality rates since there is not enough timely information available to offer warnings. Effective FEWRS implementation is therefore largely dependent on the availability of an IS that can provide accurate and timely data with good service quality and user satisfaction [3]. A danger detection, forecasting, warning, and response system for FEWRS should be provided by such an IS.

Furthermore, citizens and responders who have been designated as the first early warning receivers must be trained on the how to interpret, repackage and communicate such messages to ensure proper dissemination of evacuation information and message to the desired target group in a proper manner. Additionally, response capabilities can also be improved by testing and practicing the existing response plans by conducting mock drills and post-event reviews to acquire knowledge from previous occurrences [1, 43]. This is important because a community is response capable' when they have knowledge acquired from practice attained by engaging in appropriate response actions.

Thus, the proposed approach should be able to provide users with information regarding the response level [1]. Thus, the response capability and risk knowledge are important in order to achieve a combined outcome from responsible public relief agencies that responses to various disasters such as flood. In this context of the study, response capability is assumed to have positive impact on user satisfaction. Thus, the hypothesis as follows:

H8: Response capability will positively influence user satisfaction.

3.6 User Satisfaction

According to Bock et al [44] user satisfaction as defined by [45] refers to the assessment of the system to ascertain if it provides the required information to end user. Thus, in the context of this study user satisfaction measures the extent to which the user believes that FEWRS provides the necessary knowledge based on the satisfaction derived from utilizing IS in supporting decision making during flood disaster. Thus, satisfaction is one of the most important variables for IS success [2, 46]. Respectively, recently studies are more focused with IS implementation for user satisfaction and only fewer studies have measured the success user satisfaction results of IS success for individual assessment. Moreover, results from prior studies reporting a high level of satisfaction and experience in exploring IS success in IS domain. Hence, it is concluded that the positive experience for users results to increased user satisfaction and a positive individual impact when FEWRS match the needs of information that improves self-efficacy. Thus, in this context, user satisfaction is assumed to have a positive impact on FEWRS success. Therefore, the hypothesis as follows:

H9: User Satisfaction will positively have an impact on FEWRS' success.

3.7 Intention to Use

Intention to use is examined based on the attitude of end users [6]. Thus, academicians such as Delone and McLean [19] highlighted that to differentiate the complexity, ISSM did not provide distinction between system use and intention to use in the original model. Where, the intention to use is a measure of likelihood that an individual will use a particular system. In general, intention to use is considered as an individual level construct that plays a critical role on users' perception to deploy new technology in actual use. Based on the discussion, the hypothesis as follows:

H10: Intention to use is positively influenced by FEWRS success.

Thus, the review of the literature suggest that FEWRS success as net benefits is based on the degree to which a user believes that using a system will result in benefits such as an increase in the performance and effectiveness to the user or the organization [6, 19]. Therefore, the net benefits of D&M model are extended to FEWRS success to propose the model, analogous with previous study where the authors changed net benefits to IS project success based on their model. Hence, in this study FEWRS success is based on the positive impacts of the success flood system on end users (society), relief staffs, and organizations that utilize the systems. Accordingly, Figure 2 depicts the proposed conceptual model and associated hypotheses.

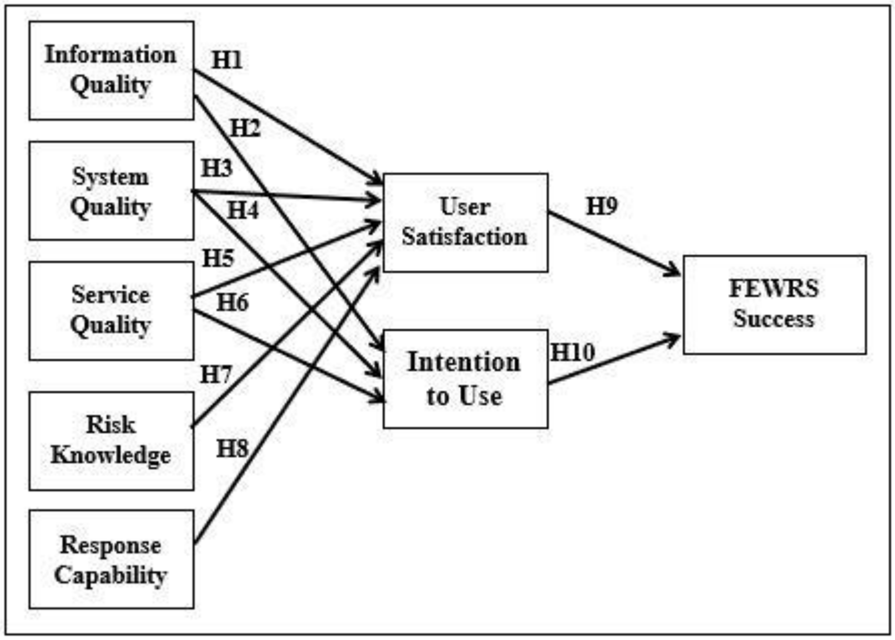

Fig. 2. The Proposed Model

Figure 2 depicts the proposed model for flood early warning and response system based on DeLone & McLean IS success model, where the dependent variable is FEWRS success as net benefits which measures the degree to which a user believes that using a system will result in benefits such as an increase the performance and effective to the users or the organization [6, 19]. Moreover, the net benefits in D&M model aligns to FEWRS success as it conceptualized in the model, similar to previous study [3] that used net benefits to IS project success in their model. Thus, the FEWRS success in this study is based on the positive impacts of the success flood system on users' satisfaction and intention to use the system.

4. DISCUSSION

The present study aimed to clarify the notion of IS theories and frameworks by conducting a thorough literature assessment, which eventually determined the most suitable theory for the research. To expand on the components obtained from FEWRS, the study looked at similar publications that used the D&M model inside the IS domain. For these elements to be included in the suggested model, they were essential. As a result of the research, a novel model and hypotheses focusing on factors and aspects essential to FEWRS effectiveness were developed. Decision-makers can make well-informed and efficient decisions with the help of this suggested paradigm. It can specifically direct the process of educating and alerting the local populace, to prevent fatalities, minimize property damage, and lessen the effects of flooding. To choose the appropriate model for this study, a comprehensive analysis of the body of research on IS theories and frameworks was done. The D&M model was selected because of its adaptability and resilience in integrating new variables. To provide light on potential extensions and modifications for the D&M model for FEWRS, the study also included research that used the model throughout time in a variety of IS domains. The D&M success model provides an organized method for investigating the contingent elements associated with IT adoption and stakeholders for FEWRS. Through stakeholder identification, firms may customize their IS strategy to guarantee favorable results. This methodology cultivates cooperation and congruence between IT and business goals, culminating in more robust and efficient IS solutions for FEWRS. By including other elements like risk knowledge and response capability in the IS success model, this study sought to understand the variables that affect FEWRS success. The D&M IS success model was used in the research because of its extensive framework, which takes into account several variables that are crucial in disaster management scenarios. It was crucial to include risk knowledge and response capability in the D&M model. The comprehension and awareness of possible flood hazards is referred to as risk knowledge, and it is essential for early warning systems to function effectively. On the other hand, response capability refers to people's and organization's capacity to heed warnings and lessen the effects of flooding. These elements are crucial because they have a direct bearing on how well FEWRS works to lower the risk of catastrophe and increase community resilience. The findings of this study have a number of applications for FEWRS implementation and design. Practitioners may increase the efficacy of early warning systems by focusing on improving risk communication and response capacity by knowing the essential success elements. Raising public awareness and educating people about flood hazards, for example, can increase risk knowledge; training initiatives and resource allocation, on the other hand, can improve response skills. This study contributes to the D&M model with new disaster management-related elements, adding to the body of knowledge in IS success models. It offers a theoretical foundation for investigating the efficacy of various IS in many crisis scenarios in upcoming studies. Research on how risk knowledge and response capability affect the efficacy of IS in disaster risk reduction has new directions thanks to its inclusion into the IS success model. Lastly, by effectively adding risk knowledge and response capability to the D&M IS success model, this study has created a thorough framework for examining the effectiveness of FEWRS. Future empirical research can further confirm and improve our understanding of essential success elements in disaster management of IS to the foundation laid by the suggested model and hypothesis. The knowledge gathered from this study can help create and execute more efficient FEWRS, which will eventually improve risk mitigation and catastrophe resilience.

5. CONCLUSIONS AND FUTURE DIRECTION

Floods are natural disasters affecting areas extensively due to frequent rainfall, resulting in loss of lives, properties, and socioeconomic damage. Thus, the FEWRS is an essential element to be considered in addressing flood mitigation management. Moreover, FEWRS ensures that all stakeholders receive the correct information and are provided with necessary response and action information to reduce the loss of lives and properties during flood disasters. This study extended the IS success model with extended factors, such as risk knowledge and response capability, to investigate the factors that influence the success of FEWRS. This paper opted to employ D&M models because the model can accommodate the identified factors to be considered in mitigating flood disasters.

Furthermore, this study reviewed prior studies to understand the concept of IS theories and frameworks and find the most suitable theory for this research. Secondly, related studies that employed D&M in the IS domain published over the years were reviewed to extend the factors derived from FEWRS, as these factors are essential to be incorporated into the model. Lastly, the proposed model was developed, and related hypotheses were presented based on the variables or factors that determine the success of FEWRS. Decision-makers can utilize the proposed model to take the right action in informing and notifying the local population about saving lives, reducing property damage, and reducing flood impacts. The study's conclusions provide a solid theoretical base and useful framework that improves FEWRS' efficacy. Stakeholders may greatly enhance their preparedness and response plans by incorporating the highlighted elements into decision-making processes, which will eventually improve results in flood-prone locations. A FEWRS model that incorporates risk knowledge and response capability into the D&M IS success model was built based on the identified criteria and the literature study. The study developed corresponding hypotheses to investigate how these characteristics affect FEWRS success. The purpose of these hypotheses was to investigate the connections between user happiness, FEWRS success, risk knowledge, information quality, system quality, and response capacity.

As this is only a conceptual framework, future work will employ qualitative and quantitative research methodology to collect data from respondents familiar with the flood disaster in Pahang, Malaysia, using a survey questionnaire to validate the developed model. The collected data will be analyzed using Partial Least Square-Structural Equation Modeling (PLS-SEM) as this paper proposes or any appropriate model and methodology given the research framework to validate the developed model. SmartPLS is recommended for statistical analysis to validate the developed model hypotheses. It is hoped that the proposed model can facilitate stakeholders' use of flood early warning and response systems to assess their current systems to ensure the system's effectiveness in supporting flood mitigation management activities.

Conflicts Of Interest

No competing financial interests are reported in the author's paper.

Funding

No grant or sponsorship is mentioned in the paper, suggesting that the author received no financial assistance.

Acknowledgment

The author is grateful to the institution for their collaboration and provision of necessary facilities that contributed to the successful completion of this research.

References

[1] R. A. Arshah, W. A., and A. Kamaludin, "An Integrated Flood Warning and Response Model for Effective Flood Disaster Mitigation Management," *Advanced Science Letters,* vol. 24, pp. 7819-7823, 2018.

[2] W. A Hammood, R. Abdullah Arshah, S. Mohamad Asmara, H. Al Halbusi, O. A Hammood, and S. Al Abri, "A systematic review on flood early warning and response system (FEWRS): a deep review and analysis," *Sustainability,* vol. 13, p. 440, 2021.

[3] W. A., S. M. Asmara, R. A. Arshah, O. A. Hammood, H. Al Halbusi, M. A. Al-Sharafi*, et al.*, "Factors influencing the success of information systems in flood early warning and response systems context," *Telkomnika,* vol. 18, 2020.

[4] M. Al-Mueed, M. R. A. Chawdhery, E. Harera, R. A. Alhazmi, A. M. Mobrad, S. M. Althunayyan*, et al.*, "Potential of community volunteers in flood early warning dissemination: a case study of Bangladesh," *International journal of environmental research and public health,* vol. 18, p. 13010, 2021.

[5] M.-A. Baudoin, S. Henly-Shepard, N. Fernando, A. Sitati, and Z. Zommers, "Early warning systems and livelihood resilience: Exploring opportunities for community participation," *UNU-EHS Working Paper Series,* 2014.

[6] W. H. Delone and E. R. McLean, "The DeLone and McLean model of information systems success: a ten-year update," *Journal of management information systems,* vol. 19, pp. 9-30, 2003.

[7] W. A. Hammood, A. Aminuddin, O. A. Hammood, K. H. Abdullah, D. Sofyan, and M. Rahardi, "Conceptual model of internet banking adoption with perceived risk and trust factors," *TELKOMNIKA (Telecommunication Computing Electronics and Control),* vol. 21, pp. 1013-1019, 2023.

[8] K. H. A. W. A., O. A., A. Aminuddin, I. Asti Astuti and I. Hadi Purwanto, , "Determinants Influencing E- Payment Adoption Amidst COVID-19: A Conceptual Framework " in *2023 7th International Conference on New Media Studies (CONMEDIA)* Bali, Indonesia 2023, pp. pp. 39-43.

[9] D. J. Moisès and O. Kunguma, "Strengthening Namibia's Flood Early Warning System through a Critical Gap Analysis," *Sustainability,* vol. 15, p. 524, 2022.

[10] D. Li, Z. N. Fang, and P. B. Bedient, "Flood early warning systems under changing climate and extreme events," in *Climate change and extreme events*, ed: Elsevier, 2021, pp. 83-103.

[11] D. Al-Fraihat, M. Joy, and J. Sinclair, "Evaluating E-learning systems success: An empirical study," *Computers in human behavior,* vol. 102, pp. 67-86, 2020.

[12] S. Samansiri, T. Fernando, and B. Ingirige, "Critical Failure Factors of Flood Early Warning and Response Systems (FEWRS): A Structured Literature Review and Interpretive Structural Modelling (ISM) Analysis," *Geosciences,* vol. 13, p. 137, 2023.

[13] A. Cucus, W. P. Sari, A. Aminuddin, D. I. S. Saputra, W. A. Hammood, and R. F. A. Aziza, "Systematic Review of IT Risk Management Using a Scientometric Approach," in *2023 6th International Conference on Information and Communications Technology (ICOIACT)*, 2023, pp. 126-131.

[14] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS quarterly*, pp. 319-340, 1989.

[15] X. Hu and K. Wu, "Assessing Information Technology Systems in the Environmental Arena of China: A Validation of the Delone and Mclean Information Systems Success Model," in *Proceedings of the 17th International Digital Government Research Conference on Digital Government Research*, 2016, pp. 276-280.

[16] N. A. Balogun, A. R. Ahlan, O. V. Mejabi, and O. W. Bello, "Introducing learner infrastructural capabilities into information systems success model using E-learning," *University of Sindh Journal of Information and Communication Technology,* vol. 1, pp. 8-16, 2017.

[17] S. Mardiana, J. H. Tjakraatmadja, and A. Aprianingsih, "DeLone-McLean information system success model revisited: The separation of intention to use-use and the integration of technology acceptance models," *International Journal of Economics and Financial Issues,* vol. 5, 2015.

[18] A. Rai, S. S. Lang, and R. B. Welker, "Assessing the validity of IS success models: An empirical test and theoretical analysis," *Information systems research,* vol. 13, pp. 50-69, 2002.

[19] S. Petter, W. DeLone, and E. McLean, "Measuring information systems success: models, dimensions, measures, and interrelationships," *European journal of information systems,* vol. 17, pp. 236-263, 2008.

[20] P. B. Seddon, S. Staples, R. Patnayakuni, and M. Bowtell, "Dimensions of information systems success," *Communications of the AIS,* vol. 2, p. 5, 1999.

[21] D. Sofyan, K. H. Abdullah, W. A., And Y. Hidayat, "In-Depth Analysıs of Exercıse and Impact to Basketball Athlete Performance from A Bıblıometrıc Perspectıve," *Akdeniz Spor Bilimleri Dergisi,* vol. 5, pp. 785-800, 2022.

[22] D. Sofyan, K. H. Abdullah, W. A., and M. F. Roslan, "Evaluative bibliometrics of artificial intelligence publications in the sports industry," *Nusantara Journal of Sports Science (NJSS),* vol. 1, pp. 1-15, 2022.

[23] K. H. Abdullah, D. Sofyan, J. R. Rojo, and W. A., "A close-up of bibliographic coupling on organizational communication in sports research," *Jurnal Manajemen Komunikasi,* vol. 7, pp. 94-114, 2022.

[24] O. A., N. Nizam, M. Nafaa, and W. A., "RESP: Relay Suitability-based Routing Protocol for Video Streaming in Vehicular Ad Hoc Networks," *International Journal of Computers, Communications & Control,* vol. 14, 2019.

[25] A. M. Hasan, N. M. Noor, T. H. Rassem, A. M. Hasan, and W. A. Hammood, "A Combined Weighting for the Feature-Based Method on Topological Parameters in Semantic Taxonomy Using Social Media," in *IOP Conference Series: Materials Science and Engineering*, 2020, p. 012002.

[26] R. Basher, "Global early warning systems for natural hazards: systematic and people-centred," *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences,* vol. 364, pp. 2167-2182, 2006.

[27] M. Aparicio-Effen, I. Arana-Pardo, J. Aparicio, M. Ocampo, S. Roque, and G. Nagy, "A Successful Early Warning System for Hydroclimatic Extreme Events: The Case of La Paz City Mega Landslide," in *Climate Change Adaptation in Latin America*, ed: Springer, 2018, pp. 241-264.

[28] M. Hasan, N. Maarop, R. Naswir, G. Samy, P. Magalingam, S. Yaácob*, et al.*, "A proposed conceptual success model of citizen-centric digital government in Malaysia," *Journal of Fundamental and Applied Sciences,* vol. 10, pp. 35-46, 2018.

[29] A. U. Jan and V. Contreras, "Success model for knowledge management systems used by doctoral researchers," *Computers in Human Behavior,* vol. 59, pp. 258-264, 2016.

[30] R. b. A. Arshah, "Software Visual Specification for Requirement Specification Validation," in *Proceedings of the 2018 7th International Conference on Software and Computer Applications*, 2018, pp. 66-71.

[31] S. Petter and E. R. McLean, "A meta-analytic assessment of the DeLone and McLean IS success model: An examination of IS success at the individual level," *Information & Management,* vol. 46, pp. 159-166, 2009.

[32] H. J. Yeo, "Information system success disparity between developer and users," *Indian Journal of Science and Technology,* vol. 9, 2016.

[33] A. R. Ahlan, M. Kartiwi, and H. T. Sukmana, "Measurement of information system project success based on perceptions of the internal stakeholders," *International Journal of Electrical and Computer Engineering,* vol. 5, p. 271, 2015.

[34] A. Dos Santos, A. J. Santoso, and D. B. Setyohadi, "The Analysis of Academic Information System Success: A Case Study at Instituto Profissional De Canossa (IPDC) Dili Timor-Leste," in *2017 International Conference on Soft Computing, Intelligent System and Information Technology (ICSIIT)*, 2017, pp. 196-201.

[35] M. Corps and P. Action, "Establishing Community Based Early Warning System-Practitioner's Handbook," 2010.

[36] O. A., M. N. M. Kahar, W. A., R. A. Hasan, M. A. Mohammed, A. A. Yoob*, et al.*, "An effective transmit packet coding with trust-based relay nodes in VANETs," *Bulletin of Electrical Engineering and Informatics,* vol. 9, pp. 685-697, 2020.

[37] O. A., M. N. M. Kahar, and M. N. Mohammed, "Enhancement the video quality forwarding Using Receiver-Based Approach (URBA) in Vehicular Ad-Hoc Network," in *2017 International Conference on Radar, Antenna, Microwave, Electronics, and Telecommunications (ICRAMET)*, 2017, pp. 64-67.

[38] W. A., R. A. Arshah, S. M. Asmara, and O. A. Hammood, "User Authentication Model based on Mobile Phone IMEI Number: A Proposed Method Application for Online Banking System," in *2021 International Conference on Software Engineering & Computer Systems and 4th International Conference on Computational Science and Information Management (ICSECS-ICOCSIM)*, 2021, pp. 411-416.

[39] O. A. and M. N. M. Kahar, "Issues and challenges of video dissemination in VANET and routing protocol," *Journal of Engineering and Applied Sciences*, vol. 12, pp. 9266-9277, 2017.

[40] O. A. Hammood, M. KaharM.N., M. Mohammed, W. A. Hammood, and A. A. Ayoob, "Enhance video quality through VANET based on Transmit Packet Coding (TPC)," 2018.

[41] W. A. Hammood, R. Abdullah, O. A. Hammood, S. M. Asmara, M. A. Al-Sharafi, and A. M. Hasan, "A Review of User Authentication Model for Online Banking System based on Mobile IMEI Number," in *IOP Conference Series: Materials Science and Engineering*, 2020, p. 012061.

[42] D. S. C. Seng, "Improving the governance context and framework conditions of natural hazard early warning systems," *IDRiM Journal*, vol. 2, pp. 1-25, 2012.

[43] W. A., K. Z. Zamil, and A. Ali, "A Review of bio-inspired algorithm," in *Conference:(SOFTEC Asia 2017), at Kuala Lumpur Convention Centre*, 2017.

[44] G.-W. Bock, R. Sabherwal, and Z. Qian, "The effect of social context on the success of knowledge repository systems," *IEEE Transactions on Engineering Management,* vol. 55, pp. 536-551, 2008.

[45] P. B. Seddon, "A respecification and extension of the DeLone and McLean model of IS success," *Information systems research,* vol. 8, pp. 240-253, 1997.

[46] S. Petter, W. DeLone, and E. R. McLean, "The past, present, and future of" IS Success"," *Journal of the Association for Information Systems,* vol. 13, p. 341, 2012.