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RESEARCH ARTICLE

Task-technology fit: intelligent evaluation model for user satisfaction with health information systems

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Abstract – This study presents a predictive model aimed at investigating the level of satisfaction with health information platforms in Gaza, focusing on medical professionals such as doctors, pharmacists, nurses, and laboratory technicians. Addressing the need for reliable assessment tools for HIS performance, the research adopts the Task-Technology Fit (TTF) framework and employs artificial neural networks to model user satisfaction. The dataset comprises 150 records, each including four input variables: technology characteristics, task characteristics, task-technology fit, and security, and one output variable representing user satisfaction. The model was developed and tested using RapidMiner, achieving a prediction accuracy of 86.7%. These findings suggest that the proposed approach offers a viable method for assessing HIS effectiveness. This study is among the first in the Gaza Strip to incorporate security as an integral component within the TTF model using ANN, thus contributing empirical insights into the design and evaluation of context-specific HIS systems. The research recommends further validation of the model across different electronic or online management information systems to confirm its generalizability.

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1. Introduction

The integration of various technological tools within the healthcare sector has become a fundamental aspect of modern health information systems, commonly referred to as electronic or online health information systems. These systems are designed to streamline healthcare processes by using advanced technologies such as the Internet, mobile devices, telephones, and computers. As Alsyouf et al. [1] emphasize, Health Information Systems (HIS) are essential for providing secure, patient-focused healthcare and for enhancing the flow of information throughout the health system. This connectivity not only improves the overall management of health data but also simplifies communication between patients, healthcare providers, and other stakeholders. The widespread adoption of internet technologies in health information systems is particularly beneficial, offering rapid transaction speeds and cost reductions. These advantages are critical in making the electronic health system an essential component in the management and delivery of healthcare services [2], [3].

At the core of electronic health systems, the internet transaction platform plays a pivotal role by enabling a range of services, such as online transaction processes, medication tracking, and various health management functions [4]. These platforms enhance the accessibility and efficiency of healthcare delivery by allowing patients and medical professionals to manage and exchange health data more effectively. Whether it's tracking a prescription, managing medical records, or engaging in virtual health consultations, internet-based systems have made healthcare more responsive to both providers and consumers.

Despite the positive outcomes these systems generate, several studies have focused on assessing the quality and efficiency of health information system services [3]. One such approach involves using data mining techniques like neural networks to evaluate the performance and effectiveness of these systems. While some progress has been made, there is still limited research that examines how customer satisfaction with health information systems can be predicted using the Task-Technology Fit (TTF) model, particularly when security features are considered [5], [6]. The TTF model is a well-established framework used to evaluate the compatibility between technology and user needs. It examines several key components, including task characteristics, technology characteristics, the fit between the two, and ultimately, user satisfaction [7].

Bui and Nguyen [8] emphasize the importance of HIS as a universal platform that integrates a variety of health management records and services. This integration not only facilitates the seamless exchange of patient information between different regions and health centers but also helps to accelerate patient care. In turn, this improves the quality of treatment, enhances patient satisfaction, and reduces healthcare costs [9]. However, as much as HIS brings about significant benefits in terms of improving healthcare delivery, there is still a need for further research to refine these systems and ensure they better meet the needs of medical staff. By improving system efficiency and responsiveness, the overall satisfaction and usage rates among healthcare workers would likely increase.

While numerous studies have focused on evaluating HIS quality using user satisfaction metrics through traditional evaluation models, including three measures: task, technology, and task-technology fit, there has been limited research

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on extending the TTF model to include security as a factor influencing user satisfaction despite increasing concerns about data integrity, privacy, and trust in HIS environments [10]-[12]. This study aims to bridge that gap by incorporating security into the TTF model and using artificial neural networks to predict user satisfaction, offering a more comprehensive and context-sensitive approach to evaluating HIS performance.

The existing literature suggests that several models have been employed to determine the functionality of health information systems and their implications for user satisfaction. Notable models include the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), the DeLone and McLean (D&M) model, and the TTF model. Each of these models aims to assess different aspects of the system, from its acceptance by users to its overall effectiveness. The TTF model, in particular, is valuable because it focuses on the alignment between the tasks users perform and the features of the technology, which is a crucial element in determining whether a system is truly effective and usable [13].

When assessing the impact of health information systems on medical staff performance, the need to apply the TTF model becomes even more apparent. This model uniquely measures the relationship between system features, user tasks, and individual characteristics, providing a comprehensive understanding of how well the system supports its users. Although several studies have examined the performance of HIS, there is still little empirical research on how security, when viewed as a mediating factor, impacts user satisfaction within the TTF model. This study seeks to fill that gap by developing a neural network-based predictive model, specifically designed for the healthcare context in Gaza. The goal is to identify which elements of the TTF framework, including security, play the most significant role in shaping user satisfaction [14]. Furthermore, this research tackles the issue of limited datasets in HIS development, especially those that are based on the TTF model dimensions.

By focusing on task-technology fit and integrating security considerations, this research aims to bridge the gap between user needs and system design. Understanding these aspects will help develop better tools and systems that not only support healthcare providers in delivering high-quality care but also ensure that these systems are user-friendly and efficient. Ultimately, this research aims to contribute to the improvement of health information systems, ensuring they align more closely with the needs of healthcare workers, which will lead to better outcomes for both providers and patients.

In conclusion, while the integration of technology into the healthcare sector has brought about significant improvements, there is still much to be done in refining these systems to better meet the needs of users. The research presented here builds on existing models and frameworks, such as the TTF model, to offer new insights into how health information systems can be enhanced. By focusing on user satisfaction, system effectiveness, and the fit between technology and tasks, it contributes valuable knowledge to the field, ensuring that health information systems continue to evolve and improve the quality of healthcare delivery worldwide. This paper is organized as follows: Section 2 presents a review of related works and theoretical foundations relevant to the Health Information System (HIS) and the Task-Technology Fit (TTF) framework. Section 3 outlines the research methods and materials employed, including data collection and model construction. Section 4 provides the experimental results, model performance evaluation, and discusses the key findings and their implications for HIS development; finally, Section 5 concludes the study and offers recommendations for future research.

2. Related Works

This part of the paper provides an overview of prior studies on HIS and the frameworks commonly used to measure their performance. Special attention is given to the TTF model because of its relevance to the current research.

2.1 Health Information Systems and Evaluation Challenges

HIS are electronic solutions designed to support health services by improving record management, coordination, and clinical decision-making. In challenging environments like Gaza, where demographic pressures and conflict strain the system, the role of effective HIS becomes essential. Prior studies highlight that properly integrated HIS can enhance efficiency, ensure accurate data, and strengthen communication between healthcare professionals [14], [15].

However, evaluating HIS effectiveness remains a complex task. Traditional models such as the TAM, the UTAUT, and the D&M model have been widely used in HIS evaluation. These models primarily assess factors like perceived usefulness, ease of use, and system success through usage and intention metrics [6], [11]. While valuable, these models often overlook how well the system supports users' actual work tasks, a critical issue in high-stakes clinical settings.

2.2 Why the Task-Technology Fit (TTF) Model?

Evaluation methodologies focus on examining the dynamics between information systems, users, and environmental contexts. Various studies have proposed different models for HIS evaluation [16], each with unique advantages for assessing multiple aspects of HIS, such as organizational concepts, social factors, technological characteristics, user behaviour, and attitudes [17]. The TTF model, introduced by Goodhue and Thompson [5], addresses this limitation by focusing on the alignment between the capabilities of technology and the demands of users' tasks.

Unlike TAM or UTAUT, which concentrate mainly on user intention and acceptance, TTF directly considers whether the technology fits the tasks it is intended to support. This makes it particularly useful in healthcare settings. Recent evidence, for example, Navarro et al. [18], demonstrates that TTF is a reliable framework for evaluating both satisfaction and success in environments where technology must seamlessly integrate into daily workflows [18]. Furthermore, TTF provides a multidimensional perspective through variables such as task characteristics, technology characteristics, and

the task-technology fit itself. This framework is particularly valuable in settings like Gaza, where medical professionals rely heavily on HIS functionality under time-sensitive and resource-constrained conditions.

Earlier investigations [1] indicate that security plays a decisive role in shaping user satisfaction with personal health record systems. Other scholars similarly underline the importance of security as a major driver of e-service adoption and satisfaction. Therefore, in this study, the extended TTF model includes task characteristics, technology features, security, and user satisfaction as its main elements [12].

a) **Task Characteristics**
Tasks refer to the activities performed by individuals to convert inputs into meaningful outputs that satisfy their information needs. Scholars describe task characteristics across three main dimensions: variety, level of difficulty, and interdependence [13].

b) **Technology Characteristics**
Technology represents the instruments and resources that support individuals in accomplishing their assigned work. In IS studies, this typically covers hardware, software, data systems, and accompanying support services like training and technical assistance [19].

c) **Security**
In the HIS context, security is defined as the level of protection given to sensitive data while being stored or exchanged, safeguarding it from unauthorized access or cyber threats [10].

d) **User Satisfaction**
User satisfaction is recognized as a central factor for organizations that provide services, and it is especially important in the evaluation of HIS. Among the common evaluation dimensions in electronic management systems, user satisfaction remains the most decisive measure [11], [20], [21].

2.3 Theoretical Prediction Model

Evidence from prior research [22]-[24] shows that the combination of task features, technological attributes, task–technology fit, and security is crucial for predicting HIS user satisfaction. The work in [20] further highlighted that artificial intelligence, particularly neural networks, provides an effective technique for modelling and forecasting satisfaction outcomes. Figure 1 illustrates the proposed predictive model for user satisfaction with the health system, highlighting the relationships among input features: task characteristics, technology characteristics, task-technology fit, and security, while the model's output represents satisfaction with the health information system.

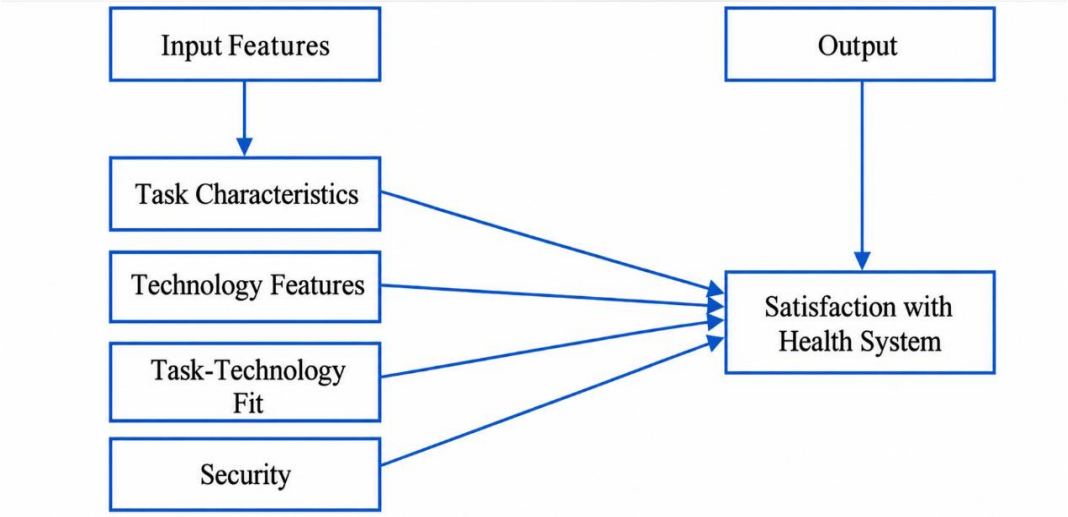


Figure 1. The proposed theoretical framework for predicting user satisfaction

2.4 Critical Summary

This research introduces an innovative method of evaluating HIS by merging the TTF framework with artificial neural networks (ANN). Unlike models such as TAM and UTAUT, which emphasize acceptance and usage intention, TTF directly investigates whether the technology enables efficient task completion [25]. Earlier TTF studies often relied on basic statistical tools that overlooked complex interactions. By using ANN, this work captures deeper patterns and provides stronger predictive accuracy [3]. Security, a critical yet often underexplored dimension in healthcare HIS, especially in Gaza, is also integrated into the model [21]. Together, these elements explain not only whether the system functions well, but also the underlying reasons why it succeeds or fails for users. It's especially useful in complex and high-risk settings like Gaza, where ensuring that systems are secure and effective can make a big difference in daily healthcare delivery.

3. Materials and Methods

Figure 2 shows the research approach following four principal steps: performing a literature review, selecting input dataset features through robust data collection or survey tools, training and calibrating the neural network, and measuring the model's predictive accuracy.

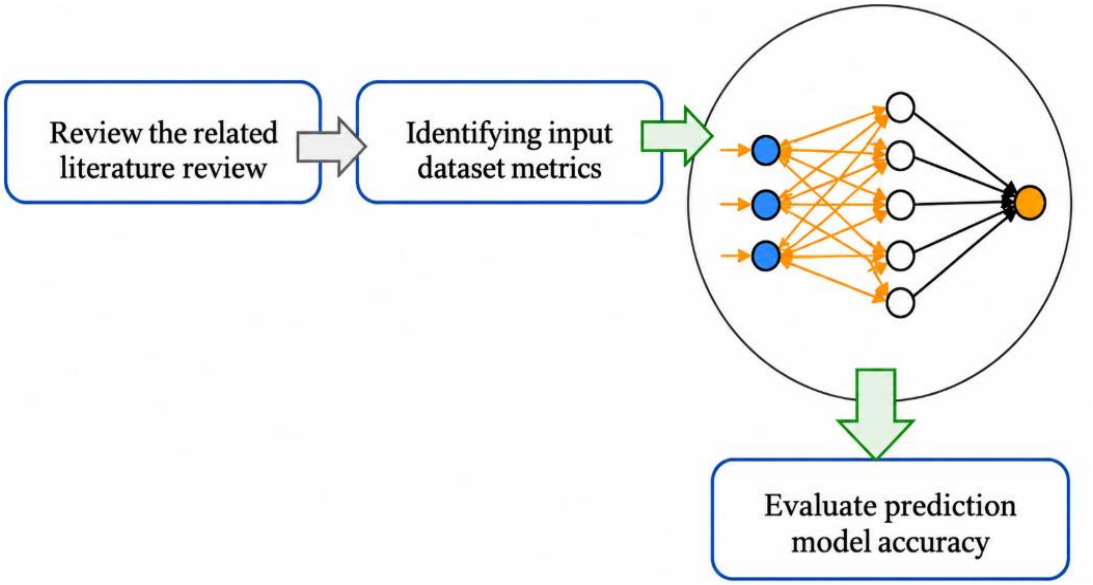


Figure 2. The research methodology of user satisfaction prediction

The validation process is clarified by specifying that a holdout method was applied, with 70% of the dataset (105 records) used for training and 30% (45 records) for testing. Model performance was evaluated using prediction accuracy and correlation coefficients, which confirmed the reliability of the model (accuracy = 86.7%; $r > 0.5$ for all predictors). The following subsections show in detail the instrument, validation, reliability, and data sets used.

3.1 Research Instrument

Quantitative data were collected using a survey completed by medical staff from the three largest hospitals in the Gaza Strip. The survey examined five aspects: task features, technology features, task–technology alignment, system security, and user satisfaction with the Health Information System (HIS). Responses were rated on a five-point Likert scale, from "strongly disagree" to "strongly agree". Table 1 presents the study factors and item counts, showing that the task–technology alignment section included the greatest number of questions (10 in total).

Table 1. The study factors

#	Factors/features	No. of items
1	Satisfaction features	4
2	Task features	6
3	Technology features	4
4	Task technology-fit features	10
5	Security features	5

3.2 Building Dataset and Optimization

In this stage, a questionnaire was developed to capture five key variables mentioned in Table 1: security, task characteristics, technology characteristics, task-technology fit, and user satisfaction with the HIS system.

3.3 Scaling

A five-point Likert scale was used to record HIS users' answers, with options from "strongly disagree" to "strongly agree".

3.4 Data Collection

The study surveyed 150 HIS users in the Gaza Strip, where the demographic variables were governorate and HIS use, and professional role, because the location represents geographic disparities; HIS use concerned regular users who are more likely to experience task-technology fit, and professional role concerned the healthcare job. The survey collected users' views on security, task features, technology features, task–technology alignment, and overall satisfaction with the online health information system.

3.5 Reliability

The reliability test results indicated a high level of internal consistency, with a Cronbach's alpha of 0.902 for the overall research scales, as shown in Table 2. Specifically, the Cronbach's alpha values for the individual scales were 0.879 for security, 0.787 for task characteristics, 0.853 for technology characteristics, 0.798 for task-technology fit, and 0.886 for user satisfaction.

Table 2. Cronbach's alpha of study variables

Variable	Cronbach's alpha
Security	0.879
Task characteristics	0.787
Technology characteristics	0.853
Task-technology fit	0.798
User Satisfaction	0.886

3.6 Implemented Neural Network Model

Following the outlined methodology, RapidMiner was utilized to construct the neural network model, incorporating four input metrics and one output target, namely user satisfaction. Subsequently, the neural network model was applied using these four significant input metrics. Figure 3 shows the model built using a Multilayer Perceptron (MLP) in RapidMiner.

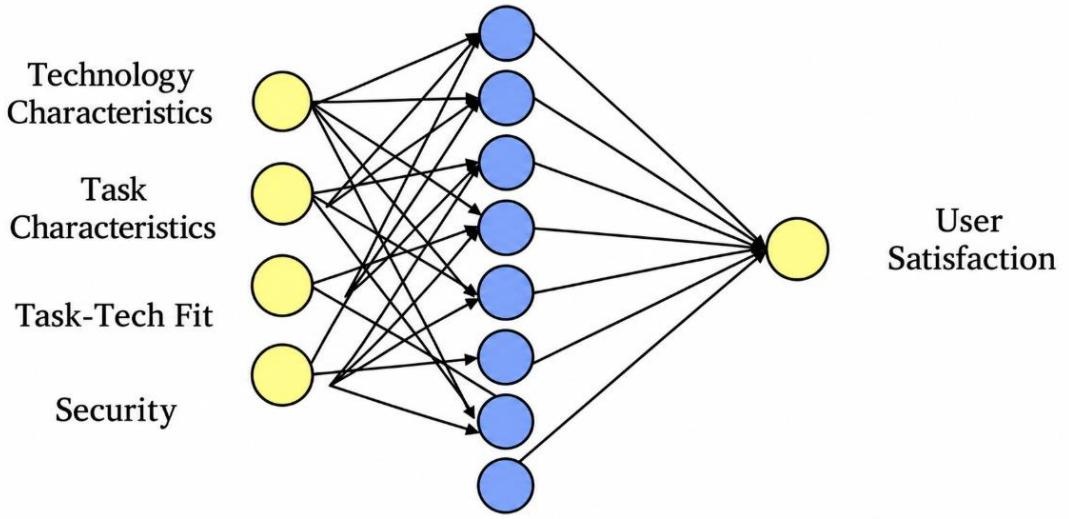


Figure 3. The ANN model structure

Figure 3 includes an input layer with four neurons (representing task features, technology features, task–technology alignment, and security), one hidden layer with eight neurons, and an output layer with one neuron representing user satisfaction. Sigmoid activation functions were applied in both the hidden and output layers. Training was conducted using the backpropagation algorithm, with a 70/30 holdout split (105 samples for training, 45 for testing). Model performance was measured using prediction accuracy, which reached 86.7%, and correlation coefficients between input features and output, ranging from 0.544 to 0.817. These results demonstrate strong predictive capability and alignment with the underlying variables, ensuring transparency, reproducibility, and reliability of the model.

4. Results and Discussion

This research employed the neural network model to develop the proposed evaluation model, leveraging its capability to discern the nonlinear relationships among various factors or attributes [21]. The ANN model was trained using a dataset of 150 records, with 105 records designated for training and 45 records used for validation and testing purposes. Table 3 presents the neural prediction statistics, highlighting the use of four significant input attributes in the prediction model.

Table 3. Neural prediction statistics with four inputs

	Correctly predicted	Incorrectly Predicted	Prediction Success Ratio	No. of input attributes
Neural	39	6	86.7%	4

Based on Table 3, the prediction success ratio is 86.7%, and this means the prediction successfully predicted 39 out of 45 cases. Figure 4 presents the accuracy rate of the prediction model.



Figure 4. Success rations of prediction

Table 4 shows the success status of the tested 45 cases, where 1 denotes that the prediction of customer satisfaction succeeds; however, 0 means the proposed model fails to predict the satisfaction with the online health system.

Table 4. The status of case predictions

Case ID	Status	Case ID	Status	Case ID	Status
C1	1	C18	0	C35	1
C2	1	C19	1	C36	1
C3	1	C20	1	C37	0
C4	1	C21	1	C38	1
C5	1	C22	1	C39	1
C6	0	C23	1	C40	1
C7	1	C24	0	C41	0
C8	1	C25	1	C42	1
C9	1	C26	1	C43	1
C10	1	C27	1	C44	1
C11	1	C28	1	C45	1
C12	0	C29	1		
C13	1	C30	1		
C14	1	C31	1		
C15	1	C32	1		
C16	1	C33	1		
C17	1	C34	1		

Figure 4 shows strong positive relationships between HIS user satisfaction and its predictors: security ($r = 0.817$), technology characteristics ($r = 0.775$), task–technology fit ($r = 0.693$), and task characteristics ($r = 0.544$). All correlations are statistically significant ($p < 0.01$), supporting the validity of the proposed extended TTF model. The x-axis represents the customer satisfaction attribute. Figure 5 shows that the security factor positively affects customer satisfaction with the online health system. Figures 6, 7, and 8 show that the other three input attributes follow a similar trend: as task characteristics, technology characteristics, and task–technology fit increase, user satisfaction also rises.



Figure 5. The impact of security on user satisfaction

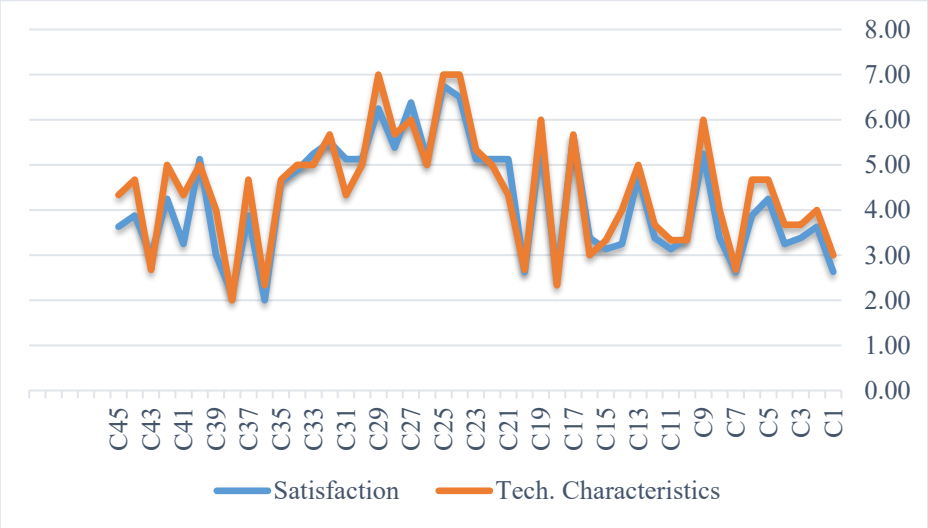


Figure 6. The impact of technology characteristics on user satisfaction

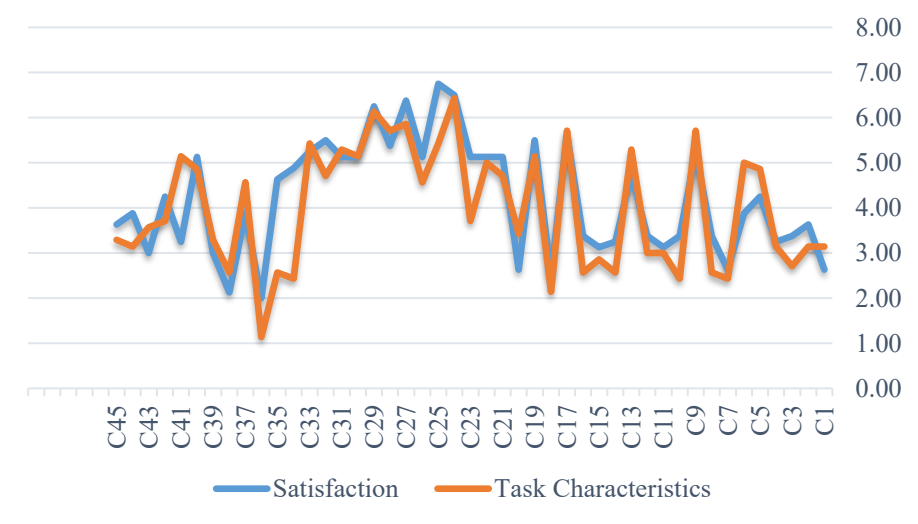


Figure 7. The Impact of task characteristics on user satisfaction

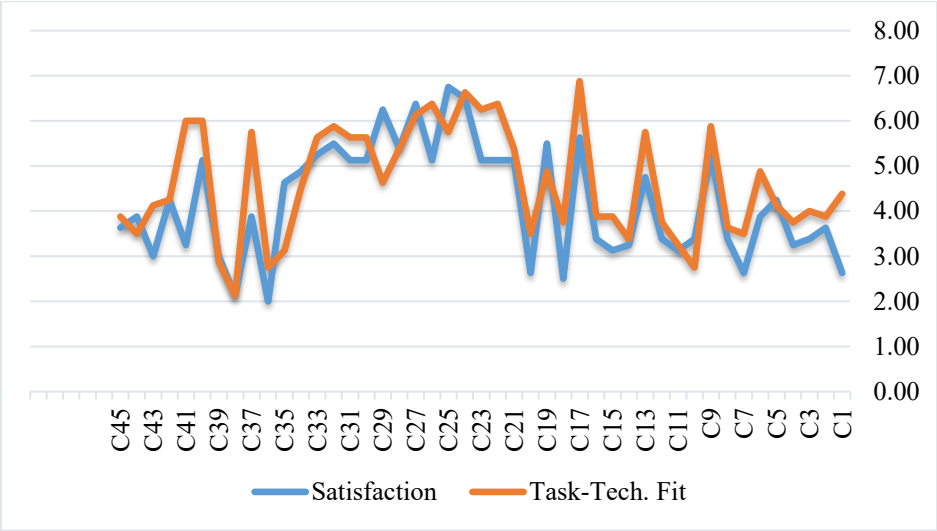


Figure 8. The effect of task-technology fit on satisfaction with HIS

Research on the role of security in shaping HIS user satisfaction is still limited. The current study emphasizes how security influences the experiences of healthcare providers and users. Findings confirm that security has a positive effect on task–technology fit, reinforcing earlier studies [10]-[12] that identified security as a key driver of satisfaction in HIS. Specifically, [10] argued that the effectiveness of system security is closely tied to how well the technology matches user needs. Likewise, [11] demonstrated that security directly contributes to satisfaction. In line with this, [12] found user security to be a central satisfaction factor, while [26] extended this evidence by showing security's influence on acceptance in mobile food ordering platforms. The research also examines the contribution of task and technology characteristics to user satisfaction as a perceptual construct. This differs from prior work [18], [27], which largely assessed HIS effectiveness in terms of use or technical performance. For instance, [18] confirmed that TTF predictors improve outcomes in online learning environments. By comparison, this study targets their effect on satisfaction, echoing the findings of [28], [29], which also reported positive relationships with user satisfaction. Study [25] further observed that TTF influences perceptual outcomes such as satisfaction more strongly than behavioural measures. Likewise, [29] verified that TTF has a positive effect on both satisfaction and system performance. Moreover, [30] demonstrated that TTF predictors shape users' behavioural intention to adopt learning systems, which in turn enhances satisfaction. Lastly, [31] confirmed that task features, technological aspects, and the task–technology alignment all have significant positive effects on HIS satisfaction.

5. Conclusion

This study adds value by highlighting specific task–technology fit factors that affect health staff satisfaction with HIS. It is among the few studies to investigate how extended TTF predictors relate to user satisfaction. The research also fills a gap by examining security as an additional TTF predictor influencing HIS satisfaction. Data were collected using a structured questionnaire, resulting in a dataset of 150 medical staff records across five variables. The data gathered pertain to task characteristics, technology characteristics, security, task-technology fit, and user satisfaction with HIS. The findings of the study show that the proposed neural network model achieved an accuracy of 86.7%, correctly predicting 39 out of 45 records. The findings demonstrate that neural network modelling is effective in predicting dependent variables in healthcare services, such as user satisfaction, system effectiveness, and individual impacts. Consequently, it is recommended to further validate the proposed model for its applicability in predicting the usage and effectiveness of online management information systems.

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Authors Contribution

Kamal M. Alhendawi: Conceptualization; Formal Analysis; Data curation; Visualization; Supervision; Investigation; Methodology; Validation; Writing - original draft.

Conflict of Interest

The author declares no conflicts of interest.

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