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User acceptance model questionnaire generator for information system applications

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ABSTRACT

To foresee users' behavior, the technology acceptance model (TAM) and theories applied in different fields were evaluated to understand factors influencing IT adoption. This study analyzed TAMs used in various IT fields where information systems are being adopted and created an application to generate a user acceptance questionnaire for user acceptance studies. These are based on key variables targeted by acceptance models that have already proven effective. In developing the software, questions relating to each attribute are compiled into one database, tagging each attribute to the model so users can select and view which question corresponds to that attribute. Sample questions can now be generated and exported to a word processor. The user acceptance questionnaire generator was successfully developed based on variables and attributes from famous TAMs. The software also passed the test results conducted for every functional requirement. Considering the abovementioned observations, reluctance to embrace and utilize information systems may be minimized by doing a user acceptance study utilizing the questionnaires exported from the generator. For improvement, other researchers may integrate more acceptance models and other variables not covered and create a web app version for broader reach.

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1. INTRODUCTION

Technology is the solution to staying competitive in the future [1]. Technology plays a vital role in all sectors, and technological advancement has marked every industry's progress [2]. As the world rapidly moves towards organizations migrating to digitally connect their people and embracing innovative ways of working, the focus for organizations shifts towards how easy-to-use, intuitive, and engaging technologies are for their employees [3]. In theory, information technology is employed to enhance employee performance. However, their benefits are often undermined and attributed to users' reluctance and uncertainty to embrace and utilize the information system [4], [5]. While extensive research was done on the factors contributing to successful system development, there is a growing concern that these investments in information systems and technology are not generating their intended outcome. Despite substantial global expenditure on information systems and technology, empirical evidence shows many of these investments fail to deliver the expected benefits. As a result, the return on investments in information systems and technology continues to fall short of expectations [6]. Research shows that user resistance concerns faced in the past can be conquered by concentrating on the easiness and usefulness of systems [7]. Ensuring the daily integration of these applications into their work routines is a fundamental requirement for users' acceptance of technology [8].

User acceptance is expressed as the willingness within a group of users to utilize information technology or information systems for the functions that it is intended to facilitate [9]. A comprehensive study of user acceptance is an essential undertaking that leads to the success and acceptance of products and services to mitigate the risk of users' resistance or rejection of technology [10]. To realize and foresee users' behavior, the technology acceptance model (TAM) and theories were applied in different fields to assess the usage of a particular developed and implemented technology [11]-[13]. By understanding the factors influencing IT adoption and use and discovering intervention strategies that can positively impact these determinants, managers can proactively decide on implementing appropriate measures that will lessen the resistance to new IT solutions and maximize their effectiveness.

There are existing software used to create survey questionnaires that may be used to generate user acceptance questionnaires. Four popular ones are SurveyMonkey [14], Google Forms, Typeform, and Qualtrics [15]. SurveyMonkey has a user-friendly interface and a wide range of customization options, including the question type, theme design, color, fonts, introductory data analytics, and reporting capability. Google Forms, on the other hand, offers the most simple and intuitive interface with basic question types, limited design options, and basic reporting with data export options. Typeform boasts sleek and engaging surveys, beautiful and interactive design, data analytics features, and integration with analytics tools. Lastly, Qualtrics offers a comprehensive interface with advanced features for extensive customization of question types and design, but a steeper learning curve is required compared to the other three. Although these four offer the question-generating capability, they have not explicitly addressed specific key variables that are being targeted by the user acceptance model, which are already proven effective through various research as a basis for user acceptance. They are more suitable for answering surveys.

This study aims to analyze different TAMs used in the IT fields where information systems and technology are being adopted. The researcher will review, discuss, and present literature that acts as a backbone of all TAMs, describe the different variables identified as having the most influence, other areas in the IT field where they were used, and analyze and design a user acceptance questionnaire generator application based on the ones investigated. This study will give important insights to implementors of technology towards successful IT adoption, use, and acceptance by users. The right intervention strategies may be planned to minimize the risk of users rejecting technology. The questionnaire generator will guide other researchers on how to craft a user acceptance questionnaire based on variables and attributes.

2. METHOD

2.1. Research design

An effective review lays a strong foundation for advancing knowledge, enabling the development of theories, addressing gaps in overly researched areas, and disclosing uncharted territories requiring further investigation [16]. With this, an investigation of acceptance models in published works and journals relating to IT was performed. The organized literature review method was adopted after Webster and Watson's recommendations. For the review, the first step is the literature search, which was undertaken over three months. Online databases such as Google Scholar, IEEE, Mendeley, and others were consulted. The keywords used are TAM, acceptance model, and user acceptance. Only those publications that are IT-based and that match the criterion were selected. After downloading all the literature that matches the keywords, the next step is screening based on abstracts and titles. After removing those that are not related, we proceed to the final step. The final step involves the reading and analyzing of the full text. Only recent publications written in English and published in reputable journals of five-year recency were considered, except for the established theoretical models used by other researchers as a basis for their acceptance model, which was published earlier.

2.2. Research procedure

As seen in Figure 1, the study will collate different TAMs in the various fields of IT. Specific areas were noted. Variables introduced were also studied and considered. If user acceptance questionnaires are shown, they are recorded and saved in the questionnaire bank. After comparing and collating, a user acceptance questionnaire generator was designed and developed similarly to this [17]. In the development of the software, the dynamic systems development method (DSDM) was the chosen methodology because of its efficiency in terms of time during the software development process [18].

The software was tested to validate compliance with customer requirements, and the black box testing technique was used precisely the use case testing [19]. This testing was selected to check if all parts of the system are working as intended and are acceptable to the user for quicker test case development, even without the knowledge or access to the code. The target of evaluation starts from the launching of the application, selection of the acceptance model, selection of the variables, selection of the questions,

generation, and access of the questionnaire. The actions are checked against their expected result and will be marked passed or failed depending on the behavior of the software.

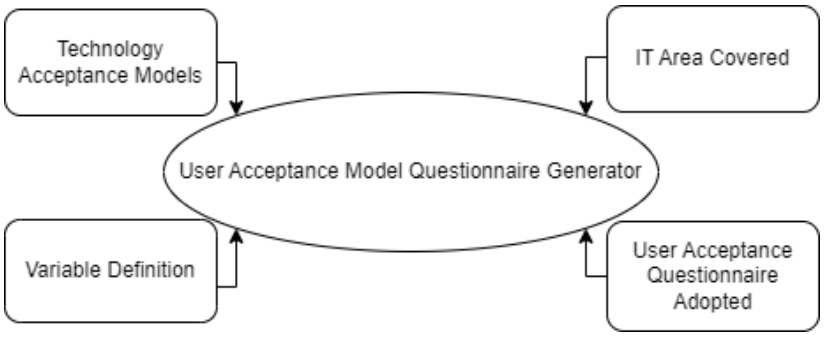


Figure 1. Conceptual framework

3. RESULTS AND DISCUSSION

3.1. Review of related literature and studies on acceptance of information systems using known TAMs

Numerous research has already studied variables affecting the acceptance of technologies, and different established behavior models have been widely incorporated into them. The following are the most used and most prominent models;

The TAM consists of two motivational variables affecting a user's behavioral intention. Perceived usefulness (PU) is the degree to which a person believes that the use of a particular system would enhance their job performance, and perceived ease of use (PEOU) refers to the degree to which a person believes that the use of a particular system would be free of effort [20]. These two fully mediated the effect of system design features on usage [21]. TAM2 considered social influences: subjective norm (SN), voluntariness (VOL), and image (IMG); and cognitive instrumental processes: job relevance (JOB), output quality (OQ), result demonstrability (RES) with two moderating variables experience (EXP) and VOL but kept PEOU as a direct determinant of PU. Social influences and cognitive instrumental processes are believed to influence technology acceptance in TAM2. In TAM3, the PEOU is determined by computer self-efficacy (SE), perception of external control (PEC), computer anxiety (CANX), computer playfulness (CP), along with two adjustment variables, perceived enjoyment (ENJ), and objective usability (OBJ) [22]. SN, JOB, RES, and IMG determine the PU in this model.

The innovation diffusion theory (IDT) talks of innovation, an idea, process, object, or practice considered new, and its diffusion, which is the movement of that innovation into the social system [23]. The theory is based on five determinants: relative advantage (RA), the perceived efficiencies gained by the innovation relative to current tools or procedures; compatibility with the pre-existing system; complexity (CPX) or difficulty to learn; trialability (TRI) or testability, and observability (OBS) or observed effects.

Unified theory of acceptance and use of technology (UTAUT) was devised including four core determinants of intention and usage and a maximum of four moderators of key behaviors. The four core determinants are performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC), and the four moderators are gender, age, EXP, and VOL [24]. UTAUT2 confirmed the essential roles of hedonic motivation (HM), price value (PRI), and habit (HA) in influencing technology use [25]. UTAUT2 is designed with the context of consumer acceptance and the use of technology in mind. The moderating variables are age, gender, and experience, while VOL has been ignored in this extended model.

Table 1 lists learning studies; most use TAM, TAM2, and UTAUT. Key variables examined include PU, PEOU, ATT, BI, system quality (SYSQ), IMG, JOB, ENJ, Computer SE, and Perceived Compatibility (COM). On e-learning, HA, HM, and IQ were identified as significant factors influencing actual use. The study on teachers' readiness to use mobile learning found that FC, PE, EE, and SI positively affected readiness, with ATT mediating the effect of PE, EE, and SI. The studies also considered other attributes and moderators, including SYSQ, computer SE, ENJ, COM, technology SE, and learning satisfaction (LS). Some studies extend the TAM model by incorporating variables such as job performance, user interface design (UID), and organizational citizenship behavior (OCB).

Table 1. User acceptance studies based on learning

Acceptance model reference	Context	Notable results	Attribute and moderators	References
TAM	Investigating the behavioral differences in the acceptance of massive open online courses (MOOCs) and E-learning technology.	PU, PEOU, ATT, and BI are the prominent variables in the learning technology, MOOCs, and e-learning acceptances.	PEOU, PU, ATT, IQ, SE, US, Confirmation	[26]
TAM2	Online learning management system (LMS) lecturers' adoption.	A positive relationship between all constructs.	PU, PEOU, SN, IMG, JOB, OQ, RES	[27]
TAM (Extended)	Using video conferencing tools in distance learning.	SN and CP had a significant; OQ has a positive influence on PU.	SN, OQ, CP, PEOU, PU, ATT, BI, ASU	[28]
TAM (Extended)	Customized moodle-based LMS for socially disadvantaged schools.	LMS would enhance teachers' job performance; effective UID leads to effective teaching operations and lead adoption.	PU, PEOU, BI, ATT, PI, SE, UID, OCD	[29]
TAM (Extended)	E-assessment amongst university students.	PU of e-assessment, TS can reduce CANX associated with computer use.	PEOU, PU, BI, Computer SE, CANX, TS	[30]
TAM (Extended)	Video usage and learning satisfaction online.	PU, ATT, and Internet SE directly affected video usage; LLI, PEOU, and LP directly influenced LS.	PEOU, PU, ATT, Internet SE, LP, LLI, LTI, LS	[31]

Legend: Learning Value (LV), Technological Innovativeness (TI), Information Quality (IQ), Actual System Use (ASU), Perceived Interaction (PI), Online Course Design (OCD), Content Quality (CQ), Accessibility (ACC), Technical Support (TS), Learner-learner Interaction (LLI), Learning Performance (LP), Learner-Teacher Interaction (LTI)

Table 2 shows studies relating to health and employing primarily TAM and its extended versions. The studies examine the influence of PU, PEOU, ATT, and BI on acceptance, having found PU and PEOU to be the most explored and influential factors. Each study focuses on different aspects of health-related acceptance. Some studies identify distinct barriers, such as Privacy (P) concerns and IMG superiority.

Table 2. Health user acceptance studies

Acceptance model reference	Context	Notable results	Attribute and moderators	References
IDT	mHealth Apps Amidst Pandemic	RA, COM, CPX, and OBS are significantly associated with TRI, influencing BI. ATT and SDM are not supported.	RA, COM, CPX, OBS, TRI, SDM, ATT, BI	[32]
TAM	Prevailing practices of healthcare professionals on Electronic Health Records (EHR)	Significant relationship between PU, PEOU, ATT, and BI of EHR. Gender, age, and experience in IT do not affect BI.	PU, PEOU, ATT, BI	[33]
TAM (Extended)	Telemedicine services investigation	PU, SI, TRU, PEOU, and FC influence BI. ANX, RTT, and PR are the significant barriers	PEOU, ANX, SI, PU, TRU, FC, PR, RTT, P	[34]
TAM	Consumer-oriented health information technologies	PU, PEOU, SE, PBC, SN, TRU, and FC influence consumers' decisions on acceptance	PU, PEOU, SE, SN, TRU, PBC, FC	[35]
TAM	Electronic Medical Record (EMR) system	Significant positive relationships among PU, PEOU, and BI. High BI yet low level of CU. There are substantial differences in ICT knowledge between regions/states.	PU, PEOU, CU, ICT	[4]
TAM	Health provider and administrator perceptions of using technology in palliative care	PEOU influences users' intention to adopt	PU, PEOU, BI	[36]

Legend: Self Discipline Motivation (SDM), Anxiety (ANX), Resistance to Technology (RTT), Perceived Risk (PR), Computer Usage (CU), Security (SEC), Trust (TRU), Information Accuracy (IA), Information Stability (IS), Information Communications Technology (ICT)

The studies in Table 3 utilize acceptance models such as TAM, TAM2, TAM3, and UTAUT. Notable acceptance variables include PU, PEOU, ATT, BI, TRU, FC, and SI. Each study investigates different technology adoption contexts within the banking and finance industry. Certain studies highlight the importance of TRU or RA as key determinants, while others find significant effects of factors like cognitive style (CGS) or PE. Certain studies, including P and SYSQ, also identify barriers to acceptance.

Table 3. Banking and finance user acceptance studies

Acceptance model reference	Context	Notable results	Attribute and moderators	References
UTAUT	Mobile payment.	PFV and FC are two main antecedents of BI. The negative indirect impact of LC on BI through PCV and FC.	PFV, FC, BI, LC	[37]
TAM (Extended)	Fintech services for bank users.	PU, BIMG, TRU, and GS all positively impacted ATT. BIMG, PR, GS, and UI significantly influenced TRU. PEOU and PR do not affect users' ATT.	PEOU, ATT, PU, BI, TRU, BIMG, PR, GS, UI	[38]
TAM	Electronic transaction succession.	TRU and PR affect BI. Acquiring TRU depends on IQ and SYSQ.	IQ, SYSQ, SEC, REP, PR, TRU, BI, US, AUT	[39]
TAM3	Islamic financial technology: three competing models.	ATT toward the behavior, PBC, and SN influence individuals' behavior. PEOU is considered one of the most important factors.	ATT, PBC, SN, IMG, JOB, OQ, RES, PEC, CANX, CP, ENJ, OBJ, SI, PRI, HA	[40]
TAM2	Cloud computing applications in banking.	The most influential are OQ and PU, PEOU and ITU, and the least influential are PEOU and PU.	SN, IMG, JOB, OQ, RES, PEOU, PU, ITU, UB, EXP, VOL	[1]

Legend: Perceived Functional Value (PFV), Learning Cost (LC), Brand Image (BIMG), Government Support (GS), User Innovativeness (UI), Assurance (AS), Website Design (WD), Customer Service (CS), Reliability (REL), Reputation (REP), User Satisfaction (US), Actual Use to Transact (AUT), Mobility (MOB)

3.2. User acceptance model questionnaire generator app development

The studies mentioned above are the sources of data that the researcher utilized in creating the acceptance model questionnaire generator, as seen in Figure 2. All questions relating to each attribute are collated and compiled into one database, tagging each attribute to what model they belong to so users can select and view which question corresponds to that attribute, generate the sample questionnaire, and export it to a word processor for easy editing.

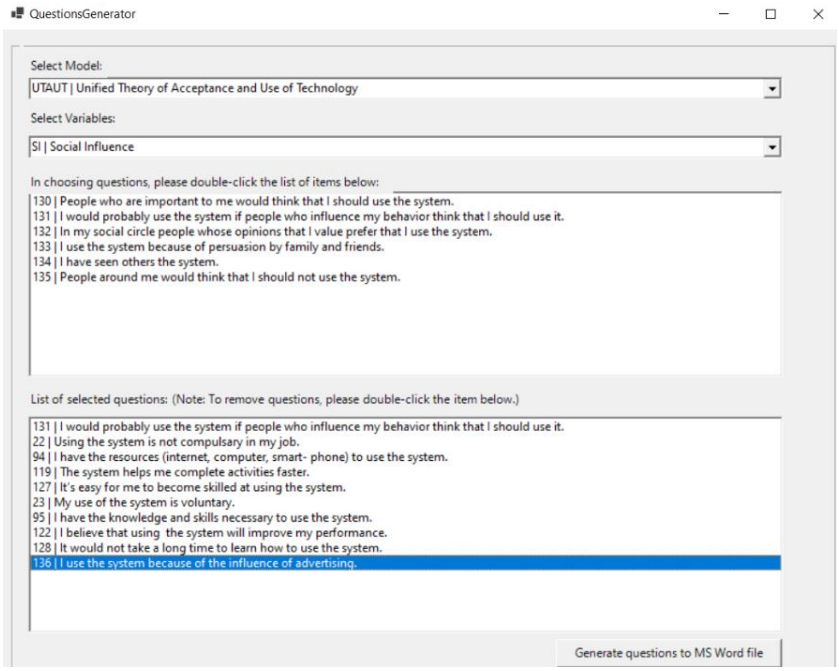
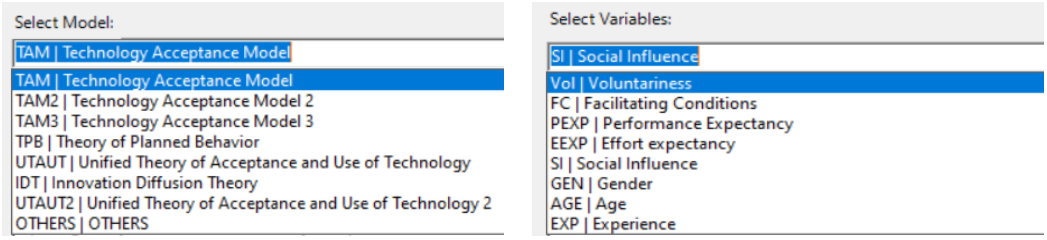


Figure 2. User acceptance questionnaire generator user interface

To use the developed system, can be seen in Figure 3. The first step illustrated in Figure 3(a) is to select the user acceptance model on which the user wants to base his research – predefined models were already inputted, including TAM variants, UTAUT variants, and IDT. As seen in Figure 3(b), the next step is to select the variables the user wishes to include. When a variable is selected, corresponding sample questions in the database will be displayed, as shown in Figure 4. These sample questions were taken from the studies reviewed.



(a) (b)

Figure 3. User acceptance questionnaire generator (a) model selection and (b) variable selection

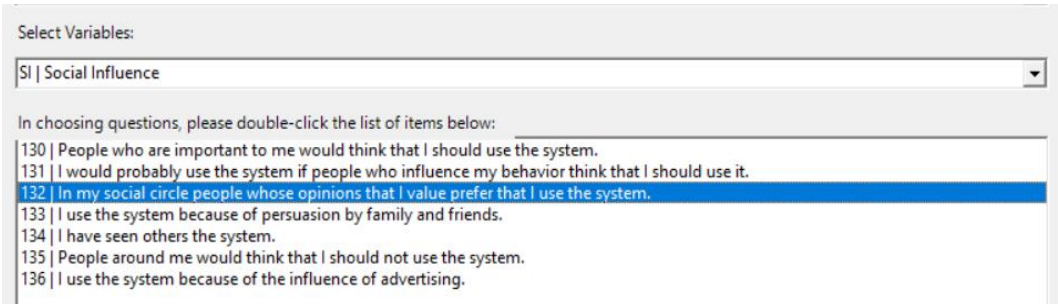


Figure 4. Questions list based on variable selection

When the sample questions are displayed, the next step is to double-click the questions they wish to include in their questionnaire, and all selected questions will be collated in one container, as seen in Figure 5. If the researcher also decided to add other variables from other models or under the others category, the user may do so by selecting others. To remove questions, double-click the item or questions you wish to remove. Once the variables to be tested are complete and the user has finalized the chosen questions, the last step is to click the Generate question to MS Word file to extract the question in a word processor (.docx) format shown in Figure 6. The user may now format the questionnaire according to their needs.

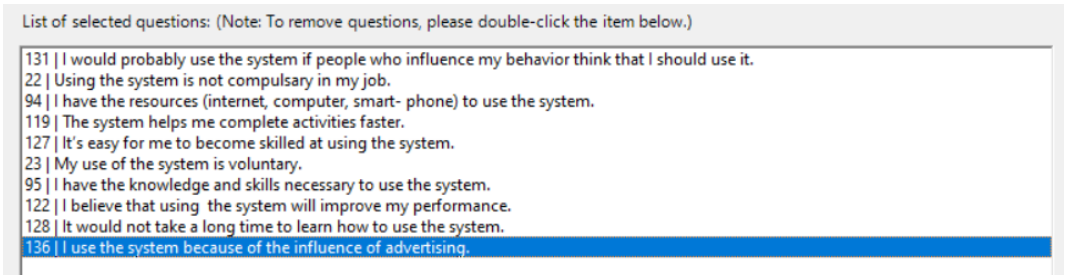


Figure 5. List of selected questions

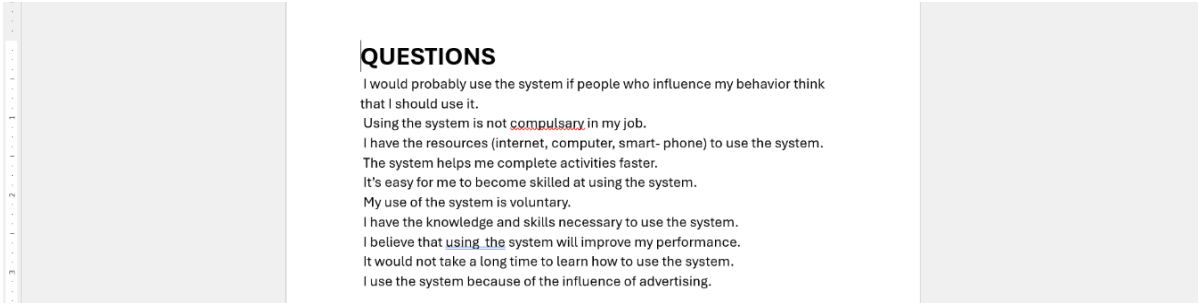


Figure 6. Sample exported user acceptance question in word processor

Figure 7 shows the management module where the user can add a new user acceptance model to the database, add new variables if the user needs to test more attributes that are not in the list, add questions relating to the new variables, add the association of the variable and the new model, and adding of the assigned questionnaire for the new variable and new model to the databank of questions. The generate questions button will direct the user to the user acceptance questionnaire generator interface. Figure 8 shows the sample module on assigning questionnaires to the data bank module. The developed application successfully passed the Blackbox testing conducted on every functional requirement.

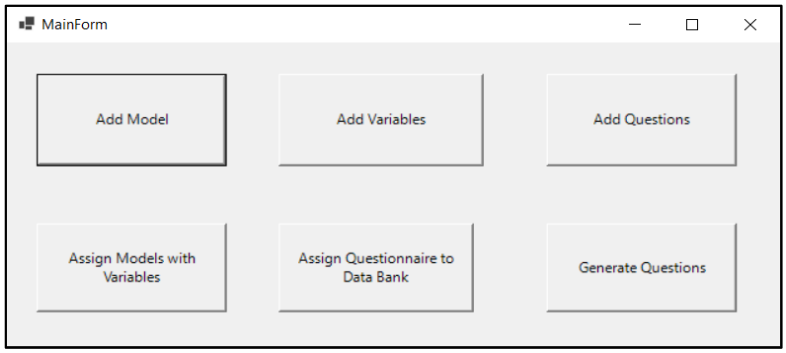


Figure 7. Management module

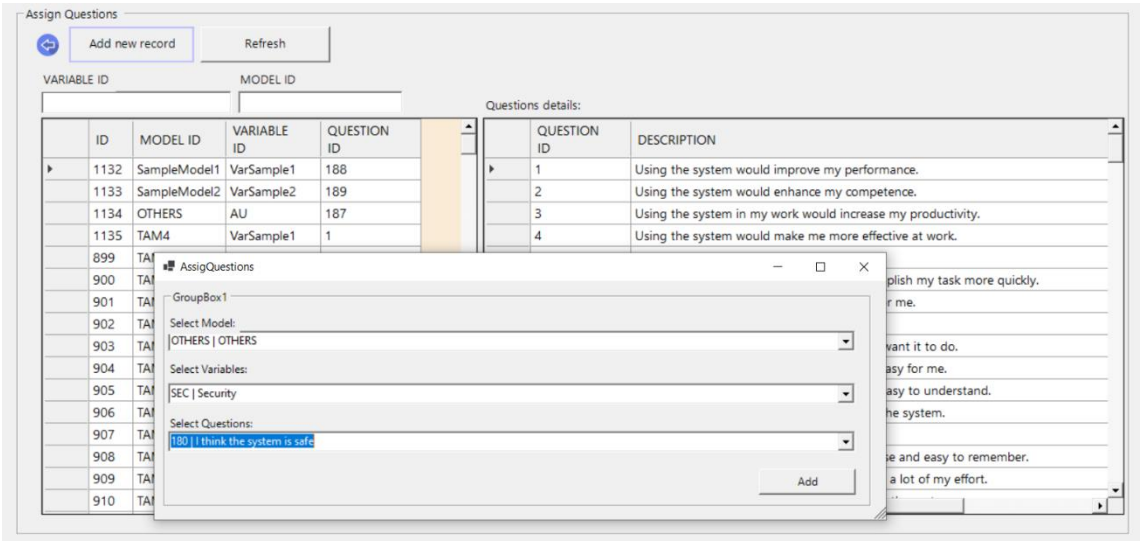


Figure 8. Assigning questionnaire to data bank module

4. CONCLUSION AND FUTURE WORKS

This study analyzed TAMs and theories applied in the different IT fields to understand factors influencing IT adoption, thereby inhibiting user resistance to technology and helping reduce barriers to technology adoption. The study created a user acceptance questionnaire generator for user acceptance studies based on variables targeted by acceptance models. Based on the literature review on the acceptance of learning applications, it was found that increased use contributes to increased usage. Users are more comfortable and satisfied if systems are easy to use and user-friendlier if contents are up to date, if there is an established policy or regulation released on its use, and if infrastructure and facilities are ready with training courses conducted and if a method of reward or recognition is given for usage. Users value establishing trust in the application when accepting health-related systems and applications. This is achieved by conducting capacity building and training, campaigns regarding the use of it, and giving free and limited trials. Support is also emphasized in providing facilities, infrastructure, and financial support. The engagement of stakeholders was also valued, as was the establishment of policy. In the banking and finance sector, confidence, trust, assurance, and security are valued to establish trust and acceptance of the application. Privacy protection

policies must also be clear. They also value good, user-friendly quality software. The user acceptance questionnaire generator software was successfully designed and developed based on the studies reviewed. The user acceptance questionnaire must first be administered before creating a system to assess the acceptability of introducing a new technology to the user. The variables and sample questions were compiled and embedded in the developed application, guided by well-known TAM s. Based on the functional testing, the developed software met and passed the user expectations of the software. Creating a user acceptance questionnaire will be easier through the system.

Further studies may explore user-centric design principles and conduct research specifically on user requirement analysis to understand the needs, preferences, and pain points to improve user acceptance and adoption of innovative technologies in any sector. Integrating user feedback throughout the design and development process to create sensitive and user-friendly applications is a must. In providing support, specific comprehensive capacity building and training programs and free trials are a must to enhance users' skills and familiarity with the new technologies. In the question generator software, additional development may be considered for creating a web or mobile app version of this system for broader reach. By integrating these suggestions, organizations and policymakers can boost the acceptance and adoption of innovative technologies, improving efficiency, user satisfaction, and overall progress.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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Rogel Ladia Quilala	✓	✓	✓	✓	✓	✓		✓		✓	✓			

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

No conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, TFGQ, upon reasonable request.

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