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Modeling ITOETAM for Cloud Computing Challenges validation and developing in Tourism and Hospitality Higher Education Institutions

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Abstract

Cloud computing is considered as one of the strongest innovations that has gained the attention of technological experts everywhere. It offers lots of benefits., but it also poses several security threats that no establishment can afford to ignore. The progressive education in creating nations is experiencing the issue of conveying dimension of the data and interchanges innovation. Based on these difficulties, the study attempts to develop and validate the Model for cloud computing challenges (CCC) in tourism and hospitality higher education institutions (THHEI) to find solutions to these challenges. In order to identify those challenges, the research aims to create and validate the model created by Juma and Tjahyanto (2019) for a unique model referred to as the proposed model for cloud computing adoption challenges (ITOETAM) to categories various difficulties and specific issues higher education institutions in tourism and hospitality face when using the educational cloud computing services. The model consists of five constructs named CCC, Internal, External factor (IEF), technological factors (TF), organizational factors (OF), and environmental factors (EF). The researchers relied on the following variables from the model as follows "CCC-THHEI, TF, EF and IEF. A total of 431 respondents are students, graduate students, staff, IT personnel and employees of Egyptian tourism and hotel education faculties and institutions. The research supports the "ITOETAM" concept. Which structural equation modelling (SEM) testing technique was used. The goodness of fit indices were good; they were as follows: x2 = 505.131 (df = 214), p 0.001, x2/df = 2.360, GFI = 0.912, Comparative Fit Index (CFI) = 0.953, Normed Fit Index (NFI) = 0.922, Root Mean Square Residual (RMR) = 0.071, Incremental Fit Index (IFI) = 0.954, Relative Fit Index We've talked about potential restrictions and lines of inquiry.

Keywords: Modeling ITOETAM, Cloud Computing Challenges, Higher Education Institutions.

Introduction

Due to developments in information and communication technology during the past three decades, the higher education industry has undergone a revolutionary change throughout the world (ICT). Due to the adoption of various information and communication technologies in higher education institutions as well as the transformation of traditional classrooms into smart classrooms, modern education has been transformed. The requirement that higher education institutions implement Education 4.0 is another important matter that necessitates effective technology application (Kurelovi´c et al., 2013).

A few years ago, the training space served as a large physical work desk. Maintaining a physical relationship with the dead stock accumulating framework was part of the project and the students' internal evaluation. If the program accepts a large number of students, maintaining track of all of their information might be an exhausting task. So, universities need systems like Cloud Computing to maintain accurate records of each student throughout time (Mukund et al., 2019). Additionally, due to students' propensity to lose information on their devices, they frequently forget to complete their decisive research introduction or any other collaborative work on academic matters. Information loss may result for a variety of reasons, including device failure, human error, programming error, PC contagion, theft, and equipment loss. (Smith, 2019). Additionally, the staff association of Lake Head University in Canada complained to the institution, claiming that because Google is a U.S. firm, the email infrastructure that was redistributed to it does not ensure its security or academic opportunities. As a result, it is subject to American Law, which mandates that Google, even without alerting the college, send information to the US government when necessary (Okai, 2014).

Both employees and students can swiftly resolve their problems using their laptops and other devices as long as they are online by employing cloud computing. A moderate rate of development in emerging countries was parallel to the expansion of development in western industrialised countries during the end of the 20th century. However, a lot of research has been done on the benefits, drawbacks, and acceptance of cloud computing techniques (Muhammed et al., 2015). The adoption of the cloud model in universities was quite slow, especially in developing nations.

Although the idea of cloud computing may have various advantages for the education sector, especially higher education, further research is needed before it becomes a reality in the near future. In order to make cloud computing adopted by many educational establishments around the world, it is essential to make Cloud Computing Service (CCS) architecture more appropriate for educational institutions. In educational institutions, cloud computing has enormous potential, developing a service model appropriate for an educational institution is critical to making cloud computing effective and widely accepted by these establishments. There is unquestionably a research gap that ought to be filled, and this is done by a thorough comprehension of the traits of a typical educational institution (particularly a higher education institute, university, or professional college), and then use this understanding to create and design a service model that would be more suitable and advantageous to educational foundations (Gupta et al., 2021).

Students, graduates, professors, employees and those responsible for technical support and information technology in tourism and hospitality, governmental faculties and private institutions were the sample of research and study in Egypt. The study developed and validated the "ITOETAM" Model for cloud computing challenges in tourism and hospitality higher education institutions, explaining the different aspects of cloud computing, and the services it provides in educational processes. Finally, suggest a solution that might be used to address those issues. The following research objectives were addressed as the following:

1. Studying the relationship between the variables of the research (Internal, External, technological, organizational, and environmental factors) makes it difficult for tourism and hospitality higher education institutions to adopt a cloud computing paradigm for education.
2. Validating the goodness of fit indices of the model of challenges of adopting cloud computing in Tourism and Hospitality Higher Education Institutions.

Literature Review

Cloud Computing Concept

A specific form of communication processing known as "cloud computing" offers techniques for remotely supplying scalable and assessed resources (Amini, 2020). The term "cloud computing" refers to both the hardware and software in the server farms that provide the applications that are provided as services via the internet. Public, communal, private, and hybrid clouds are among the cloud deployment methods for cloud systems (Rao et al., 2013). The National Institute of Standards and Technology (NIST) uses four cloud organization models and three cloud administration models to describe the cloud computing architecture. The top three cloud services included software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS) (Liu et al., 2012).

Every day, the use of cloud computing is growing in popularity. It is not only a promise or something that is discussed at conferences and seminars anymore. Due to the reality of quick, automated, and cost-effective management of IT resources, information technology has evolved into a compelling paradigm for greater productivity and efficiency. There is a growing idea that cloud computing will make computing the fifth utility that offers the main computer services that are regarded as essential for carrying out daily tasks, following telephone, water, electricity, and gas (Buyya et al., 2008).

Applications of Cloud Computing in the Educational Field

Students, teachers, employees, administrators, and other campus users can now access files, databases, and other university applications from anywhere at any time thanks to the potent tool known as cloud computing, which is incredibly scalable and flexible (Jain and Pandey, 2013). In the world of educational technology, cloud computing has been named "Silverbullet" (Mell and Grance, 2010). Therefore, some universities, especially in more developed and advanced countries, have embraced this innovation for a number of reasons, such as decreased hardware acquisition and maintenance costs, maintenance of more prominent access to web 2.0 applications for instructors and students, and ultimately better superior scholastic yield. By using cloud computing to run their virtual computer lab, North Carolina State University and the United States save a tonne of money on software licence costs. By contracting out their email services, Lakehead University in Canada and Eastern Washington University in the United States have both saved a sizable amount of money. According to James Holt, the vice president and chief information officer of the University of Virginia in the United States, cloud computing provides a significant opportunity for academics to rethink and re-craft services (Thomas, 2011).Computing resources are now more widely accessible due to the popularity, development and internet use of ICT (Information and Communication Technology), but the level of cloud technology adoption and implementation, particularly in poor nations, is still quite low. In order to understand the difficulties and causes of the slow rate of acceptance of cloud computing by colleges, this article investigates the topic, and it proposes solutions to the issues and outlines a plan for effective adoption.

Cloud computing enables all students and employees to achieve their requirements just when their computers or other devices are linked to the internet. Additionally, providing straightforward backup and recovery. Having such cloud technology gives an excellent option to control risks because everything might be far away and will only be provided as a service by a cloud service vendor, whose backup and recovery plans are significantly greater to what the higher institutions of learning can provide. The idea of cloud computing is growing in popularity recently, and more research is being done on its benefits for institutions of higher learning, including the ability to save a lot of money on IT equipment purchases and

maintenance and have access to resources stored in the cloud from anywhere. However, adoption rates of cloud computing are still very low due to the difficulties and worries associated with doing so (Ume et al., 2012).

Software as Services (SaaS)

There are many services of cloud computing that can help faculties through encouraging education, learning, and other academic improvement exercises. Examples of these cloud computing services are Google apps, IBM Cloud Foundation, Amazon Web Services, and Microsoft Training Cloud (Almazroi et al., 2019). SaaS is a particular kind of cloud that includes frameworks for learning the executive's framework, customer connections framework, board relationships framework, and frameworks for receiving, processing, and transferring programming applications over a system model email framework. SaaS can help students improve their understanding of their academic materials by providing the tools necessary for anytime, anywhere learning. (Belle, 2019). One of the key problems with SaaS is the need to reduce the work cost of cloud administration while maintaining effective administration (Liao and Chen, 2017). According to the advantages of (SaaS), this study makes use of cloud computing services.

Cloud Computing Problems and Challenges

Multiple tenancy feature of cloud computing makes adoption even more challenging. Service providers need to solve the following problems (Namahoot and Laohavichien 2018; Sharma et al. 2017):

Loss of Governance

Clients lose control over a number of issues that jeopardise the security of their data and apps when they use cloud computing, since they transfer power to the service company. In other words, SLAs cannot delegate the provider's end of security responsibilities. In order to prevent being held accountable for any illegal access to, use of, fraud against, or removal of customer data or applications, every organization employs the word rules. Google App Engine states that by using the service, users "accept that Google shall have no responsibility or liability for the deletion or failure to store any content and other communications."Amazon is a different business that describes its online services using the word "use." All clients who wish to keep up with their have a difficulty with this.

Lock-In

Lack of awareness about the processes, norms, and tools that enable information compactness and interoperability among cloud services and cloud providers is another barrier. The client is wholly dependent on service providers as a result.

Isolation Failure

Although cloud computing has several advantages, such resource sharing and multitenancy, it also fails to separate storage devices and reputation among different occupiers. Security issues develop when attackers access stored data, for instance, through guest-hopping assaults.

Negative Insider

Since the implications are inconceivable, this is the trickiest challenge in cloud computing to address. The rise of cloud computing has increased the possibility of insider attacks in some professions. System administrators for cloud service providers, security service providers, and other professions fall under this category.

Deletion of Insecure or Incomplete Data
Users lack the ability to respond if a client requests the removal of a cloud resource since they have no control over it and are unable to look into it. Or how about eliminating some of it? The customer cannot determine whether the account was deleted or not, let alone how quickly it occurred.

Security
Due to the spread-out nature of the cloud, security is a significant hurdle to adoption. Threats to an organization's data and software include data loss, phishing, botnets (remote computer networks), resource placement, multitenancy, authentication, and trust, as well as system monitoring and logging.

Cloud vendors can provide more security measures and expertise than those within educational institutions (McDonald et al., 2010).

Management Interface Compromise
Aggressive behaviour is a problem because cloud providers have complete control over all processes. You might encounter issues with service manipulation, data loss during upload or intracloud transfer, distributed or economic denial-of-service (DDoS) attacks, encryption key loss, malicious probes or scans, and other issues.

Costing Model
Users of the cloud must weigh the advantages and disadvantages of processing, communication, and integration. When switching to a public or community cloud, an organisation may spend less on infrastructure but more on data transmission costs, such as the cost of sending data to and from the cloud and the cost for each computer resource unit consumed. This problem arises from the fact that an organization's data is scattered across numerous public, private, and community clouds. On-demand computing seems to be a better choice for applications demanding a lot of processing power.

Charging Model
Comparing cost analysis for standard data centres that are based on static compute consumptions to cost analysis for an elastic resource pool reveals that the latter is far more difficult. The freshly created virtual machine is where the cost analysis unit will now focus its attention instead of the physical server. Multi-tenancy has the ability to significantly increase the price of SaaS cloud providers' products. Price increases are the result of the redesign and rebuilding of singletenancy software, the creation of new capabilities to enable thorough customization, the enhancement of concurrent user performance and security, and the resolving of any problems brought about by the aforementioned changes. The cost reductions from multi-tenancy must be compared to other factors, such as decreased overhead, fewer on-site software licences, and others.

Reasons for universities' poor uptake of cloud computing
In spite of cloud computing 's numerous benefits, there are difficulties facing cloud computing adoption in higher education institutions at the university of carnegie mellon, including data security protection, vendor lock-in, privacy and regulatory compliance, legal jurisdiction, as well, reliability of cloud service providers by Low et al (2011) and Mircea and Andreescu (2011), In addition to that, the research by university of carnegie mellon has pointed out that the challenges of cloud adoption in institutions of higher education are not just limited to the obstacles listed above, but as well revealed that relative recency and underdevelopment of

cloud services is among the essential issues for adopting cloud computing (Sultan, 2010). Any hacking attempt or other assault on a cloud provider's infrastructure has the potential to affect all clients whose data are stored there. Since vital data is stored outside the gates of organizations, security and privacy are therefore seen as among the most important problems for implementing cloud technology. The lack of Service Level Agreements (SLA) compliance by cloud service vendors, according to Rittinghouse and Ransome (2010), is one of the factors contributing to the low adoption rate of cloud services. If cloud providers do not adhere to the SLA's requirements and address downtimes, prompt performance will be negatively impacted.

Changing prices and cloud service terms or discontinuing them put pressure on institutions due to this issue, which is known as vendor lock-in. As vendor lock-in together with discontinuation of cloud service can result in irrecoverable loss of sensitive data by educational institutions. Weber (2013) clarified that in 2008 when Lively, the former Google's online virtual world, was shut down, content of educational data could have been lost due to difficulty in exporting data. Weber (2013) illustrated that possible solutions for this matter can be by signing contracts with different cloud vendors to diversify risks, but it can be difficult to manage institutions. This solution can avoid discontinuation of cloud services, but not loss of data.

Software interoperability in one or more layers of cloud services (IaaS, PaaS or SaaS) can be a technical solution to avoid the problem of vendor lock-in (McDonald et al., 2010). Regarding that, work is underway in various institutions and initiatives, such as the Distributed Management Task Force39 (DMTF) to assure VM transfer across multiple virtualization platforms, DeltaCloud40 to determine REST-based APIs to manage IaaS, or the NIST41 to set up formats of standardized data to support cloud interoperability at various tiers.

Due to restrictions surrounding the location of the data, institutions may encounter unwanted or unpleasant scenarios that could lead to conflicts that can linger for years. Institutions no longer have control over the physical infrastructure where the data is located after using cloud providers' services. In contrast to typical users who might not be concerned about where their data is stored, these academic institutions keep sensitive information about thousands of people and systems as research findings and conclusions that demand a high level of security and privacy (Cegielski et al., 2012). Because Google complies with American law, which requires it to give data to the government of the USA without getting permission from their institution, Lakehead University in Canada faces these legal problems as staff members complain about not having their academic freedom and privacy protected once using Google's public cloud. (Todd, 2008). These earlier worries put data confidentiality at risk and prevent higher education institutions from using cloud services. In developing nations, adoption of cloud computing is still fairly slow. As a result, colleges in these developing nations will mostly adhere to the copyright rules of the chosen cloud vendors and the country in which their infrastructure is housed. Therefore, the ease with which colleges can comply with copyright regulations will be a major factor in choosing providers.

Research Methodology

Measures and Instrument Development

Van Selm and Jankowski (2006) mentioned that online questionnaires and other internet-based data gathering methods have recently gained popularity, particularly in quantitative research methodology. So, the researchers used an online questionnaire survey that was used as the major method of data collecting for this investigation. A thorough analysis of the study literature was utilized to design the questionnaire in order to discover reliable and often applied measures. The questionnaire is divided into two divisions, i.e. (A and B), in which Section A asks demographic questions about age, current position, and educational institution type. The second section B consists of model dimensions of a five-point Likert scale ranging from 1-strongly agreed to 5-strongly disagreed.

Nomenclature

A	**ITOETAM**	The proposed model for cloud computing adoption challenges
B	TOE	**Models of technology, organization, and environment that have been applied in cloud issues in the past**
C	**TAM**	Utilizing a technological acceptance model to address the issues with cloud computing
D	**I-E model**	**Integrated internal and external model used to address cloud computing issues**
E	**TF**	**The latent variables of the ITOETAM model are technological variables.**
F	**OF**	**The ITOETAM model's latent variable is organizational factors.**
G	**EF**	**The ITOETAM model's latent variable is environmental factors.**
H	**EFTH**	**Egyptian Faculties of Tourism and Hotels**
I	**THHEI**	**Tourism and Hospitality Higher Education Institutions**
J	**PLS-SEM**	**Partial Least Squares-Structure Equation Modeling**
K	**TOGAF**	**Framework for Open Group Architecture**

Source: Juma and Tjahyanto (2019)

The previously indicated relationship between cloud computing acceptance (endogenous) and cloud computing implementation issues (exogenous) is measured using the ITOETAM model, and the model's fit is evaluated. The TAM model and the TOE model are combined to form the study's internal-external model. We were unsure of the precise obstacles that THHEI would encounter while employing the cloud computing paradigm, thus the study chose to apply ITOETAM, which takes into account the fact that the challenges were expected before testing. As a result, we can decide and categorise many issues related to cloud computing services in THHEI.

H1. Validating the goodness of fit indices of the model of challenges of adopting cloud computing

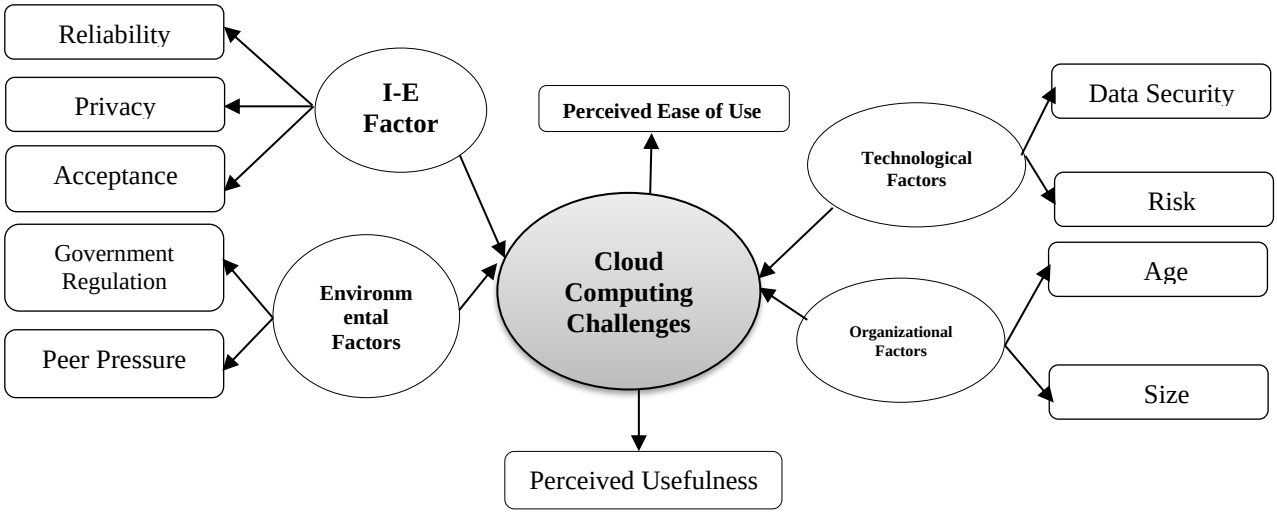

Fig. 1. TIF (a) Analysis of the ITOETAM model on Amos; (b) The proposed model (ITOETAM) for cloud computing adoption.

Source: Juma and Tjahyanto (2019).

Table 1: Overview of methodological steps undertaken in this research.

Study Objectives	Author and Year	Systems Approach	Outcomes
1. Explain the different aspects of cloud computing, and the services it provides in educational processes. 2. Examining a hybrid modeling approach for testing the correlation between the factors that cause challenges in using the educational cloud computing adoption model in ECITH. 3. Suggesting procedures and mechanisms to benefit from cloud computing services in developing tourism and hotel education and overcoming the challenges facing the adoption of cloud computing in THHEI.	Alharthi et al 2012	Integrated TAM mode (I-E factors)	If numerous organizations and universities are convinced that cloud computing will benefit them through their attitudes, actions, and actual use of it, they may adopt it.
	Yu-Ting Lee et al 2013	DEMATEL and TAM	Although increased value and efficiency under the topic of seeming helpfulness (PU) are progressively vital to implement, clear understanding and operational straightforwardness under the subject of seeming convenience (PEOU) are becoming more and more fundamental.
	Sabi et al 2016	DOI and TAM	A methodology that assesses the technological, economic, and contextual ramifications of cloud computing adoption in universities has been introduced.
	Salim Al 2016	DOI and TOE	It was discovered that organizational, technological, and environmental factors could all affect whether cloud computing services are adopted.
	Tashkandi et al 2015	TOE	Relative advantage, data privacy, and complexity are the most significant factors for cloud adoption.
	Rohani et al 2015	TTO, DOI, and TOE	This research identifies four contexts: human characteristics, technological, organizational and environmental, which are essential elements of the adoption of the Cloud computing services.

3.2. Sampling and Data Collection

To avoid any misunderstandings, the survey was first produced in English before being translated into the participants' native Arabic language. After that, the questionnaire was translated from Arabic back into English. Five hospitality scholars were invited to assess the questionnaire's content and provide any criticism in order to ensure that it measures the qualities it is intended to measure. On a sample of thirty institutions' staff members who are

not included in the study's main sample, the practicality of the questionnaire was also assessed by looking at whether it was appropriate and intelligible and whether the questions were clearly stated, understandable, and presented.

The research sample is a sample of students, graduate students, staff, IT personnel and employees of THHEI. The research population consists of THHEI, where the number of institutes accredited by the Ministry of Higher Education is 15 and the number of government colleges is 10 (Alsotohy and Abdullah 2020). The research team invites people to take part in the field study through their relationships with members of the study population. The study included convenience sampling and snowball sampling techniques. The questionnaire was to be completed, and participants were asked to invite their colleagues and still-running institutes. The sample study population's participants reacted in various ways.

As a method of gathering data, the researchers relied heavily on surveys to obtain the responses of the respondents. To this end, links to the surveys were distributed online to participants via email, WhatsApp, and social media, rather than directly to the study sample. A welcome letter has been sent along with comprehensive study-related information. The study is voluntary, the participants were informed. On a scale from 1 to 5, where 1 represents strongly disagree and 5 represents strongly agree, they were respectfully asked to check the correct response. They were then instructed to submit the survey after finishing it. Nearly two months were spent collecting the data (March 2022 until the end of May 2022).

Because of the difficulty of enumerating the study community and the fraternal sample of colleges and institutes of tourism and hotels. The right sample size was chosen based on the advice of Hair et al. (2010) and Kock and Hadaya (2018). On the basis of the quantity of the variables under investigation, they advised determining the proper sample size. It is permitted to use the minimum ratio (variable: sample = 1:10). With 24 variables altogether under research, 240 participants were the bare minimum sample size needed for this study.

500 questionnaires were distributed from the sample of the research, and the return of the questionnaires was 452, of which 48 were lost, 21 were excluded, and the number of valid questionnaires for analysis was 431, with a response rate of 86.2%.

The research participants were given the assurance that the data would be kept anonymous, secret, and used only for study in order to lessen the threat of (CMV). There are no right or wrong answers to the questions; therefore, they were instructed to answer them completely honestly. Furthermore, the widely used and straightforward statistical approach to Harman's single-factor test reveals the utilization of CMV (Rodrguez-Ardura and Meseguer-Artola, 2020). 431 of the investigation's participants provided honest responses. N = 278 participants, or 64.5%, fell into the older category of participants with an average age of 20 to 50 years. 46.6% of the participants in the open post (N = 201) were students. More of the participants in the study came from educational**.**

Data Analysis

Using SPSS version 22 and Amos version 26, the data was examined. Descriptive statistics, including mean, standard deviation (SD), frequencies, and percentage, were used to depict the demographic information of the researched respondents and identify their perceptions of the study constructs. Through the Harman's single factor test, common method variance (CMV) was investigated. By using confirmatory factor analysis (CFA), the measurement items' validity and reliability were verified. For the purpose of validating the results, the average extracted variance (AVE), composite reliability (CR), and maximum shared variance (MSV)

were determined. Additionally, the Fornell-Larcker criterion-based discriminant validity was looked at. Finally, to ascertain the direction and correlations between the study hypotheses, structural equation modelling (SEM) was used.

Results

Descriptive Statistics

Table 2 displays the mean and standard deviation for each variable pertaining to the study's constructs. About the challenges of educational cloud computing adoption, the studied respondents concurred and strongly concurred on the majority of the examined questions, where the average mean varied from (3.70 to 4.48).

Measurement Model

CFA with maximum Likelihood was used to investigate the reliability and validity of the study constructs (see Figure 2).

As shown in Table 1, all latent variables' composite reliability (CR) values are above the recommended cutoff point of 0.80 (Hair et al., 2013), indicating acceptable internal reliability. Utilizing convergent and discriminant validities, construct validity was also investigated (Chin et al., 1997). Convergent validity requires a factor loading of at least 0.50 and an average variance extracted (AVE) value over 0.50. (Duckworth and Kern, 2011). The AVE of each construct was over 0.50, ranging from 0.464 to 0.982, and the factor loading of all study items is higher than 0.50, demonstrating that convergent validity has been attained. According to the Fornell-Larcker criterion, each construct's square root of AVE must be greater than its correlation with another in order for it to have discriminant validity.
The study's model fit was adequate as evidenced by the following numbers: x2 = 505.131) df = 214) p 0.001, x2/df = 2.360, Goodness of Fit Index (GFI)= 0.912, Comparative Fit Index (CFI)= 0.953, Normed Fit Index (NFI)= 0.922, Root Mean Square Residual(RMR)=0.071, Incremental Fit Index (IFI)= 0.9

Because of the study's measurement model's strong validity and dependability, we got to the definite conclusion that the outer model is strongly supported by the inner model.

Structural Equation Modeling

The goodness of fit indices was high; they were as follows: x2 = 505.131 (df = 214), p 0.001, x2/df = 2.360, GFI = 0.912, CFI = 0.953, NFI = 0.922, RMR = 0.071, IFI = 0.954, RFI = 0.900, and RMSEA = 0.056.

Table 2: Reliability, confirmatory factor analysis features, and descriptive statistics

Construct	Estimate	Estimate^2	Theta= 1- Estimate ^2	Sum Theta	Sum (estimate)	CR	CR^2	AVE	Sqrt (Ave)	MSV	M1 (S.D.)2	Std. Loading (CFA)3	t-value
Size <--- Technology	0.816	0.665	0.334	0.051	2.945	0.994	8.673	0.982	0.997	0.25	-	0.816	-
Risk <--- Technology	0.973	0.946	0.053									0.973	9.383
Data Security <--- Technology	1.156	1.336	-0.336							0.5		1.156	8.727
Government Regulation <-- Environmental Factors	0.884	0.781	0.218	0.196	1.895	0.948	3.591	0.901	0.949	0.25	-	0.884	9.974
Peer Pressure <--- Environmental Factors	1.011	1.022	-0.022							0.5		1.011	-
Acceptance <--- I-E Factors	1.033	1.067	-0.067	-	3.08	1.017	9.486	1.054	1.026	0.84	-	1.033	-
Privacy <--- I-E Factors	1.055	1.113	-0.113	0.164								1.055	8.155
Reliability <--- I-E Factors	0.992	0.984	0.015							0.92		0.992	12.92
DS1 <--- Data Security	0.479	0.229	0.770	3.161	2.875	0.723	8.265	0.367	0.606	-	4.50(.83)	0.479	-
DS2 <--- Data Security	0.454	0.2061	0.793								4.24(.81)	0.454	8.493
DS3 <--- Data Security	0.861	0.741	0.258								3.55(1.29)	0.861	10.93
DS4 <--- Data Security	0.344	0.118	0.881								4.52(.77)	0.344	6.932
DS5 <--- Data Security	0.737	0.543	0.456								3.91(1.14)	0.737	10.50
R1 <--- Risk	0.53	0.280	0.719	1.570	1.909	0.698	3.644	0.476	0.690	-	4.14(.86)	0.53	-
R2 <--- Risk	1.004	1.008	-0.008								3.54(1.26)	1.004	12.77
R3 <--- Risk	0.375	0.140	0.859								4.19(1.09)	0.375	7.086
S1 <--- Size	0.66	0.435	0.564	1.607	1.916	0.695	3.671	0.464	0.681	-	3.88(1.14)	0.66	-
S2 <--- Size	0.918	0.842	0.157								3.30(1.40)	0.918	14.76
S3 <--- Size	0.338	0.114	0.885								4.46(.78)	0.338	6.452
GR1 <---Government Regulation	0.808	0.652	0.347	0.945	1.442	0.687	2.079	0.527	0.726	-	4.56(.73)	0.808	11.30
GR2 <--- Government Regulation	0.634	0.401	0.598								4.41(.74)	0.634	-
PP2 <--- Peer Pressure	0.711	0.505	0.494	1.111	1.33	0.614	1.768	0.444	0.666	-	4.44(.719)	0.711	-
PP1 <--- Peer Pressure	0.619	0.383	0.616								4.45(.720)	0.619	11.31
REL3 <--- Reliability	0.626	0.391	0.608	1.825	1.874	0.657	3.511	0.391	0.625	-	4.42(.758)	0.626	-
REL2 <--- Reliability	0.668	0.446	0.553								4.21(.944)	0.668	11.65

REL1 <--- Reliability	0.58	0.336	0.663								4.24(.886)	0.58	10.81
P3 <--- Privacy	0.709	0.502	0.497	1.829	1.865	0.655	3.478	0.390	0.624	-	4.43(.798)	0.709	
P2 <--- Privacy	0.577	0.332	0.667								4.40(.821)	0.577	11.85
P1 <--- Privacy	0.579	0.335	0.664								4.12(1.05)	0.579	11.31
ACC3 <--- Acceptance	0.404	0.1632	0.836	2.213	1.518	0.509	2.304	0.262	0.511	-	4.23(.95)	0.404	-
ACC2 <--- Acceptance	0.591	0.349	0.650								3.93(1.08)	0.591	7.51
ACC1 <--- Acceptance	0.523	0.273	0.726								4.43(.83)	0.523	7.14

Theta=1-Estimate ^2, Sum (Estimate), CR=Composite Reliability, AVE; Average Variance Extracted. AVE=average (estimate^2), Sqrt; Square Root. MSV; Maximum shared Variance. M1 = Mean, (S.D.) 2 = Standard Deviation, Std. Loading, (CFA) 3 = Standardized Factor Loading. Model fit; x2 = 505.131 (df = 214) p < 0.001 x2/df = 2.36, Goodness of Fit Index (GFI) = 0.912, Comparative Fit Index (CFI) (0.953, Normed Fit Index (NFI) (0.922), Root Mean Square Residual (RMR) (0.071), Incremental Fit Index (IFI) (0.954), Relative Fit Index (RFI) (0.900), Root-Mean Square Error of Approximation (RMSEA) (0.056), ***p < 0.001.

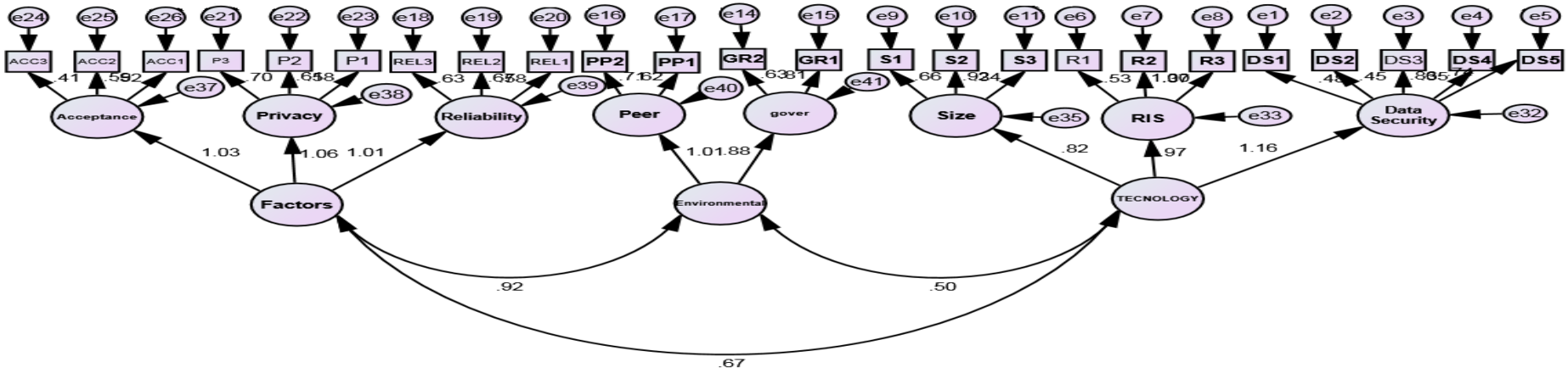

Figure 2: Confirmatory factor analysis.

DS1; Insecurity and privacy of data stored in the cloud is one of the obstacles to the adoption of cloud computing. DS2; Adoption of cloud computing applications in higher education institutions makes the process of data storage safe. DS3; the databases of cloud computing services in the educational process in your organization are adequately secured. DS4; Users' access to cloud computing is sufficiently secured from traditional attacks. DS5; storing data in a way that is not compatible with modern systems supports the implementation of cloud computing.R1; Cloud computing is more secure and less risky than traditional distributed data protection systems.R2; Cloud computing removes the worry of protecting sensitive data in the educational field.R3; Google's redistributed email framework ensures security and opportunity.S1; Your educational institution plans to use mobile cloud services to manage information in the future at a large scale.S2; Lack of interoperability, technically or economically, to move virtual devices, data, or services from one cloud to another hinders the use of cloud computing.S3; Decreased demand for university services, and the increasing rate of students turning to foreign competitors are obstacles to the adoption of cloud computing.GR1; Legal jurisdiction supports to adaption of cloud computing in institutions of higher education.GR2; Lack of integration, interaction and connection of information technology systems in most branches of Egyptian public universities in a central way with each other hinders the use of cloud computing.PP1; Restricting vendors, making educational institutions under the pressure of changing prices and terms of service or discontinuing cloud services.PP2; The institute's uses cloud computing services (SaaS), such as (Google applications-Microsoft training cloud- Amazon web administration and IBM cloud foundation).R1; Your educational institution relies on various technological applications to become smart institutions.R2; Cloud adoption helps address your issues directly from your computers.R3; Cloud computing technology provides a better way to deal with disasters and facilitate the backup and recovery of various data.P1; Vendor locking and cloud service suspension lead to educational data being lost and never being recovered again.P2; Unsecured vendors and data location obstruct the adoption of cloud computing in higher education institutions.P3; Privacy and regulatory compliance are among the obstacles to cloud computing adoption in higher education institutions.A1; Lack of technological skills is one of the obstacles to using cloud computing.A2; If higher education institutions are certain that cloud computing would benefit them based on their attitudes, behaviours, and present use of it, they will adopt it. According to A3, the most crucial variables for cloud adoption are comparative benefits, data protection, and complexity.

The Fornel-Larcker criterion advises using the square root of AVE in each construct to establish discriminant validity if the value is bigger than the other correlation diagonally. For instance, the square roots of the constructs AVE of CCC, TF, EF, and IEF were determined to be 0.991, 0.950, and 1.026, respectively, from the preceding table; these values are higher than the correlation values of the corresponding columns. As shown in Table 3, the outcome shows that the discriminant validity is well established.

Table 3: Discriminant validity based on Fornell–Larcker criterion.

	TF	EF	IEF
TF	**0.991**		
EF	0.502	**0.949**	
IEF	0.671	0.915	**1.026**

In higher education institutions for tourism and hospitality, using cloud computing may provide difficulties. The main and specific purpose of the tourism and hospitality higher education institutions is the research and study sample that may not work well in displaying competition in teaching, using services for cloud computing, and the possibility of storing big data to serve the teaching process. The aim of this study is to develop and validate the "ITOETAM" Model for cloud computing challenges in tourism and hospitality higher education institutions. The model was developed by Juma and Tjahyanto (2019) for a special model named the proposed model for cloud computing adoption challenges (ITOETAM). The model consists of five constructs named CCAM, IEF, TF, OF, and EF. The researchers relied on the following variables from the model as follows: "CCC-THHEI, TF, EF and IEF". By using it on a sample of the study population, the researchers' reliance on the model known as the seventh of the barriers of implementing cloud computing in tourism and hospitality higher education institutions. Technological factors seem to have a very important impact on the challenges of cloud computing services adoption in tourism and hospitality higher education institutions, which include data security, risk, and size. Therefore, as indicated by the results of the research, the Ministry of Higher Education must provide full support to all the study sample institutions to show the adoption of cloud computing services in educational institutions in order to keep pace with the digital transformation and conduct comparative measurement with international and international institutions in tourism and hotel education. To be able to do this, it is necessary to secure the data well, protect it from various risks, and establish rules for raising and storing large data. The results also showed that environmental factors have an impact on the challenges of adopting cloud computing services in tourism and hotel education institutions, which include “government regulations and peer pressure.” Depending on the results of the model and the extent of the quality of conformity, the concerned authorities must make a radical change in the regulations of the educational process in the tourism and hotel higher education institutions to keep pace with the huge technological development at the level of the countries of the world, and to support the adoption of cloud computing services. I-E factors are among the difficulties that need further research and study regarding the internal and external factors of the challenges of cloud computing adoption in tourism and hotel education institutions. The adoption of the cloud computing model.

Conclusion

In conclusion, our goal is to give the reader a broad overview of the cloud computing adoption issues model in higher education institutions for the hospitality and tourism industries as well as to explain how cloud computing services can be accepted after overcoming the challenges.

The outcomes demonstrated the model's equivalence because the goodness of fit indices were high: x2 = 505.131 (df = 214), p 0.001, x2/df = 2.360, GFI = 0.912, CFI = 0.953, NFI = 0.922, RMR = 0.071, IFI = 0.954, RFI = 0.900, and RMSEA = 0.056.The challenges faced by tourism and hospitality higher education institutions in adopting cloud computing services, and the results showed that Environmental Factors, I-E factors and technological factors were critical challenges for institutes in the research sample.

Data Availability Statement

Additional questions may be directed to the corresponding author, whose original contributions to the study are provided in the additional article(s) (s).

Ethics Statement

The Mansoura University's Scientific Research Ethics Committee assessed and authorised studies involving human subjects. To participate in this study, participants gave their written, informed consent.

Author Contributions

ME: conception and approach. ME: formal analysis and software. Validation from RA and AA. formal analysis, myself. RA, and AA: research. Curation of data by AE and ME. ME, RA, and AA: first draught of the writing. ME and RA: writing, editing, and peer review. The final version of the manuscript was approved by all authors, who also contributed pertinent contributions.

Limitations of the Study

This research has faced some limits and restrictions, and those limits are as follows: First, the research dealt with the subject of study employees, students, graduates, IT employees, in colleges and institutes of tourism and hotels in Egypt. As a result, it will be difficult to generalize the findings of the research to all educational institutions in public and private universities. The findings of this research should be used in this particular field of tourism and hospitality education establishments. The research recommends a future study to explore the opinions of the study sample in colleges and institutes affiliated with higher education in general. Secondly, this research study focuses only on the model of the challenges of accrediting cloud computing services in tourism and hotel education institutions, but in future research work is being done to study the model of accrediting cloud computing for educational services in tourism and hotel institutions. The data was collected through an online questionnaire. Participants may therefore respond based on their own opinions. As a result, performing prospective research with a mixed methodology (quantitative and qualitative) may result in a deeper comprehension.

نمذجة ITOETAM "للتحقق من صحة تحديات الحوسبة السحابية وتطويرها في مؤسسات التعليم العالي للسياحة والضيافة

المستخلص

تعد الحوسبة السحابية واحدة من أقوى الابتكارات التي أثارت اهتمام التقنيين في جميع أنحاء العالم. كما تقدم الحوسبة السحابية العديد من المزايا ، ولكنها تطرح أيضًا العديد من التهديدات الأمنية التي لا يمكن لأي مؤسسة أن تتجاهلها. يواجه التعليم التدريجي في إنشاء الدول مسألة نقل بُعد البيانات والابتكار التبادلي. بناءً على هذه الصعوبات ، تحاول الدراسة تطوير والتحقق من صحة نموذج "**ITOETAM**" لتحديات الحوسبة السحابية (**CCC**) في مؤسسات التعليم العالي للسياحة والضيافة (**THHEI**) لإيجاد حلول لهذه التحديات. من أجل تحديد هذه التحديات ، يهدف البحث إلى تطوير والتحقق من صحة النموذج الذي أنشأه **(Tjahyanto and Juma, 2019)** لنموذج فريد يشار إليه بالنموذج المقترح لتحديات اعتماد الحوسبة السحابية (**ITOETAM**) لفئات الصعوبات المختلفة والقضايا المحددة الأعلى التي تواجهها المؤسسات التعليمية في السياحة والضيافة عند استخدام خدمات الحوسبة السحابية التعليمية. يتكون النموذج من خمسة متغيرات تسمى **CCAM** و **IEF** و **TF** و **OF** و **EF**. اعتمد الباحثون على المتغيرات التالية من النموذج على النحو التالي: **CCC-THHEI**، **TF**، **EF and IEF**. بلغ إجمالي المشاركين 431 من الطلاب وطلاب الدراسات العليا والموظفين وموظفي تكنولوجيا المعلومات والعاملين في مؤسسات السياحة والتعليم الفندقي المصرية. كما أوضحت نتائج التحقق من صحة نموذج "**ITOETAM**". اختبار **SEM** الذي تم استخدامه. كانت جودة مؤشرات الملاءمة جيدة ؛ **x2 = 505.131 (df = 214) p <0.001**، **x2 / df = 2.360**، **GFI = 0.912**، **CFI = 0.953**، **NFI = 0.922**، **RMR = 0.071**، **IFI = 0.954**، **RFI = 0.900**، **RMSEA = 0.056** تمت مناقشة القيود واتجاهات البحث المستقبلية.

الكلمات الدالة: نمذجة ITOETAM ، تحديات الحوسبة السحابية ، مؤسسات التعليم العالي

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