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Development and psychometric evaluation of the cloud computing acceptance questionnaire for academic libraries

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ABSTRACT

Cloud computing is a new technology that drives libraries to create and share knowledge, leading to the cost reduction, easy management, and unlimited data storage capacity. Given the importance of cloud computing technology and the lack of tools to investigate the factors affecting cloud computing acceptance in academic libraries; therefore, the aim of present study was to perform the development and psychometric evaluation of the cloud computing technology acceptance questionnaire for academic libraries. This study is a methodological research. After defining the concept of cloud computing acceptance, the initial version of the questionnaire consisting of 43 items and 11 components was designed. Then, face and content validity were used to assess validity, and Cronbach's alpha coefficient and intra-class correlation coefficient (ICC) were used to determine reliability. The results showed that the questionnaire has acceptable face validity (more than 1.5) and content validity (0.79). The Cronbach's alpha coefficient and the intra-class correlation coefficient were 0.77 and 0.92, respectively. In this study, for the first time, a tool was designed to evaluate the acceptance of cloud computing technology in academic libraries. Due to the fact that this tool has acceptable validity and reliability, it can be used in various studies and surveys.

Introduction

Over the past two decades, information technology (IT) has created many benefits, opportunities, and challenges for organizations, and public and private institutions. Academic libraries are no exception in this regard. With the acceleration of the IT developments, the functions, processes, and services of libraries have been affected (Moyo, 2004; Melchionda, 2007; Tsakonas & Papatheodorou, 2008).

The existential philosophy of academic libraries is to assist professors, students, and researchers in advancing education and research. In order to fulfill their educational and research mission in the best possible way, these libraries must use the latest technologies to be able to provide their services in the best way (Kokabi, 1998). For this reason, all academic librarians need to adapt to changes in information technology (Emanuel, 2012). Lack of necessary facilities and training makes the academic librarians reluctant to accept IT changes, which can hinder the development of the library (Islam & Islam, 2007). The use of IT to coordinate organizations in the face of environmental changes and gain flexibility is inevitable, necessary and desirable (Lederer, 2008). One of these technologies is cloud computing.

The basic concept of cloud computing dates back to the 1950s. In 1961, nearly six decades ago, Jahn McCarthy predicted what we now know as cloud computing. On the 100th anniversary of MIT, McCarthy stated: "Computing may someday be organized as a public utility just as the telephone system is a public utility," (Greenberger, 1964; Madhavaiah & Bashir, 2012).

The cloud computing is based on the principle that individuals and companies, instead of purchasing the required products and software, can receive these items through the network when needed and pay the price based on the required amount (Avram, 2014).

The most comprehensive definition of cloud computing is provided by the National Institute of Standards and Technology (NIST). As defined by NIST (2011):

"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Atobishi & Podruzsik, 2017; Mell & Grance, 2011).

Cloud computing services have great potential for revolutionizing

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library and information services. Cloud computing is the delivery of computing services over the Internet, which is why libraries enable businesses and individuals to use software and hardware that are managed by third parties (cloud computing service providers) in remote locations. (Onwubiko et al., 2021). This technology has some special features that attract library administrators and professionals because of its application in library and information services. These features include On-demand service; broad network access, resource pooling; rapid elasticity; measured service; and multi tenancy (NIST, 2011). Cloud computing can facilitate the dissemination and access of wider information (NIST, 2013). It also has the potential to significantly increase the productivity of library staff and can fundamentally re-engineer and rebuild library operations that support the provision of effective information services (Salam & Ali, 2020). This technology is a combination of computer and Internet use that can create integrated data with many libraries. With the use of cloud computing, providing various library services through the Internet becomes a possibility (Miss, 2021). Cloud computing transforms systems and service delivery and provides an opportunity for libraries to expand their impact on customers and society as a whole (Onwubiko et al., 2021). Cloud computing in libraries is a democratizing force, and in this regard, access to cloud technologies helps librarians and information professionals to overcome limitations and use robotic computing in their librarianship performance (Sultan, 2013).

Cloud computing is divided into three models: 1) Infrastructure-as-a-Service (IaaS), 2) Platform-as-a-Service (PaaS), and 3) Software-as-a-Service (SaaS). For library and information services, SaaS cloud computing technologies are the most accessible and practical form of cloud computing (Onwubiko et al., 2021). SaaS refers to software that is designed for end users and is available over the Internet. SaaS computing technologies provide powerful options for organizations that do not have the expertise, staff, time or infrastructure to implement and support various computing services. Using the software-as-a-service (SaaS) model, library operators begin deploying their software on remote servers, allowing their clients to access data through web-based user interfaces. Examples include the shared management services provided by the Online Computer Library Center (OCLC).

PaaS is a computing platform in which web applications are created quickly and easily without the need to purchase and maintain the software and infrastructure required for it. In fact, it is a set of services that provides a platform or environment to allow developers to build the software applications required and users to easily access the web through the Internet (Onwubiko et al., 2021). Using this service is hassle-free, and libraries will not have to worry about maintaining their hardware or software infrastructure without using it.

IaaS is the core layer of cloud computing. In this type, both storage services and computing power are provided to users. And includes virtual service space or software platforms (environment), storage space, network connections, internet providers (IP) addresses and bandwidth to handle the workload of organizations (Onwubiko et al., 2021). This service is very popular because of the features or the ability to provide custom services requested for wide area network access and metered services. A common example of SaaS is Amazon Web Services (AWS).

Generally, The most important areas where cloud computing can lead libraries to create and share knowledge are, in short, resource sharing and knowledge creation, ordering and collection, management, accessing, selection, and description, which includes cataloging and collection building (Wilson, 2012; Yeboah-Boateng & Essandoh, 2014).

Cloud computing has many benefits that users or organizations have taken advantage of. Benefits such as cost reduction, independence of time and place, easy scalability, easy management, upgrades and maintenance, reduction of hardware costs (elimination of maintenance and repair services) and software (Gangwar et al., 2014; El Khatib & Opulencia, 2015), service scalability, fast and continuous software upgrades, more document format compatibility, unlimited data storage capacity, more data reliability (increased security), permanent and universal performance and accessibility for users (accessible from anywhere and location independency), Increase access to expert staff, access to the latest information (ease of updating), flexibility with environmental changes (Bhardwaj et al., 2010; Buyya et al., 2009; Garison et al., 2015) and automation in managerial tasks (JoSEP et al., 2010).

The cloud computing is integrated into the libraries in developed countries and can have many benefits, but this technology has not yet been implemented in the academic libraries in developing countries like Iran. On the one hand, cloud computing not only should develop and deploy in a country's academic libraries to get its benefits, but also must be accepted by all academic librarians. Therefore, in order to achieve the potential benefits of this technology, we need to accept it first of all (Boufeas et al., 2004; Hamner & Al-Qahtani, 2009).

Technology acceptance is a demonstrable satisfaction with the practical use of information technology in tasks designed to support it (Al-Qeisi, 2009; Dillon & Morris, 1996). Several models have been proposed to measure the acceptance of a technology. These models include the technology acceptance model (TAM), Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Decomposed Theory of Planned Behavior (DTPB), and Unified Theory of Acceptance and Use of Technology (UTAUT). Among the mentioned models, Technology Acceptance Model (TAM) is the most prominent and valid technology acceptance model. This model has received significant theoretical and experimental support in many countries of the world and its applicability has been studied. This model was proposed by Davis, Bagozzi and Warshaw in 1989 and is still validated and used by many researchers in many countries around the world (Park et al., 2014). Fig. 1 shows the technology acceptance model (TAM).

Lee, Kozar, & Larsen, 2003 introduced TAM studies as the most influential and general theory in the field of technology acceptance (Lee, Kozar, & Larsen, 2003). King and He (2006) introduced TAM as a valid and robust model that has been widely used. Marangunić and Granić (2015) in a study examined the literature on the TAM model. The results of their study showed that most TAM studies focus on the acceptance situations that users have the freedom to choose or not to use technology (Marangunić and Granić, 2015).

There have been numerous research studies conducted on the acceptance of different types of technologies in different organizations (Manis & Choi, 2019; Scherer, Siddiq, & Tondeur, 2019; Vanduhe et al., 2020). Some studies have also showed that TAM can be used to accept a new technology in libraries (Tella et al., 2020; Rafique et al., 2020; Adeyemi & Issa, 2020). To date, no studies have been carried out regarding the use of TAM to evaluate cloud computing accepted by all academic librarians in developing countries before its development and deployment. In many academic libraries, despite the positive attitude toward the utilization of IT and support of administrators, policy makers and planners for the use of it, due to the lack of its acceptance by all academic librarians, new information the use of emerging technologies such as cloud computing had received relatively less attention (Isfandyari & Hoseini, 2011).Administrators, policy makers, and planners focusing on the academic libraries need a reliable tool in order to provide the necessary context for all academic librarians to embrace this technology with as much enthusiasm. Therefore, the aim of present study was to perform the development and psychometric evaluation of the cloud computing technology acceptance questionnaire for all academic libraries based on TAM model.

Materials & methods

This was a methodological study conducted in 2020 for designing and psychometric evaluation of the cloud computing acceptance questionnaire in academic libraries. In the present study, questionnaire development and psychometric evaluation was performed in four stages according to the method proposed by Waltz et al. (2010). The following steps are explained (Fig. 2):

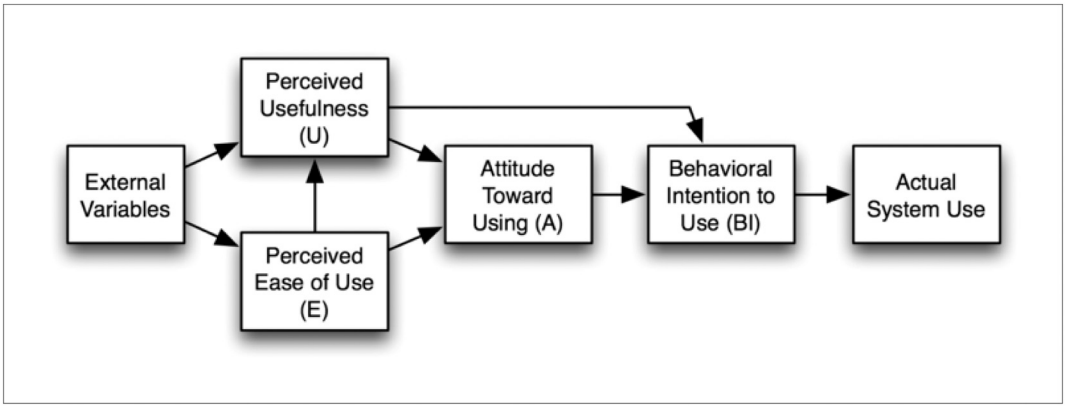

Fig. 1. Technology acceptance model (Davis et al., 1989).

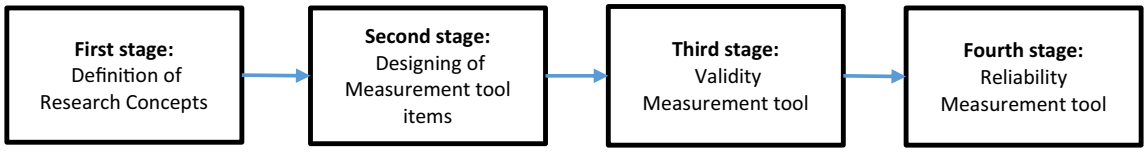

Fig. 2. Strategies for designing measurement tools and procedures.

Stage 1: In this step, by adding six external variables to the technology acceptance model (TAM), the conceptual model of the research was designed and its constructs were determined.

As shown in Fig. 3, the conceptual research model consists of two categories of constructs. 1- External constructs (external variables) include individual factors, social factors, organizational factors, technology factors, economic factors and environmental factors. 2- Internal constructs include perceived usefulness, perceived ease of use, attitude toward using, intention to use, and actual use.

Stage 2: In this stage, based on the research literature, questions were designed for the constructs of the conceptual research model. The initial version of the questionnaire consisted of 43 items and 11 constructs. The basic questions are presented in Table 3.

Stage 3: After preparing the initial version of the items, the validity of the questionnaire was measured. Validity is the ability of an instrument to measure a variable that is built to measure it. In fact, without knowing the validity of the measurement tool, the accuracy of the data obtained cannot be guaranteed. In this study, two methods were used, including face validity and content validity, which are common in psychometric studies.

Face validity

To calculate the face validity of each item, the Item Impact Score (IIS) should not be less than 1.5. Only items with an IIS value higher than 1.5 are acceptable. In investigating the face validity, 15 experts were asked to comment on the importance of each item in the questionnaire based on a range of five-point Likert scale (not important = 1, somewhat important = 2, moderately important = 3, important = 4, and very important = 5).

IIS was calculated for each item as follows:

Item Impact Score = percentage of raters who scored a score of 4 or 5 × mean score for the importance of each item.

Formula 1. Calculation of the impact score of questionnaire items.

Content validity

Content validity depends on the logical analysis of the content of a test and its determination is based on subjective and individual judgment. In examining the content validity, two indicators are calculated: 1) Content Validity Ratio (CVR) and 2) Content Validity Index (CVI).

1. Content validity ratio (CVR)

This index was designed by Lawshe (1975). To measure this index, experts were asked to classify each item based on a range of three-point Likert scale (necessary, useful, and unnecessary). Then, based on the following formula, the content validity ratio of the items was calculated:

$$CVR = \frac{ne - \frac{n}{2}}{\frac{n}{2}}$$

Formula 2. Calculation of the content validity ratio of the questionnaire items.

n: total number of experts.

ne: Number of experts who chose the necessary option for the questionnaire items.

Based on the number of experts evaluating the items, the minimum acceptable CVR value should be based on Table 1. Items for which the amount of CVR calculated is less than the desired amount considering the number of evaluators should be omitted because they do not have acceptable content validity.

In the present study, 15 experts participated to calculate the face and content validity. Therefore, the questionnaire items were accepted or rejected according to the criteria in Table 1 based on one of the following two cases.

1. If the CVR value of the item was equal to or greater than 0.49, the item was accepted.
2. If the CVR value of the item was less than 0.49, the item was rejected.

2. Content validity index (CVI)

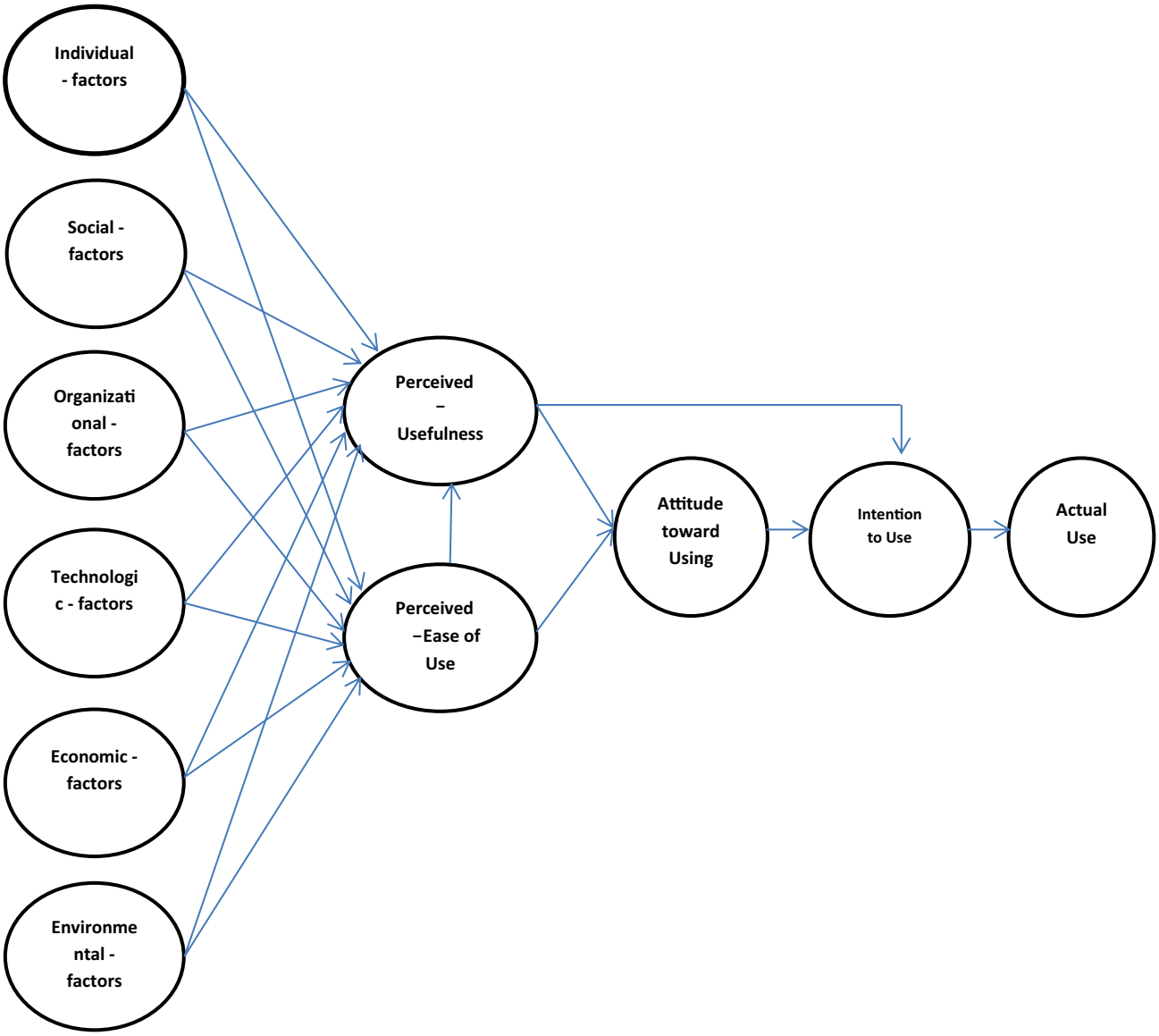

Fig. 3. Research conceptual model.

Table 1
Minimum values of CVR introduced by Lawshe for the appropriateness of content validity (1975).

The number of experts	The minimum value of CVR
5	0. 99
6	0. 99
7	0. 99
8	0.75
9	0.78
10	0.62
11	0.59
12	0.56
13	0.54
14	0.51
15	0.49
20	0.42
25	0.37
30	0.33
35	0.31
40	0.29

Waltz and Basel method was used to examine this index. In this method, the relevancy, simplicity and clarity of the questionnaire items can be measured using a four-point Likert scale as follows (Drost, 2011).

Relevancy of each item is specified from 1 (not relevant), 2 (relatively relevant), 3 (relevant) to 4 (completely relevant). In terms of clarity, scores ranging from 1 (not clear), 2 (relatively clear), and 3 (clear) to 4 (very clear) were given. Finally, the CVI is calculated using the following formula.

$$\mathrm{CVI} = \frac{\sum_{\mathrm{N}}^{1} \mathrm{CVR}}{\text{retained number}}$$

Formula 3. Calculation of content validity index of questionnaire items.

Number of experts who gave the item a score of 3 and 4: $\sum_{N}^{1} CVR$.
Retained number: total number of experts

According to the Waltz and Bausell method, the minimum acceptable value for the CVI index is 0.79. If the CVI index score is between 0.70 and 0.79, the item needs to be modified. If the CVI index score is less than

0.70, the item is deleted. Based on this, a decision was made for CVI.

Stage 4: After determining the validity of the questionnaire items, reliability was examined. Cronbach's alpha coefficients were used to check the internal consistency of the questions and test-retest and intra-class correlation coefficient (ICC) were used to check the external consistency. The following describes the reliability in detail.

Reliability

Reliability is a measurement means referring to the accuracy. The questionnaire has reliability when if we give it to a single group of people several times in a short period of time, the scores obtained from several times of implementation are close to each other (DeVon et al., 2007).

Internal consistency and external consistency were used to determine reliability. Internal consistency was assessed by calculating Cronbach's alpha coefficients. The interpretation of Cronbach's alpha is presented in Table 2. In the present study, the minimum sample size required to calculate Cronbach's alpha was obtained from 30 all academic librarians. Therefore, the questionnaire was distributed among 30 all academic librarians in Iran. After collecting the questionnaires, SPSS statistical software was used to calculate Cronbach's alpha. It is worth noting that the alpha coefficient equal to or greater than 0.7 was considered acceptable.

After determining the internal consistency of the questionnaire, the external consistency was assessed through test-retest and calculation of intra-class correlation coefficient (ICC). For this purpose, a group of 30 Iranian all academic librarians were selected and the test was performed twice in a period of two weeks for them and thus the reproducibility or external stability of the questionnaire was calculated using SPSS statistical software. If the result of this index is higher than 0.70, the questionnaire with external consistency is acceptable, and accordingly, external consistency of the questionnaire this is decided.

Results

In this section, the design and psychometric evaluation results of the cloud computing acceptance questionnaire for academic libraries are presented. First, the results of face validity assessment of the questionnaire are presented. Content validity findings are then reported. The reliability of the questionnaire is measured below. Finally, the standard cloud computing acceptance questionnaire in academic libraries is presented.

Face validity of questionnaire

At the beginning of the study, the number of initial items in the questionnaire was 43. The face validity of the questionnaire was assessed using Item Impact score. To accept the face validity of any research item, its impact score should not be less than 1.5 and only items with a score higher than 1.5 are acceptable in terms of face validity. The results of face validity study in Table 3 indicate that the impact score of all items is more than 1.5, so all items remained in the questionnaire and no item was omitted.

Table 2
Cronbach's alpha interpretation

Cronbach's alpha coefficient	Interpretation
Below 0.6	Non-acceptable
Between 0.6 and 0.65	Unsuitable
Between 0.65 and 0.7	Relatively acceptable
Between 0.7 and 0.8	Acceptable
Above 0.8	Very good

Table 3
Face validity of cloud computing technology acceptance questionnaire for academic libraries

Research question	Impact score	Result
Individual factors		
1. I have previous experience using the features and services of cloud computing technology.	3.4	Accepted
2. I have previous knowledge and awareness of using the facilities and services of cloud computing technology.	4.0	Accepted
3. I have good confidence to work with cloud computing technology.	2.7	Accepted
4. I have a good education to work with cloud computing technology.	3.6	Accepted
5. I have a suitable space to work with the facilities and services of cloud computing technology.	3.8	Accepted
Social factors		
6. My social view of cloud computing technology is appropriate.	2.7	Accepted
7. I trust the opinion of those around me about the facilities and services of cloud computing technology.	2.8	Accepted
8. The context and conditions of the community are provided to get acquainted with the facilities and services of cloud computing technology.	3.7	Accepted
Organizational factors		
9. Cloud computing technology facilities and services are available.	2.4	Accepted
10. Support services are provided in case of using cloud computing technology.	2.2	Accepted
Technologic factors		
11. Cloud computing technology has a comparative advantage over other technologies.	3.0	Accepted
12. Cloud computing technology has the compatibility feature.	3.2	Accepted
13. Cloud computing technology is a bit complicated.	3.0	Accepted
14. Features and services of cloud computing technology are visible.	2.6	Accepted
15. Features and services of cloud computing technology have the feature of testability.	2.7	Accepted
Economic factors		
16. Cloud computing technology software costs little.	3.6	Accepted
17. The cost of human recourses to launch cloud computing technology is low.	3.3	Accepted
18. The cost required to support and upgrade cloud computing technology is low.	2.7	Accepted
19. Low cost is required to maintain the facilities and services of cloud computing technology hardware.	3.2	Accepted
20. It is possible to pay for the use of the facilities and services of cloud computing technology.	2.7	Accepted
21. Using the facilities and services of cloud computing technology leads to more return on investment.	2.3	Accepted
Environmental factors		
22. Cloud computing technology is in line with business and technology.	3.6	Accepted
23. Cloud computing technology is adapted to changes in industry and market.	2.1	Accepted
24. Cloud computing technology complies with national and international regulations (intellectual property laws, patents).	2.6	Accepted
25. Cloud computing technology has access to global service platforms.	3.6	Accepted
Perceived usefulness		
26. The application of facilities and services of cloud computing technology leads to increased productivity.	3.8	Accepted
27. The application of facilities and services of cloud computing technology reduces production costs.	3.8	Accepted
28. The application of facilities and services of cloud computing technology leads to better control over the organizational activities.	2.6	Accepted
29. The application of facilities and services of cloud computing technology helps to perform organizational tasks.	3.0	Accepted
Perceived ease of use		

(*continued on next page*)

Table 3 (*continued*)

Research question	Impact score	Result
30. It is easy to learn how to use the facilities and services of cloud computing technology.	2.7	Accepted
31. The facilities and services of cloud computing technology are clear and understandable.	3.3	Accepted
32. It is easy to gain skills in using the facilities and services of cloud computing technology.	3.3	Accepted
33. It is easy to use different types of facilities and services of cloud computing technology.	3.3	Accepted
Attitude toward using		
34. It is wise to use the facilities and services of cloud computing technology.	2.3	Accepted
35. Using the facilities and services of cloud computing technology is very pleasant.	2.8	Accepted
36. Using the facilities and services of cloud computing technology is lovely.	2.6	Accepted
37. Using the facilities and services of cloud computing technology is beneficial.	1.8	Accepted
Intention to use		
38. I would like to use the facilities and services of cloud computing technology to perform my tasks.	2.7	Accepted
39. I would like to use the facilities and services of cloud computing technology continuously.	3.7	Accepted
40. I would like to use the facilities and services of cloud computing technology in the future.	3.2	Accepted
41. I would like to recommend the use of cloud computing technology facilities and services to others.	2.9	Accepted
Actual use		
42. I use the facilities and services of cloud computing technology frequently.	3.6	Accepted
43. I have been using cloud computing technology for a long time.	3.6	Accepted

Content validity of questionnaire

In examining the content validity of the questionnaire, two indexes were calculated: Content Validity Ratio (CVR) and Content Validity Index (CVI).

The results of CVR calculation are shown in Table 4. According to the Lawshe (1975) table described in the methodology, the acceptable CVR for 15 experts is 0.62. Accordingly, the items with a CVR of more than 0.62 are consistent and acceptable in terms of content with the objectives of the questionnaire. The results showed that necessary and important items were used in the questionnaire. Out of 43 items of the questionnaire, 39 ones were accepted and only the score of four items (5, 19, 29, and 36) was less than 0.62. Therefore, these four items were omitted from the questionnaire.

The results of the CVI for the questionnaire items are shown in Table 5. According to the Waltz and Bausell method, the minimum acceptable value for the CVI index is 0.79. If the CVI index is less than this value, the item should be omitted. The results of the CVI indicated that the CVI score of the two items (6 and 15) is less than 0.79 and these items are unacceptable and should be omitted from the questionnaire.

Reliability of questionnaire

In psychometric evaluation of questionnaire, after calculating the validity, the reliability of the questionnaire should be examined. In order to determine the reliability, Cronbach's alpha coefficient (Cronbach's alpha) and test-retest methods were used, which are the most common methods used for measuring reliability. First, the questionnaire was distributed among 30 all librarians working in Iranian academic libraries. After collecting the questionnaires, Cronbach's alpha coefficient of the questionnaire components was calculated. Cronbach's alpha results are presented in Table 6.

As observed in Table 6, the Cronbach's alpha coefficient for all components of the Cloud Computing Acceptance Questionnaire in

Table 4
Calculation of CVR for cloud computing technology acceptance questionnaire for academic libraries.

Research question	Content validity ratio (CVR)	Result
Individual factors		
1. I have previous experience using the features and services of cloud computing technology.	0.86	Accepted
2. I have previous knowledge and awareness of using the facilities and services of cloud computing technology.	0.73	Accepted
3. I have good confidence to work with cloud computing technology.	0.60	Accepted
4. I have a good education to work with cloud computing technology.	0.60	Accepted
5. I have a suitable space to work with the facilities and services of cloud computing technology.	0.46	Rejected
Social factors		
6. My social view of cloud computing technology is appropriate.	0.73	Accepted
7. I trust the opinion of those around me about the facilities and services of cloud computing technology.	0.60	Accepted
8. The context and conditions of the community are provided to get acquainted with the facilities and services of cloud computing technology.	0.60	Accepted
Organizational factors		
9. Cloud computing technology facilities and services are available.	0.73	Accepted
10. Support services are provided in case of using cloud computing technology.	0.73	Accepted
Technological factors		
11. Cloud computing technology has a comparative advantage over other technologies.	0.73	Accepted
12. Cloud computing technology has the compatibility feature.	0.60	Accepted
13. Cloud computing technology is a bit complicated.	0.60	Accepted
14. Features and services of cloud computing technology are visible.	0.60	Accepted
15. Features and services of cloud computing technology have the feature of testability.	0.60	Accepted
Economic factors		
16. Cloud computing technology software costs little.	0.60	Accepted
17. The cost of human recourses to launch cloud computing technology is low.	0.60	Accepted
18. The cost required to support and upgrade cloud computing technology is low.	0.60	Accepted
19. Low cost is required to maintain the facilities and services of cloud computing technology hardware.	0.46	Rejected
20. It is possible to pay for the use of the facilities and services of cloud computing technology.	0.60	Accepted
21. Using the facilities and services of cloud computing technology leads to more return on investment.	0.60	Accepted
Environmental factors		
22. Cloud computing technology is in line with business and technology.	0.60	Accepted
23. Cloud computing technology is adapted to changes in industry and market.	0.60	Accepted
24. Cloud computing technology complies with national and international regulations (intellectual property laws, patents).	0.73	Accepted
25. Cloud computing technology has access to global service platforms.	0.73	Accepted
Perceived usefulness		
26. The application of facilities and services of cloud computing technology leads to increased productivity.	0.73	Accepted
27. The application of facilities and services of cloud computing technology reduces production costs.	0.60	Accepted

(*continued on next page*)

Table 4 (*continued*)

Research question	Content validity ratio (CVR)	Result
28. The application of facilities and services of cloud computing technology leads to better control over the organizational activities.	0.60	Accepted
29. The application of facilities and services of cloud computing technology helps to perform organizational tasks.	0.46	Rejected
Perceived ease of use		
30. It is easy to learn how to use the facilities and services of cloud computing technology.	0.73	Accepted
31. The facilities and services of cloud computing technology are clear and understandable.	0.73	Accepted
32. It is easy to gain skills in using the facilities and services of cloud computing technology.	0.60	Accepted
33. It is easy to use different types of facilities and services of cloud computing technology.	0.60	Accepted
Attitude toward using		
34. It is wise to use the facilities and services of cloud computing technology.	0.86	Accepted
35. Using the facilities and services of cloud computing technology is very pleasant.	0.73	Accepted
36. Using the facilities and services of cloud computing technology is lovely.	0.46	Rejected
37. Using the facilities and services of cloud computing technology is beneficial.	0.60	Accepted
Intention to use		
38. I would like to use the facilities and services of cloud computing technology to perform my tasks.	0.60	Accepted
39. I would like to use the facilities and services of cloud computing technology continuously.	0.73	Accepted
40. I would like to use the facilities and services of cloud computing technology in the future.	0.60	Accepted
41. I would like to recommend the use of cloud computing technology facilities and services to others.	0.60	Accepted
Actual use		
42. I use the facilities and services of cloud computing technology frequently.	0.60	Accepted
43. I have been using cloud computing technology for a long time.	0.73	Accepted

academic libraries is between 0.70 and 0.80. In other words, the reliability and internal consistency of the questionnaire is "acceptable". To measure the external consistency of the questionnaire, test-retest method and Interclass Correlation Coefficient (ICC) were used. For this purpose, firstly, the questionnaire was completed by 30 all librarians working in Iranian academic libraries. Then, after two weeks, the same 30 people were asked to complete the questionnaire again. Finally, the scores obtained from the two tests were examined and their correlation coefficient was calculated. The results showed that the value of Interclass Correlation Coefficient Index (ICC) is 0.92 and $p < 0.001$. This result suggests good external reliability and consistency for the questionnaire, as well as a high correlation coefficient and repeatability.

Discussion and conclusion

Today, information technology is one of the main structures of libraries. Information technology has positive effects on the functioning of libraries, including academic libraries. In various studies such as Kumar and Biradar (2010), Mahmood and Richardson (2013), and Husain and Nazim (2015), the need to use information technology in libraries has been emphasized. Academic libraries use the benefits of information technology to do a variety of library work. Considering the importance of cloud computing acceptance and the benefits of using it in libraries, this study was conducted with the aim of development and psychometric evaluation of a cloud computing technology acceptance

Table 5
CVI Calculation of Cloud Computing Technology Acceptance Questionnaire for Academic Libraries

Research question	Content validity index (CVI)	Result
Individual factors		
1. I have previous experience using the features and services of cloud computing technology.	0.93	Accepted
2. I have previous knowledge and awareness of using the facilities and services of cloud computing technology.	0.86	Accepted
3. I have good confidence to work with cloud computing technology.	0.86	Accepted
4. I have a good education to work with cloud computing technology.	0.93	Accepted
Social factors		
6. My social view of cloud computing technology is appropriate.	0.66	Rejected
7. I trust the opinion of those around me about the facilities and services of cloud computing technology.	0.86	Accepted
8. The context and conditions of the community are provided to get acquainted with the facilities and services of cloud computing technology.	0.86	Accepted
Organizational factors		
9. Cloud computing technology facilities and services are available.	0.80	Accepted
10. Support services are provided in case of using cloud computing technology.	0.80	Accepted
Technical factors		
11. Cloud computing technology has a comparative advantage over other technologies.	0.80	Accepted
12. Cloud computing technology has the compatibility feature.	0.80	Accepted
13. Cloud computing technology is a bit complicated.	0.66	Rejected
14. Features and services of cloud computing technology are visible.	0.80	Accepted
15. Features and services of cloud computing technology have the feature of testability.	0.60	Rejected
Economic factors		
16. Cloud computing technology software costs little.	0.86	Accepted
17. The cost of human recourses to launch cloud computing technology is low.	0.86	Accepted
18. The cost required to support and upgrade cloud computing technology is low.	0.93	Accepted
20. It is possible to pay for the use of the facilities and services of cloud computing technology.	0.93	Accepted
21. Using the facilities and services of cloud computing technology leads to more return on investment.	0.93	Accepted
Environmental factors		
22. Cloud computing technology is in line with business and technology.	0.86	Accepted
23. Cloud computing technology is adapted to changes in industry and market.	0.80	Accepted
24. Cloud computing technology complies with national and international regulations (intellectual property laws, patents).	0.80	Accepted
25. Cloud computing technology has access to global service platforms.	0.86	Accepted
Perceived usefulness		
26. The application of facilities and services of cloud computing technology leads to increased productivity.	0.80	Accepted
27. The application of facilities and services of cloud computing technology reduces production costs.	0.80	Accepted
28. The application of facilities and services of cloud computing technology leads to better control over the organizational activities.	0.80	Accepted
Perceived ease of use		

(*continued on next page*)

Table 5 (*continued*)

Research question	Content validity index (CVI)	Result
30. It is easy to learn how to use the facilities and services of cloud computing technology.	0.80	Accepted
31. The facilities and services of cloud computing technology are clear and understandable.	0.80	Accepted
32. It is easy to gain skills in using the facilities and services of cloud computing technology.	0.86	Accepted
33. It is easy to use different types of facilities and services of cloud computing technology.	0.86	Accepted
Attitude to use		
34. It is wise to use the facilities and services of cloud computing technology.	0.80	Accepted
35. Using the facilities and services of cloud computing technology is very pleasant.	0.86	Accepted
37. Using the facilities and services of cloud computing technology is beneficial.	0.80	Accepted
Intention to use		
38. I would like to use the facilities and services of cloud computing technology to perform my tasks.	0.80	Accepted
39. I would like to use the facilities and services of cloud computing technology continuously.	0.93	Accepted
40. I would like to use the facilities and services of cloud computing technology in the future.	0.86	Accepted
41. I would like to recommend the use of cloud computing technology facilities and services to others.	0.93	Accepted
Actual use		
42. I use the facilities and services of cloud computing technology frequently.	0.93	Accepted
43. I have been using cloud computing technology for a long time.	0.80	Accepted

Table 6
Reliability of components of cloud computing technology acceptance questionnaire for academic libraries.

No.	Component	Cronbach's alpha coefficient
1	Individual factors	0.75
3	Social factors	0.77
3	Organizational factors	0.77
4	Technologic factors	0.76
5	Economic factors	0.74
6	Environmental factors	0.75
7	Perceived usefulness	0.75
8	Perceived ease of use	0.75
9	Attitude toward using	0.75
10	Intention to use	0.75
11	Actual use	0.79
12	Total	0.77

questionnaire for academic libraries. The results of psychometric analysis showed that the final version of the Cloud Computing Technology Acceptance Questionnaire in academic libraries with 36 items and 11 components has acceptable face validity and content validity. Based on this, it can be said that this questionnaire is a useful and practical tool to examine the factors affecting the cloud computing acceptance in academic libraries and other libraries and can be used by researchers in future studies.

Cloud computing technology allows all librarians to place information on an Internet space and access it using an Internet service instead of storing it in a folder on the computer. In cloud computing, neither computer hard disk space is occupied nor it is needed to install applications (Sosinsky, 2010). Cloud computing, a rapidly evolving technology, allows all librarians to choose from hardware, software, and network infrastructures that are independently managed by the organization or provided by an external vendor (Armbrust et al., 2010). There are many advantages in using cloud computing. Advantages such as cost management and investment cost savings on items such as hardware, software and services. In other words, cloud computing is one of the best ways to provide information technology services and identifying its values and services and using them properly can help library administrators to provide appropriate services and avoid high costs (Rajendran, 2013). Cloud computing makes it possible to use programs that were previously impossible in libraries, such as mobile dialog programs that were sensitive to a particular location or platform. Library cloud services that benefit from support at the general cloud system level increase system trust and security due to the use of centralized management by improving compatibility between applications as well as their rapid updating. Cloud computing has great economic benefits for libraries, while storage costs for cloud computing service providers are only 1/10 of the operating costs and only 1/3 of the processing power for each computer system, while the bandwidth of the costs in cloud computing is halved (Sun, 2012). The cost of maintaining infrastructure, including software and hardware, is simplified and as a result, the organization's IT is less troubled. In addition, at the user level, only a browser and an Internet connection are needed. Another advantage of cloud computing for libraries is ease of scalability (Jadeja & Modi, 2012) and reduced costs. Cloud computing avoids spending on expensive computing systems and specialized manpower; costs are calculated per use only (Deng, 2009). Finally, it can be said that one of the important applications of this article is a questionnaire designed to assess the cloud computing technology acceptance in academic libraries. Due to the fact that this tool has acceptable validity and reliability, it can be used in various studies and surveys.

Implications and limitations

The adoption of cloud computing technology by libraries leads to the establishment and actual use of cloud computing in libraries. Identifying the factors influencing the acceptance of cloud computing as a new technology in libraries is highly dependent on external variables. In this study, we used the technology acceptance model (TAM), which is one of the most popular models of information technology acceptance, and six external variables, including individual factors, social factors, organizational factors, technologic factors, economic factors and environmental factors were added to the model. Future studies may use other IT acceptance models, such as Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Decomposed Theory of Planned Behavior (DTPB), and Unified Theory of Acceptance and Use of Technology (UTAUT), or add other external variables to our model.

Using cloud computing technology in libraries requires special technical skills. As a result, all librarians need new skills to be effective in using this technology and to meet the challenges of this technology. Using cloud computing may change the way library libraries work. Thus, some librarians may resist change. Based on this, it is suggested that the library managers who intend to use cloud computing technology hold various training courses and workshops to familiarize all librarians with this new technology. In addition, it is necessary to conduct studies to evaluate the feasibility of using cloud computing and to examine the level of familiarity of all librarians with this technology.

One of the most important limitations of the present study was the lack of familiarity and use of cloud computing technology by some all librarians. To overcome this limitation, an attempt was made to use all librarians who are familiar with this technology and use it. Accordingly, all librarians, especially academic libraries, are advised to pay special attention to the issue of all librarians' familiarity and use of cloud computing technology. Cloud computing is an emerging and very important technology and there is a need for a lot of research on the application of cloud computing technology in libraries. Also, researchers of academic libraries can use the tools designed in this study to identify the factors affecting the cloud computing acceptance in their libraries.

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CRediT authorship contribution statement

Parvin Jahangiri: Methodology, Validation, Formal analysis, Investigation, Writing - Original Draft.

Dr Mohammad Karim Saberi: Conceptualization, Methodology, Formal analysis, Writing - Original Draft, Writing - Review & Editing.

Dr Hossein Vakilimofrad: Conceptualization, Validation, Formal analysis, Writing - Original Draft, Writing - Review & Editing, Supervision.

Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix 1. The final version of the cloud computing acceptance questionnaire in academic libraries

No.	Research question	Very low	Low	Average	High	Very high
Individual factors						
1	1 I have previous experience using the features and services of cloud computing technology.					
2	2. I have previous knowledge and awareness of using the facilities and services of cloud computing technology.					
3	3. I have good confidence to work with cloud computing technology.					
4	4. I have a good education to work with cloud computing technology.					
Social factors						
5	7. I trust the opinion of those around me about the facilities and services of cloud computing technology.					
6	8. The context and conditions of the community are provided to get acquainted with the facilities and services of cloud computing technology.					
Organizational factors						
7	9. Cloud computing technology facilities and services are available.					
8	10. Support services are provided in case of using cloud computing technology.					
Technologic factors						
9	11. Cloud computing technology has a comparative advantage over other technologies.					
10	12. Cloud computing technology has the compatibility feature.					
11	13. Cloud computing technology is a bit complicated.					
	14. Features and services of cloud computing technology are visible.					
Economic factors						
12	16. Cloud computing technology software costs little.					
13	17. The cost of human recourses to launch cloud computing technology is low.					
14	18. The cost required to support and upgrade cloud computing technology is low.					
15	20. It is possible to pay for the use of the facilities and services of cloud computing technology.					
16	21. Using the facilities and services of cloud computing technology leads to more return on investment.					
Environmental factors						
17	22. Cloud computing technology is in line with business and technology.					
18	23. Cloud computing technology is adapted to changes in industry and market.					
19	24. Cloud computing technology complies with national and international regulations (intellectual property laws, patents).					
20	25. Cloud computing technology has access to global service platforms.					
Perceived usefulness						
21	26. The application of facilities and services of cloud computing technology leads to increased productivity.					
22	27. The application of facilities and services of cloud computing technology reduces production costs.					
23	28. The application of facilities and services of cloud computing technology leads to better control over the organizational activities.					
Perceived ease of use						
25	30. It is easy to learn how to use the facilities and services of cloud computing technology.					
26	31. The facilities and services of cloud computing technology are clear and understandable.					
27	32. It is easy to gain skills in using the facilities and services of cloud computing technology.					
	33. It is easy to use different types of facilities and services of cloud computing technology.					
Attitude toward using						
28	34. It is wise to use the facilities and services of cloud computing technology.					
29	35. Using the facilities and services of cloud computing technology is very pleasant.					
30	37. Using the facilities and services of cloud computing technology is beneficial.					
Intention to use						
31	38. I would like to use the facilities and services of cloud computing technology to perform my tasks.					
32	39. I would like to use the facilities and services of cloud computing technology continuously.					
33	40. I would like to use the facilities and services of cloud computing technology in the future.					
34	41. I would like to recommend the use of cloud computing technology facilities and services to others.					
Actual use						
35	40. I would like to use the facilities and services of cloud computing technology in the future.					
36	41. I would like to recommend the use of cloud computing technology facilities and services to others.					

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