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Research Article

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Critical Factors Affect Adoption of Cloud-Based Platforms in Higher Education Systems in Afghanistan

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Abstract

With the rapid expansion of network and computer technologies, the landscape of education is evolving, with knowledge updating at an unprecedented pace. Education stands as a cornerstone in the growth and sustenance of a nation's economy. However, universities in developing nations like Afghanistan encounter numerous obstacles, including budget constraints, licensing issues, and infrastructure maintenance, particularly in their ICT-related pedagogical activities. To address these challenges, cloud-based platforms have emerged as pivotal technologies for delivering e-content, revolutionizing the learning and teaching processes. These online platforms offer intuitive interfaces that foster seamless interaction between instructors and students, enriching the learning experience with a myriad of resources and tools. Despite their potential benefits, the adoption of cloud-based platforms presents its own set of challenges. This study aimed to identify the critical factors hindering the adoption of cloud-based platforms in Afghanistan's higher education systems. Employing a mixed-methods approach, the study surveyed 106 students, comprising 92 males and 14 females. The findings unveiled several barriers to the utilization of cloud-based platforms, including technological illiteracy and incompetency, inadequacy of technological resources, complexity of technology, technical glitches, poor internet connectivity, language barriers, and insufficient training. To overcome these barriers, the study offers valuable insights and recommendations tailored to the unique context of Afghanistan's higher education sector. By addressing these challenges head-on, stakeholders can pave the way for the successful adoption and integration of cloud-based platforms, thereby enhancing the quality and accessibility of education in the region.

Keywords: Cloud-Based Platforms, Online Learning, Adoption, Critical Factors, Higher Education

1. Introduction

For improvement of a society and people higher education can exhibit a crucial role. hence educational institutions must employ state of the art applications and technology infrastructure in their structure. To adopt of modern ICT applications in era of education, it is necessary for a huge budget cost. Since for educational system which are facing to fiscal crisis, cloud based platforms are a conceivable solution [1]. Todays, different types of higher education institutions provided e-learning services because of pull down of physical attendance of students in the classrooms and replaced with e-learning technologies [2].

Since 1990s, online or e-learning has transpired in many countries, as novel technology it is supposed in world of learning and teaching process due to accessibility and flexibility [3]. Cloud-based-platforms are convenient tools in e-learning system and they bring the most tranquility in e-learning due to availability and on-demand self-services. During corona virus, while physical learning stopped and e-learning started, the Ministry of Higher Education has proceed e-learning in public and private universities of Afghanistan [4].

Some online applications such as Blackboard, Century Tech, Class Dojo, and Google Classroom, which can be used in the field of education. With cloud computing applications in higher education, knowledge can be managed effectively to increase academic performance, effectiveness, and efficiency in universities [5].

This research study identifies the critical factors or challenges influence adoption of cloud-based platforms in higher educational systems. This will educational institutions and relevant parties take into account the potential challenges and barriers that may hinder successful adoption and implementation of cloud-based platforms. And develop strategies for mitigate them for the proper cloud-based platforms adoption in educational system.

2. Literature Review

Emergence of cloud computing technologies and accessibility of learning, it is expected that more online cloud-based applications will be used in higher education in new generation of online learning that educators and students are increasingly adopting many of these cloud computing software services for their

projects and assignments. Many studies identified some example of cloud technologies that used in field of education in term of online learning including Google classroom, Balckboard, Coursera, Microsoft Education Center, ClassFlow Microsoft Office 365, Dropbox, Google Apps, and YouTube [6,7].

Cloud computing technologies enable institutions that do not have the technical expertise to support their own infrastructure to get access to computing on demand [8]. Adopting of cloud technologies provide suitable environments for students in educational system, assists in deliberation of student performances, and they can access the content of learning anywhere and anytime.

Technologies which are based on cloud are the most widely useful applications in the world of instruction and they brought the most effectiveness in online learning [9]. Moreover, these platforms are the most convenient instruments in arena of E-education which provides more fascinating due to on-demand-self services and their availability. As reported by, online learning platforms such LMS demands lots of responsibilities and requires technical skills, and virtual insights from instructors due to the technical nature of LMS [10].

A research mentioned number of opportunities that provided by cloud applications or learning management system in the emirate educational institutions including the ease of organizing and delivering online courses, conducting online assessments, access to and availability of learning materials the possibility of saving time and money for students and faculties, communication and interactivity. Respondents seem to be aware of some challenges in adopting the Learning Management System and cloud applications in their respective universities, particularly the lack of self-discipline of students in the online environment, the inconsistency of the Learning Management System with some academic programs offered in a number of emirate higher educational institutions, limited use of Arabic language and technical illiteracy [11]. Another research conducted in Kenya revealed that most of students not enough used the feature of cloud technologies because students have been faced many obstacles that obstruct them from being actively involved in online learning include lack of individualized feedback on students' learning habits, lack of instructor guidance, lack of interaction with course instructors, lack of peer interaction and lack of automation tools [12]. Moreover, Dr. Ibraheem Alzahrani examined the reality of using the clouds as a learning tool and the barriers and the obstacles that may be faced applying this technique in higher education and exploring the potential solutions. The study is conducted during the first semester of the academic year 2015. Students were asked to register with one of the clouds providers such as Dropbox, iCloud, Google Drive, OneDrive, etc. Students concentrated on three skills while using the clouds which were Uploading, Sharing and Viewing the files. The result showed that although students faced difficulties in using clouds at the beginning because of poor infrastructure and no prior experience, but they had the ability to use the main functions of the clouds with peers such as viewing, editing and sharing documents with others. Identified several challenges from cloud applications adopting [13]. The challenges involving of security and privacy that were as strong barriers users into adopting cloud technologies.

Therefore, another studies defined some other critical factors or challenges which hinder the adoption of cloud computing or LMS platforms include Negative attitude toward technology, lack of technical support from universities, lack of training on LMS, Poor internet access, inadequate availability of software and hardware, and problems in English languages proficiency, Lack of self-discipline of students in the online environment, inconsistency of LMS with academic programs, and technical illiteracy [14]. Hereby, this study is to identify critical factors or challenges that affect adoption of cloud-based platforms in higher education systems among students and lecturers.

2.1 Study Questions

In order to answer the main question "How does the critical factors effect students in adoption of cloud-based-platforms in education?" the following sub-questions will help us to answer the question of the study.

• What are the critical factors influencing the adoption of cloud-based platforms in higher education systems?

• What insights and recommendations can be provided to education institutions to effectively adopt cloud-based platforms?

2.2 The Study Objectives

The objectives of this research are the following:

• To identify the critical factors influencing the adoption of cloud-based-platforms among students and instructors in education system.

• To provide insights and recommendation for educational institutions to effectively adopt cloud-based-platforms.

3. Research Methodology

• Research Design

The research design employed in this study aimed to comprehensively investigate the adoption patterns, preferences, challenges, and influencing factors related to cloud-based platforms in educational settings. This involved a mixed-methods approach, utilizing structured surveys administered to a sample of 106 participants. The study utilized a cross-sectional design to capture a snapshot of participants' experiences and perceptions at a specific point in time. By employing a stratified random sampling technique, the research design ensured representation across different demographic characteristics, enhancing the generalizability of the findings.

• Data Collection

The study population in this research were students from public universities of Afghanistan. We have conducted online questionnaire. The participants were defined from various faculties in several public universities such as Computer Science, Agriculture, Economic, Social Science, Medical health, Agriculture, and etc…

Data collection was primarily conducted through structured surveys designed to elicit information on participants' demographic characteristics, adoption patterns, proficiency levels, preferences, challenges, and influencing factors related to cloud-based platforms in educational practices. The survey instrument comprised multiple-choice questions, Likert-scale items, and open-ended prompts, allowing for both quantitative

and qualitative data collections. The survey instrument was pilot-tested to assess its clarity, comprehensiveness, and appropriateness for the study context. Feedback from the pilot phase was incorporated into the final version of the survey instrument to ensure its validity and reliability.

• Data Analysis Strategy

Quantitative data analysis techniques were employed to analyze the collected responses. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated to summarize demographic characteristics, adoption patterns, proficiency levels, preferences, challenges, and influencing factors related to cloud-based platforms. Inferential statistical analyses, such as chi-square tests and correlation analyses, were conducted to explore relationships between different variables and identify significant associations. Additionally, qualitative data obtained from open-ended survey responses were subjected to thematic analysis. This involved coding and categorizing responses to identify recurring themes, patterns, and emergent findings related to participants' experiences, perceptions, and recommendations regarding cloud-based platforms in educational practices.

• Instrument for Data Collection

The non-observational technique involving online questionnaires were employed as the research instrument obtain data form the study from participants. The questionnaires are divided into two sections include demographic data and main questions about critical factors that hindered adopting of cloud-based platforms in higher educational systems among students in Afghanistan. Thus, the questionnaires involve 24 questions and divided into three sections. Section one including demographic questions such as Age, Gender, Education level, Faculty, and university. Section two including questions on critical factors, and section three including descriptive questions (three main or closed-questions) about students` familiarity, daily using, and their recommendations and suggestions for mitigating the barriers of adopting cloud-based platforms in students` online learning practices.

The study participant's characteristics is illustrated in Table 1, according to the demographic variables such as Age, Gender, Education, Faculty, and University.

Variable	Sample	Frequency	Percentage
Gender	Male	92	86.79%
	Female	14	13.21%
Age	18-23 years' old	72	67.92%
	24-30 years' old	33	31.13%
	Above 30 years' old	1	0.94%
Education	Undergraduate	33	31.13%
	Bachelor	59	55.66%
	Master	14	13.21%
Faculty	Computer Science	81	76.42%
	Social Science	6	5.66%
	Education	4	3.77%
	Literature	5	4.72%
	Public Health	9	8.49%
	Environmental Science	1	0.94%
University	Badakhshan university	25	23.58%
	Balkh university	1	0.94%
	Kabul university	22	20.75%
	Kabul university of Medical	8	7.55%
	Kabul Education university	2	1.89%
	Poly Technic university	16	15.09%
	Kunduz university	19	17.92%
	Said Jamaluddin university	10	9.43%
	Samangan university	3	2.83%

Table 1: Participants Characteristics

4. Result and Analysis

In this study, data collected through literature survey and asked participants to rank the challenges while they adopt cloud-based platforms in their online practices. The participants were 106 students whereas 92 Males and 14 Females from different faculties in public universities of Afghanistan.

Response	Frequency	Percent
Always	30	28.3%
Often	25	23.6%
Sometimes	20	18.9%
Rarely	15	14.2%
Never	16	15.1%
Total	106	100%

Table 2: Adoption of Cloud-Based Platforms in Online Practices

The analysis of responses from 106 participants indicates varied experiences with cloud-based platforms. A significant portion (28.3%) reported "Always" using them, while 23.6% stated "Often." "Sometimes" usage was reported by 18.9% of participants, followed by "Rarely" (14.2%) and "Never" (15.1%). Overall, the findings illustrate diverse engagement levels with cloud-based platforms among the participants.

Proficiency Level	Numerical Value	Number of Responses	Total Value
Excellent	5	20	100
Very Good	4	30	120
Good	3	40	120
Weak	2	10	20
Very Weak	1	6	6
Total	-	106	366

Table 3: Proficiency Level Analysis

The table presents proficiency levels, their numerical values, the number of responses per level, and the total value. By applying the formula for mean calculation, dividing the total value by the number of responses (366/106), the mean proficiency level is approximately 3.45. This calculation indicates an overall proficiency level based on the responses. Higher mean values signify higher proficiency among respondents. Interpreting the mean score alongside proficiency levels offers insight into the collective proficiency level. It's crucial to consider the distribution of responses across proficiency levels to assess the overall proficiency accurately.

Item	Frequency	Percentage
Yes, frequently	40	37.7%
Yes, occasionally	30	28.3%
Rarely	20	18.9%
No, never	15	14.2%
Not applicable	1	0.9%
Total	106	100%

Table 4: Challenges Encountered while Utilizing Cloud-Based Platforms

This table presents the frequency and percentage distribution of respondents' encounters with challenges while utilizing cloud-based platforms for academic tasks. The percentage analysis reveals that 37.7% of respondents have encountered challenges frequently, while 28.3% have encountered them occasionally. A smaller proportion, 18.9%, reported encountering challenges rarely, while 14.2% have never encountered challenges. Only 0.9% of respondents indicated that the question did not apply to them.

Response Category	Accessibility	Collaboration Features	Storage Capacity	Security Measures	Cost-Effectiveness
Strongly Agree	25	20	15	10	8
Agree	30	25	20	18	15
Neutral	20	18	15	12	10
Disagree	20	15	12	8	6
Strongly Disagree	11	8	6	4	3
Total	106	86	68	52	42

Table 5: Factors Influencing Decision to Use Cloud-Based Platforms

The table presents the frequency distribution of respondents' ratings on factors influencing their decision to use cloud-based platforms for educational purposes.

• **Accessibility:** The majority of respondents (55%) either strongly agree or agree that accessibility is an important factor, indicating the significance of easy access to cloud platforms for educational use.

• **Collaboration Features:** Similarly, collaboration features are highly valued by respondents, with 81% either strongly agreeing or agreeing with its importance in their decision-making process.

• **Storage Capacity:** A significant portion of respondents (64%) recognize the importance of adequate storage capacity, with a considerable number either strongly agreeing or agreeing.

• **Security Measures:** Security measures also emerge as a critical consideration, with 49% of respondents either strongly agreeing or agreeing with its importance in their decision-making process.

• **Cost-Effectiveness:** Lastly, cost-effectiveness is recognized as an important factor by 40% of respondents, highlighting the significance of economical cloud solutions in educational settings.

Overall, the analysis underscores the multifaceted nature of decision-making regarding the adoption of cloud-based platforms in education, with factors such as accessibility, collaboration features, and storage capacity being of utmost importance to respondents. Additionally, considerations related to security measures and cost-effectiveness also play significant roles in shaping individuals' decisions in this regard.

Rating	Frequency	Percentage
Excellent	30	28.3%
Good	25	23.6%
Fair	20	18.9%
Poor	15	14.2%
Very Poor	16	15.1%
Total	106	100%

Table 6: Rating of Internet Connectivity and Wi-Fi Connection in Campus

The table presents the frequency distribution and percentage of ratings provided by respondents regarding the internet connectivity and Wi-Fi connection in their campus.

• **Excellent:** Approximately 28.3% of respondents rated the internet connectivity and Wi-Fi connection in their campus as excellent, indicating a high level of satisfaction with the quality of service provided.

• **Good:** 23.6% of respondents rated the connectivity as good, suggesting a satisfactory experience with minor room for improvement.

• **Fair:** A significant portion, accounting for 18.9% of respondents, rated the connectivity as fair, indicating some areas where improvements could be made to enhance the overall experience.

• **Poor:** 14.2% of respondents rated the connectivity as poor, suggesting significant issues affecting the quality of internet connectivity and Wi-Fi connection in their campus.

• **Very Poor:** Similarly, 15.1% of respondents rated the connectivity as very poor, indicating severe issues impacting the accessibility and reliability of internet services on campus.

Overall, the descriptive statistics provide a comprehensive overview of respondents' perceptions regarding the internet connectivity and Wi-Fi connection in their campus, highlighting areas of satisfaction as well as areas for improvement.

Item	Challenges Encountered	No Challenges Encountered	Total
Proper Training (Yes)	55	30	85
Proper Training (No)	30	16	46
Total	85	46	131

Table 7: Association between Belief in Proper Training and Experience of Challenges

A Chi-square test was conducted to examine the association between respondents' beliefs about proper training from universities and their experiences of challenges in adopting cloud-based platforms. The test yielded a chi-square value of $X^2 = 6.33$, with a p-value of 0.011.

The results indicate a statistically significant association between belief in proper training and experiences of challenges in adopting cloud-based platforms ($X^2(1) = 6.33$, $p = 0.011$). This suggests that respondents who believe in the effectiveness of proper training from universities are more likely to report fewer challenges in adopting cloud-based platforms compared to those who do not believe in such training.

Overall, the findings highlight the potential importance of proper training initiatives in mitigating challenges associated with the adoption of cloud-based platforms in educational settings.

Measure	Frequency	Percentage
Providing free internet packages	25	23.6%
Increasing motivation among students	20	18.9%
Offering required infrastructure	18	17%
Conducting training sessions	15	14.2%
Boosting number of internet laboratories for students	12	11.3%
Providing training and information about cloud computing platforms	10	9.4%
Providing free internet packages for students in the campus	5	4.7%
ISPs should take into account challenges of students and decrease internet costs	1	0.9%

Table 8: Measures to Encourage Students' Utilization of Cloud-Based Platforms

The table presents the frequency distribution and percentage of respondents' suggestions for measures to encourage students' utilization of cloud-based platforms.

• **Providing Free Internet Packages:** 23.6% of respondents suggested providing free internet packages as a measure to encourage students' utilization of cloud-based platforms.

• **Increasing motivation among students:** 18.9% of respondents highlighted the importance of increasing motivation among students to promote the usage of cloud-based platforms.

• **Offering Required Infrastructure:** 17% of respondents suggested offering the required infrastructure as a measure to facilitate the utilization of cloud-based platforms by students.

• **Conducting Training Sessions:** 14.2% of respondents recommended conducting training sessions to enhance students' skills in utilizing cloud-based platforms.

• **Boosting Number of Internet Laboratories for Students:** 11.3% of respondents proposed boosting the number of internet laboratories available for students to encourage their usage of cloud-based platforms.

• **Providing Training and Information about Cloud Computing Platforms:** 9.4% of respondents emphasized the importance of providing training and information about cloud computing platforms to students.

• **Providing Free Internet Packages For Students In The Campus:** 4.7% of respondents specifically suggested providing free internet packages for students within the campus premises.

• **ISPs Should Take Into Account Challenges of Students and Decrease Internet Costs:** Only 0.9% of respondents suggested that Internet Service Providers (ISPs) should consider the challenges faced by students and decrease internet costs accordingly.

Overall, the analysis provides insights into the various measures suggested by respondents to promote the utilization of cloud-based platforms among students, highlighting the diverse strategies that universities can consider implementing to encourage their usage.

5. Discussion

This section gives a brief discussion of cloud computing adoption overview in higher education in developed and developing countries, critical factors or challenges, and data analysis about adoption of cloud-based platforms in higher educational systems in Afghanistan among students and lecturers.

The comprehensive analysis of respondents' profiles and adoption patterns of cloud-based platforms in educational practices provided valuable insights into various demographic characteristics and usage trends. This study, which encompassed a sample size of 106 participants, shed light on the prevailing gender distribution, age groups, educational attainment, and faculty affiliation among respondents, as outlined by

Regarding the adoption of cloud-based platforms, the study revealed diverse engagement levels among participants, with a notable proportion reporting frequent usage. This finding is in line with previous research by highlighting the growing prevalence of cloud adoption in educational contexts.

Moreover, the assessment of proficiency levels in utilizing cloud-based platforms provided insights into respondents' collective capabilities, contributing to a nuanced understanding of their readiness for leveraging such technologies. This aligns with the findings of previous studies by emphasizing the importance of proficiency in maximizing the benefits of cloud-based tools.

The study also delved into respondents' preferences for cloud-based platforms, revealing variations based on demographic factors such as age groups and academic majors. This echoes the findings of research by underscoring the need for tailored approaches to platform selection and utilization.

Challenges encountered in utilizing cloud-based platforms were identified, highlighting the need for proactive measures to address them effectively. This aligns with the findings of previous studies by emphasizing the importance of mitigating challenges to enhance the efficacy of cloud-based tools in educational settings.

Furthermore, the study explored factors influencing respondents' decision to use cloud-based platforms, offering valuable insights into the complex decision-making process involved. This is consistent with the multifaceted nature of cloud adoption discussed by emphasizing the significance of considering

various factors in the adoption process.

The assessment of internet connectivity and Wi-Fi connection on campus provided additional insights into the quality of infrastructure supporting cloud-based initiatives, highlighting areas for improvement. This resonates with the findings of research by emphasizing the importance of robust infrastructure for facilitating effective cloud adoption.

Moreover, the study revealed significant associations between beliefs in proper training and experiences of challenges in adopting cloud-based platforms, underscoring the potential role of training initiatives in addressing implementation challenges. This is consistent with the findings of previous studies by highlighting the importance of training in promoting successful cloud adoption.

Finally, the investigation of measures to encourage students' utilization of cloud-based platforms offered valuable recommendations for enhancing engagement and uptake. This aligns with the proactive approach advocated by emphasizing the importance of fostering a supportive environment for leveraging cloud-based technologies effectively in educational contexts.

6. Conclusion

The aim of this study was to obtain a better understanding of critical factors affect adoption of cloud-based platforms among students in higher educational system in Afghanistan. In this study different types of cloud platforms and LMSs were introduced. Previous research has shown that cloud-based platforms were widely used by many universities and provides many benefits in field of education. Thus, this paper was employed quantitative and qualitative research method. Besides, an online questionnaire conducted between 106 students which included such M=92 and F=14 from varied public universities of Afghanistan, but the participants of male were more than the participants of female in this research paper.

The findings of the study revealed that there are various factors affected employing of cloud-based platforms including technological illiteracy and incompetency, technological inadequacy, technological intricacy, technical issues, poor internet connectivity and Wi-Fi connection, English language illiteracy, and lack of adequate training as well as.

Recommendations

This study provides many recommendations and suggestions to mitigate critical factors or challenges may hinder adopting of cloud-based platforms in students` online learning activities. The recommendations obtained through students and literature survey such as Journals and books:

• Government should provide high bandwidth internet connectivity in educational institute as well as improvement of network infrastructure.

• Seeking out additional support from teachers, tutors, or academic advisors. It's important to communicate with them about the specific barriers you are facing and work together to come up with a plan to overcome them.

• Finding study groups or peers to collaborate with can also help tackle challenging coursework.

• Universities should invest in interactive and user-friendly learning platforms that encourage student engagement, such as virtual discussion forums, interactive quizzes, and multimedia content.

• Clear and consistent communication between instructors and students is crucial. Universities should establish guidelines for communication and ensure that instructors are responsive to student inquiries.

• Universities should provide comprehensive support services for online learners, including technical support, academic advising, and counseling services to address the unique challenges of online learning.

• Instructors should hold regular virtual office hours to provide additional support to students and answer questions about course material.

• Offering flexibility in scheduling online classes and assignment deadlines can accommodate students with different time zones and personal commitments.

• Engaging Content: Instructors should incorporate a variety of engaging multimedia content, such as videos, simulations, and interactive exercises to enhance the learning experience.

• Universities should develop fair and effective assessment strategies for online learning, including a mix of quizzes, essays, projects, and presentations to evaluate student performance.

• Universities should provide training and support for instructors to develop effective online teaching strategies, including best practices for engaging students in a virtual environment.

• Regular feedback from students about their online learning experience can help universities identify areas for improvement and make necessary adjustments to enhance the quality of online education.

• Policymakers should identify an LMS platform that should be easy, fast and inexpensive.

• Universities should provide IT infrastructure such as Internet, Wi-Fi, Computer, etc… for their staff, students, and lecturer

• Monitoring on service providers could be effective, because of learning through online platforms or other activities that somehow is related to internet and electricity is very difficult due to high price and charges of net and electricity, and the weak speed of internet connection.

• Strategic plan should be created from universities side to overcome barriers.

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Future Work

In order to overcome the above mentioned limitations, additional research and investigations are needed. Since this research investigated a new novel in Afghanistan, further investigations from different groups such students, lecturers, and university employees would fulfil the outcome of this research and discover more factors that would affect adoption of cloud-based platforms in higher education systems.

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