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RESEARCH ARTICLE

A framework of critical success factors of cloud-based project management software adoption

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Abstract
Project Management (PM) software is an enabler of project success and is now being offered as a cloud-based software with the advancement of cloud computing. This research was conducted to explore the critical success factors affecting the adoption of cloud-based PM software. Semi-structured interviews were carried out with Information Technology (IT) professionals following the qualitative approach. Through thematic analysis, four themes were identified as areas considered when adopting cloud-based PM software: technological, organizational, environmental, and vendor-specific factors. Relative advantage, ease of use, compatibility, and reliability were categorized as the technological factors. Organization size, the technological readiness of the organization, employee willingness, top management support, and change management process were identified under organizational factors. Competitors' adoption, industry trends, and dedicated internet connectivity were identified under environmental factors. Additionally, features such as maintenance and service support from the vendor, popularity of the brand name, and availability of free trials emerged as vendor-specific factors.

Keywords
project management; project management software; cloud-based software; cloud-based project management software; critical success factors.

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1. Introduction

Software development is the process of designing, developing, deploying, and maintaining software applications that can be used to carry out daily tasks using computers (IBM, 2021). Project management has become a crucial component of the software development process to guarantee the success of development projects because it is constrained by time, scope, cost, and quality aspects (Schwalbe, 2015). The PMBOK Guide (Project Management Institute, 2017) defines project management as "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements".

Project Management (PM) software is an important tool that helps project teams accomplish their goals by combining multiple tools and techniques like Gantt charts, Work Breakdown Structures (WBS), Network Diagrams, resource allocation, reporting, and more into a single application (Bajwa & Deichmann, 2018; Schwalbe, 2015).

With the development of networking and Internet technologies, cloud computing revolutionized the way that IT resources are digitally provided via the Internet without the need for any physical infrastructures (Calheiros et al., 2009; Munguti & Opiyo, 2018). It comprises three main models (Ahmad & Waheed, 2015; Palos-Sanchez et al., 2017):

- Infrastructure as a Service (IaaS): Provision of various virtual pay-per-use IT infrastructure solutions, including networking, storage, etc.
- Platform as a Service (PaaS): Platforms for application development are delivered virtually on a rental basis.
- Software as a Service (SaaS): Internet-based third-party software delivery with usage-based billing that eliminates the need for download and installation.

Recently, PM software has begun to be provided as a cloud-based or Software as a Service (SaaS) application due to developments in cloud computing that have transformed how Information Technology (IT) resources are provided through internet channels without any physical boundaries (Ahmad & Waheed, 2015; Słoniec, 2015). Due to the benefits of cloud-based software, 60% of 400 project management professionals surveyed by Capterra Inc. in the United States in 2019 changed their software usage habits (Capterra Inc., 2019). Project teams can save money and avoid license concerns by using cloud-based PM software, which is easily accessible on any device and offers the most recent version upgrades (Bajwa & Deichmann, 2018).

Though these software programs have advantages, prior research indicates that their uptake is still in its early stages, particularly in developing nations like Sri Lanka. As such, more research is necessary to fully understand the acceptance of these applications (Asirvatham & Ayoobkhan, 2018; Assalaarachchi et al., 2022; Das & Dayal, 2016; Munguti & Opiyo, 2018). For instance, there is still a dearth of research on the use of cloud-based PM software in Sri Lankan software development companies, despite some studies on the use of cloud-based software in various other industries in the country (Ayoobkhan & Asirvatham, 2018; Dakshina & Perera, 2018; Livera, 2017). A recent study conducted to identify the factors that affect the usage of cloud-based PM software in the software development industry of Sri Lanka using the Unified Theory of Acceptance and Use of Technology (UTAUT) model in a quantitative approach has pointed out that Effort Expectancy and Social Influence are significant factors that affect Behavioral Intention to use cloud-based PM software. In contrast, the Behavioral Intention and Facilitating Conditions significantly affect the Use Behavior of such software. They highlight the limitation of applying an established theoretical framework, which focuses solely on the attitudes that people have when embracing new technologies to test in an environment with little available literature. Instead, they recommend conducting additional qualitative research to develop a model that will enable further investigation into adopting cloud-based PM software (Assalaarachchi et al., 2022). The same limitations have been identified by most of the previous studies done in different contexts using a quantitative approach, and more qualitative studies have been suggested to be conducted to overcome that limitation (Bajwa & Deichmann, 2018; Livera, 2017).

This study was carried out to fill the research gap mentioned earlier by exploring the critical success factors affecting the adoption of cloud-based PM software in managing software development projects within the software development industry. Additionally, a conceptual framework for the critical success factors of cloud-based PM software adoption was proposed as the study's outcome.

A conceptual framework for critical success factors of Cloud-based PM software adoption is introduced as the novel outcome of this study to fill the theoretical gap identified and software development firms can adopt that to promote the successful adoption of such software.

Literature related to this study is discussed in the second section of this article. Later, the methodology section presents an overview of the qualitative research approach used in this study, the sample, the data collection procedure using semi-structured interviews, and the thematic analysis carried out in analyzing the data. The fourth section explains the results of this study derived from the thematic analysis. It discusses how the proposed conceptual framework for critical success factors of Cloud-based PM software adoption was developed by identifying the factors based on technological, organizational, environmental, and vendor-specific categories. Then, in the next section, the results of this study will be discussed along with the similar literature. Finally, the conclusion section summarizes the overall study while highlighting the implications of this study, its limitations, and future research suggestions from this study.

2. Related Literature

In the research conducted by Bajwa and Deichmann (2018), they found that several factors, including Subjective Norm, Output Quality, Result Demonstrability, Perceived Ease of Use, and Perceived Usefulness, have a significant impact on project managers' acceptance of cloud-based PM tools in the oil and automotive industries. In their study, they employed the Extended Technology Acceptance Model (TAM2), an established technology acceptance theory, and tested the model using a quantitative methodology. Thus, they highlight the limitations of focusing only on the variables in the current model and recommend that more exploratory research be done in the future to fully understand the impact of all potential factors that affect the adoption of cloud-based PM software (Bajwa & Deichmann, 2018).

A similar study by Assalaarachchi et al. (2022) adopting a quantitative methodology and the Unified Theory of Acceptance and Use of Technology (UTAUT) was carried out recently in Sri Lanka to determine the factors influencing the use of cloud-based PM software in the software development sector. The researchers have determined that behavioral intention to use cloud-based PM software is highly influenced by effort expectation and social influence. In contrast, the actual use of the program is largely determined by facilitating conditions and behavioral intention (Assalaarachchi et al., 2022). They also elaborate on the limitations of using an existing theory and suggest more research to be carried out qualitatively to identify the real picture of cloud-based PM software adoption. Further, they have pointed out the need for new models to be created with factors identified, thereby contributing to a theory area that lacks literature (Assalaarachchi et al., 2022).

Another survey carried out with cloud workers to identify the factors influencing the organizational adoption of cloud computing revealed that factors such as relative advantage, compatibility, security, and less complexity will create a more positive attitude towards such software that increases their use. However, they have elaborated that limiting factors of existing technology adoption theories might hinder the prediction of actual usage. Therefore, they suggest future research to explore various other factors to better predict the usage of such software. Further, they recommend that studies be carried out with various cloud applications that are used in different contexts (Livera, 2017). Most of the cloud-based software adoption studies done in other sectors have also followed the same approach and pointed out the same limitations (Assalaarachchi et al., 2023; Ayoobkhan & Asirvatham, 2018; Irshad, 2021; Stieninger et al., 2022; Wamuyu, 2017).

A systematic review has been carried out by Al Hadwer et al. (2021) to identify the factors affecting cloud-based technology adoption using the Technology-Organization-Environment (TOE) framework, considering recent literature within seven years. In their study, the authors have identified that most similar studies have adopted the TOE framework as it reveals

not only the technology-specific factors but also important organizational and environmental factors such as top management support, regulatory support, and organization size. However, they highlight the need to conduct future research in similar contexts to validate those findings (Al Hadwer et al., 2021).

Few studies have been conducted by adopting a qualitative approach to research cloud computing adoption and cloud-based software adoption in different contexts such as the Enterprise Resource Planning (ERP), healthcare, and education sectors. But they also have limited to the factors available in already existing theories, such as the TOE framework, to identify the various technological, organizational, and environmental factors influencing the adoption (Ahmad & Waheed, 2015; Das & Dayal, 2016; Nedev et al., 2014; Sulaiman & Magaireah, 2014).

Upon reviewing the previously mentioned literature, it became evident that there was insufficient research about the critical success factors that influence the adoption of cloud-based PM software. Additionally, most of the literature has only considered already existing theories using a quantitative method. This study was carried out to fill the research gap by exploring the critical success factors affecting the uptake of this type of software and to develop a new framework in a field with limited literature.

3. Methodology

Previous studies have highlighted the limitation of testing already existing frameworks in a context where little study has been conducted and recommends further exploration by the inductive approach of qualitative research (Assalaarachchi et al., 2022; Ayoobkhan & Asirvatham, 2018). Therefore, this research followed a qualitative approach to explore the critical success factors influencing the adoption of cloud-based PM software. Further adopting a case study method, the software development industry in Sri Lanka was chosen as the case for this study. The software development sector accounts for 29% of all service exports from Sri Lanka, making it the nation's fourth-largest exporter (SLASSCOM, 2021). It has become an accelerator for multi-sector growth by offering advanced software solutions to digitalize the business activities of other industries and supporting them in achieving industrial competitiveness (Dahanayake, 2022).

Since most software development companies in Sri Lanka are based in the Colombo district, the study's related population consisted of IT professionals from software development companies that operate in the country. The target population for this study was limited to team members of software development companies located in Colombo (SLASSCOM, 2020).

Semi-structured interviews were used to collect data to explore the critical success factors influencing the adoption. Thirteen (13) interviews were carried out with selected software development team members, including project managers, business analysts, software engineers, and quality assurance engineers from each software development firm of various sizes representing small, medium, and large scales. Participants were selected based on the snowball sampling technique, where the next participant was referred through the industry connection of the previous participant. Participation in these interviews was completely voluntary, and anonymity of the responses was ensured by giving codes for each respondent with their organization size and job role (for example, "Large-PM1"). Interviews were stopped at the thirteenth interview as it reached the saturation point. A summary of the respondents' details is given in Table 1.

Collected data was analyzed using thematic analysis, where the recorded interviews were transcribed and coded into various themes to identify the critical success factors of cloud-based PM software adoption. NVivo, one of the most used qualitative data analysis software, was used for the above purpose. First, transcripts of the meetings were generated through MS Teams, which was used to conduct the interviews. Later, they were edited accordingly by re-reading to get an in-depth understanding of the data. Data were then coded using NVivo and categorized into themes by grouping similar codes. These themes were refined into four major themes and several sub-themes under them with reference to the literature. Finally, with the themes, a framework for critical success factors affecting cloud-based PM software adoption was proposed as the outcome of this study.

Table 1: Summary of Respondents' Details

Respondent	Job Role	Company Scale	Adopted Cloud-based PM Software
Large-PM1	Project Manager	Large Scale	Jira
Large-PM2	Project Manager	Large Scale	Jira
Large-BA	Business Analyst	Large Scale	Azure DevOps
Large-SE	Software Engineer	Large Scale	Jira
Large-QA	Quality Assurance Engineer	Large Scale	Azure DevOps
Medium-PM1	Project Manager	Medium Scale	Jira Monday.com
Medium-PM2	Project Manager	Medium Scale	Jira
Medium-BA	Business Analyst	Medium Scale	Jira
Medium-SE	Software Engineer	Medium Scale	Jira
Medium-QA	Quality Assurance Engineer	Medium Scale	Jira
Small-PM/BA	Project Manager/Business Analyst	Small Scale	Asana
Small-SE	Software Engineer	Small Scale	Trello
Small-QA	Quality Assurance Engineer	Small Scale	Trello

4. Results

4.1. Critical Success Factors of Cloud-based PM Software Adoption

It was found that all the respondents were aware of the subject and their companies had already adopted cloud-based PM software. The majority of respondents most popularly used Jira and Azure DevOps was identified as famous for its advanced features. Large-scale companies mostly use it due to the cost of getting those features. Asana, Monday.com, and Trello were mentioned as the other cloud-based PM software used in the industry, mostly among small and medium-scale companies.

Four broader themes were identified as critical success factors of cloud-based PM software adoption through the thematic analysis of interview transcripts:

I. **Technological Factors;**

II. **Organizational Factors;**

III. **Environmental Factors;**

IV. **Vendor-specific Factors.**

I. Technological Factors

This theme includes the factors that are more technology-oriented and considered to be critical for the successful adoption of cloud-based PM software. Sub-themes such as Relative Advantage, Easy to use, Compatibility, and Reliability were identified as technological factors affecting the successful adoption of cloud-based PM software.

I.I. Relative Advantage

Relative advantage refers to the benefits of using cloud-based PM software to manage software development firms over other platforms. All the respondents commented that the major factor affecting the adoption of cloud-based PM platforms is the benefits available specifically when compared to in-house PM software.

> *"There are lots of advantages of using these tools definitely. Otherwise, people weren't using them." (Large-QA)*

> *"Drawbacks are not enough to force anyone away from cloud-based tools because their advantages outweigh the disadvantages." (Medium-PM1)*

Collaboration, real-time updates, accessibility, cost-effectiveness, no storage issues as in in-house software, and scalability were commented on as relative benefits of using these tools by the IT professionals.

Most respondents discussed that this software is easily accessible with little infrastructure and is accessible anywhere, anytime, on any device. They mentioned that as one of the advantages of adopting cloud-based PM software over in-house platforms.

> *"So, I would say the main benefit is it is cloud-based, and it can be accessed by anyone at any given time, providing they have a proper Internet connection and access that is granted. So that enables anyone to work from anywhere." (Medium-PM1)*

> *"There's a really good mobile application for JIRA. Because of that, I have worked on some locations other than using a laptop, I mean like traveling." (Medium-SE)*

> *"When we shift to another laptop and other devices, we can access it by using just the URL." (Small-QA)*

Also, it was evident from the findings that this software does not require dedicated storage capacity as in-house PM software does, as they are available in the cloud and accessible over the Internet.

> *"And even I would say if you're using in-house, storage issues might come. But I think if you have this Jira software, that won't be a problem at all." (Large-PM1)*

> *"Cloud-based PM software doesn't need to have a separate program or software installed into your device and supports easy access to this software via the internet." (Medium-PM1)*

They also mentioned that cloud-based PM tools enable team members to facilitate better collaboration, which is necessary for better project management.

> *"So, the most important thing that these tools provide is, I think, collaboration. Because as a BA, I might be working with requirements, but in the end, ultimately, that is what becomes the product at last, right? So, to take that requirement up to the level of deliverable, there are certain stages that we have to go through, and there are certain people, like team members and different stakeholders, who are engaged. So, these tools really help you know and collaboratively manage the requirements. You can easily manage them and collaboratively work on them with the team, not only your team, but they can be used cross-functionally, which makes things easier." (Large-BA)*

> *"So, when it comes to project management, it's easier when we can collaborate with all the team members on one platform. So, when it comes to the task of project manager, I don't always have to keep track of tasks and*

updates personally. Team members can update when they finish the task; they move the task like the done part. So, it's much more collaborative and easier." (Medium-PM2)

"The first benefit that comes to my mind when it comes to cloud-based PM software is collaboration, of course, because that's the great thing about being a project manager and a BA in my role. Everyone can work together on one platform and are on track about one particular thing." (Small-PM/BA)

Also, as these tools are cloud-based, all those updates are available in real-time, making project management easier.

"A key feature that I see that helped me was that we can see the real-time activities in Jira." (Large-SE)

"You know, when I'm getting a task update in the in-house project management software, I have to update it from my end and send it through e-mail. Then, other team members will update it and send it back to me again. So, it's not like real-time updates are not there, but when it comes to this software, real-time update is there." (Small-PM/BA)

"I update all tasks that I work on so that the project manager can get the update. These updates are real-time and easy to track with frequent updates." (Small-SE)

Cost-effectiveness is another advantage discussed by most respondents when it comes to cloud-based PM software. Since it does not require additional infrastructure and license payments as in in-house PM software, the majority of firms have shifted to this type of software. Also, a small-scale startup can run on a free version without any licensing costs.

"For in-house software, we need servers. Rather than using that, using a cloud-based software is really cost-effective as we don't need to maintain dedicated servers." (Large-SE)

"So, the first thing that comes into our mind is cost efficiency. In mid-size businesses, we are trying to pound with some heavy expenses. So, to reduce our expenses, we must go for tools that we can use to get maximum outcomes with little pay. So, when we compare it with the tools in the market, we thought JIRA would be a better call when it comes to cost efficiency." (Medium-BA)

Cloud-based PM software is easily scalable as it is just a matter of creating another user account and adding it to the relevant projects.

"So basically, in most projects I am working on, the development party is outsourced or outside vendors. So rather than introducing MS Project sort of a thing, it's easier for us to get the user Jira accounts created and get them onboarded to Jira projects, which means it's easy for the configuration and scale." (Large-PM2)

The above findings revealed that relative advantages obtained via adopting cloud-based PM software affect as a factor when deciding to adopt this software.

I.II. Easy to use

Easy to use in this study refers to the degree of complexity of cloud-based PM software when adopting it. It was evident from the findings that these tools are easy for anyone to get used to when they adopt them.

"It is easy to understand because even within my team, the newcomers also easily adopt this type of software." (Large-PM1)

"It's easy to use, and I understand, so like even though we get a newbie, they can get along with the tool as soon since it's so easy." (Medium-QA)

Further, most respondents commented that they find Jira the easiest software to get used to based on their experience. That has become one reason for the popularity of Jira as a cloud-based PM software.

"Jira is very straightforward, very easy, and colorful as well. You know, colors are important when it comes to projects. If it's a bug, you'd have to show it in red and stuff like that." (Large-QA)

"So personally, for me, rather than adapting to DevOps board, I just felt really easy to adapt to Jira." (Medium-PM2)

Also, it was found through the analysis that this software became easy to use because of its user-friendliness and availability of learning materials.

"I didn't have to go through any tutorials, and it was user-friendly. For example, when you open up a board or dashboard, you can see everything there to navigate. I find this so easy to use, interface-wise. also, it's very well managed, I would say." (Large-SE)

"UI is also pretty much easy, like even if you go through it, you can understand what is here, what is there. So, it's easy to learn." (Medium-QA)

"It was not too hard. By looking at a couple of demos or user guides, I guess it was easy to understand and handle from the next day. So yeah, it's not that something has to worry about." (Large-BA)

"These tools are not very difficult to learn. Simply you can go to YouTube and other platforms, so they do have their own community pages." (Medium-BA)

With what the majority of respondents explained, it was also identified that having some prior knowledge or awareness through their degree programs or online courses makes it easier to practically adapt in the workplace.

"I have heard of these tools before. But yeah, I started working on the tool when I got into the job. But it wasn't that hard because for me, at least, I think I had a foundation-level understanding of what agile is, what project management is, what these tools are, and how things happen." (Large-BA)

"During my time at university, we were introduced to a project management tool called Trello. So, it was easier for me to adapt that knowledge and apply it to Jira when I joined the company. So, I would say it supported me in that aspect of having prior knowledge of a tool like that during my university." (Large-PM2)

Therefore, it can be concluded from the findings that the tool's ease of use will be a critical factor in adopting cloud-based PM software.

I.III. Compatibility

Compatibility can be referred to as the level of compatibility of the cloud-based PM software with the organization's available technical infrastructure. Respondents stated that since this software is offered via the cloud, they require only a device and internet connectivity to access it. Companies do not need any additional hardware and software when adopting these types of software.

"Because this is a cloud application, we don't need any hardware to purchase. We just need a good Internet connection with a continuous power supply because otherwise, we can't run the software. So, I don't see any need for any special technical infrastructure to adopt this software." (Large-PM1)

"Since this software is cloud-based, they are compatible with existing technical infrastructure. So, we don't need to buy any extra hardware or software or anything; you know, having Internet connectivity is enough. So it also affects the adoption, I guess, because we can easily, you know, adopt them with our existing technical infrastructure, and especially when we are a startup, that's an easier thing because we can't go for, like, you know, pay and get any hardware also software. Now we can manage everything easily with the existing technical infrastructure." (Small-PM/BA)

Therefore, it was realized that the compatibility of cloud-based PM software is a critical success factor affecting the adoption of such software.

I.IV. Reliability

To what extent the users rely on the security aspects of cloud-based PM software can be termed reliability. Most respondents stated that they could trust this software as all needed security mechanisms are in place or their organization has taken actions to make it secure. None of the respondents or their work colleagues have encountered any security threat during their work period so far.

> *"I mean, from our side, at least during my time, we haven't come across any incidents as such from the security perspective. I believe that there are procedures in place for them in these tools." (Large-BA)*

> *"So far, we haven't faced any issue like in my experience I haven't faced any issue. So, I feel confident in working with those tools." (Medium-QA)*

> *"So far, I have not heard or personally faced such security there. And when it comes to, like, as I mentioned, even before, there are functionalities, we can just give access to outsiders for their project only, just for their project as well. So, from our side, also the security, I feel like they have secured the platform." (Medium-PM2)*

A few respondents said they are reluctant to trust this software because they use a free version where security aspects are not fully available. All such respondents are from small-scale companies with free versions of cloud-based PM software.

> *"I fear to trust because there is a free version we are using. So there it may be a third party person can access our system." (Small-QA)*

> *"But when we are using a free version, there's a bit of a security issue, but I have never encountered any so far." (Small-PM/BA)*

Therefore, it can be concluded that reliability is another critical success factor in adopting cloud-based PM software.

A summary of the findings relevant to the technological factors is given in Table 2.

Table 2: Summary of Technological Factors

Broader Category	Themes	Sub-themes (if any)
Technological Factors	Relative Advantage	Collaboration Real-time updates Accessibility Cost-effectiveness No storage issues as in in-house software Scalability
	Easy to use	Prior awareness User-friendliness Availability of learning materials
	Compatibility	-
	Reliability	-

II. Organizational Factors

Factors that are within the control of the organization and affect the process of adopting cloud-based PM software are considered under the broad theme of organizational factors. Sub-themes such as Organization size, Technological

readiness, Employee willingness, Top management support, and Change management process were identified as organizational factors affecting the successful adoption of cloud-based PM software.

II.I. Organization Size

Analysis of the interview data elaborated that the organisation's size or scale can be a factor in the successful adoption of cloud-based PM software. As the financial capability and requirements for cloud-based PM software will be determined based on the company scale, it was evident that large and medium-scale companies have successfully adopted paid versions of cloud-based PM software with more functionalities. Comparatively, small-scale companies face financial struggles in adopting better versions of such software during the initial stages, and free versions can also be sufficient for their team sizes.

> *"I think not all organizations from different scales can afford the same software, both from a financial and technological aspect. They might not need it sometimes or from a financial aspect as well, even if they wanted to; they might not be able to adapt in the early stages of the organization. So, I think it's a large investment for the organization." (Large-BA)*

> *"When we started, we had only around ten members, and the free version was enough, but now, when expanding, we need more functionalities. And now, we are going to move to a paid version with extra functionalities and integrations. Previously, we didn't have enough finance, but now we can also manage that." (Small-SE)*

> *"I think the company size affects the adoption, specifically the level of adoption. Because it has become a trend, especially in the IT sector. So, every company has to, you know, adjust to, but the level of adoption, you know, whether we can afford a free version or have a highly paid customization will depend on company size." (Small-PM/BA)*

With the above findings, it can be stated that Organization size is a critical success factor for cloud-based PM software adoption.

II.II. Technological Readiness

The availability of necessary technical infrastructure, technical expertise, and provision of training to employees by the organization can be termed as the technological readiness of an organization to adopt new technologies such as cloud-based PM software. Respondents commented that their companies have successfully adopted cloud-based PM software as they have better infrastructure and technical expertise, and employees have been given sufficient training. From the findings, it was identified that the majority of large-scale and some medium-scale companies have separate support teams for these kinds of software and provide extensive training even during the onboarding of an employee. Small-scale companies do not seem to have such special teams but are managed by the management itself.

> *"I would say that our company had a separate customer support team. So, when we have any issues regarding Jira, we simply need to raise a Jira ticket. So we can get support from the customer support team anytime. Also, we had pretty much knowledgeable people regarding Jira, so they also do training sessions." (Large-PM1)*

> *"There is a mail group called Jira support, so I can contact them via e-mail or mobile and say what issue I'm facing with Jira. That also plays a huge role because, especially if there are downtimes and log-in issues or something like that, it can get very frustrating sometimes. So, it's good to know that kind of support is available in the company." (Large-PM2)*

> *"But let's say if the tools are like whole new to us and none of us are familiar with it, obviously from our organization side, they will provide any support to follow the tutorials and like if there is any cost for that, they will consider covering it or else if we need technical skills for using it, they would like to arrange training programs for us." (Large-SE)*

Therefore, the technology readiness of an organization when adopting cloud-based PM software can be considered a factor affecting its successful adoption.

II.III. Employee Willingness

Acceptance and willingness to use cloud-based PM tools by employees without any force from the company can be defined as employee willingness. The majority of respondents stated that they adopt this software willingly rather than just getting used to it as a part of a system in the workplace as it easy their work.

> *"In this case, if I take our team and myself and like with the way we use Azure, we are using it willingly because, you know, if I imagine my job without it, it would have been like 100 times worse or like difficult for me to manage and everything." (Large-BA)*

> *"Employees are very willingly adopting the software, I would say. Because they find this software easy their work. So, because of that, all the employees willingly adopted these new tools, and they also suggested new plugins that we can freely adapt to these things." (Small-PM/BA)*

With those findings, it can be concluded that employee willingness is a factor affecting the successful adoption of cloud-based PM tools. Once employees adopt it willingly, the company does not need to put effort into managing employee resistance, and the productivity of project management tasks can be improved by better using these tools.

II.IV. Top Management Support

Acceptance and support while using systems such as cloud-based PM software by the senior management of the organization were identified under the sub-theme of Top management support. Through the analysis, it was identified that top management support is a crucial factor in supporting the adoption of any new technology in an organization, as they are the ones who decide and approve such strategic decisions. Also, most respondents stated that their support is necessary not only to introduce this software but also to facilitate relevant support for using this software to get the maximum benefits from them.

> *"Anybody can initiate a decision that we are going to take this software for project management or something. But to gain the benefit of it, I think you have to direct it in the right way. So, in our organization, whenever we get to use something like this, our top management closely follows the process even after it is adopted. They provide continuous service and feedback forms to understand how people have adapted it. So yeah, I think top management has to work along this kind of process in order to get the maximum out of it." (Large-BA)*

> *"Top management support is always necessary for any kind of change, especially if you're moving towards a new tool that is affecting the entire organization. And at our company, top management was heavily involved and heavily supportive of this change since it increases efficiency and reduces redundancies." (Medium-PM1)*

> *"Top management are the ones who actually decide which software to take and manage the whole process. So yes, that support is needed when moving forward with new technologies in the organization." (Small-SE)*

Therefore, with the above findings, it can be concluded that Top management support is another critical factor affecting the successful adoption of cloud-based PM software.

II.V. Change Management Process

The introduction of tools and technologies to an organization is a change for that organization, and having a better change management process to ensure everyone adopts it smoothly and without resistance is essential. From the analysis, it was evident that a better change management process is also necessary for cloud-based PM software as it is a change for that organization. Companies that have managed this change successfully and with a better change management process have gotten the maximum benefit from using such software.

"So, I think one of the major factors would be having a proper change management structure. Because you know, managing change is always an important element of any proper company. If you don't manage change properly, it's bound to cause trouble. So, I think that we had in abundance. So, when this change was announced, I think everyone was fully on board since we had a great change management process." (Medium-PM1)

"One other thing is that we need to have a better change management process along with all these companies, as I feel. You know, introducing these tools to the organization is a change, and that must be managed well. So, everyone will smoothly adopt it." (Small-SE)

Therefore, the change management process can be categorized as another crucial sub-theme under the organizational factors affecting the successful adoption of cloud-based PM software.

A summary of the findings relevant to the organizational factors is given in Table 3.

Table 3: Summary of Organizational Factors

Broader Category	Themes	Sub-themes (if any)
Organizational Factors	Organization size	Financial capability Requirements in the software
	Technological readiness	Technical expertise Training
	Employee Willingness	-
	Top Management Support	-
	Change Management Process	-

III. Environmental Factors

All the external factors that are outside the control of the organization but might impact while adopting cloud-based PM software are termed using the theme of environmental factors. Sub-themes such as competitors' adoption, industry trends, and dedicated internet connectivity were identified as environmental factors affecting the successful adoption of cloud-based PM software.

III.I. Competitor's Adoption

It was evident through findings that the adoption of cloud-based PM software by similar rival organizations in the industry can influence the decision to adopt such software by the organization. Respondents commented that to keep up with the competition, they must adopt this software if their competitors are adopting it. They further elaborated that they perform analysis before adopting this type of software to see what their competitors have adopted and how they have achieved productivity through this software.

"Otherwise, we can't compete with the competitors within the industry, I would say. So, we have to adapt because we clearly see there is a benefit when they are using these in their projects. So, I would say the competitor's adoption also affects the decision-making." (Large-PM1)

"We would consider what other organizations or competitors or whoever is adopting because, of course, they might be changing for a good reason, and you know, if it's an advantage that can be gained by us as well, why not go forward with it." (Medium-PM1)

"Other IT startups are also using this software, and they perform well when they use the software. So, to face the competition, we also need to adopt." (Small-QA)

Therefore, with the above findings, it can be stated that competitor adoption is a factor in the decision to adopt cloud-based PM software.

III.II. Industry Trend

It was evident through the findings that moving most of the work resources and processes into the cloud has become the new norm, specifically in the IT industry. Therefore, most organizations also move to cloud-based PM software when managing software development projects because it is the industry trend. Respondents stated that to survive and gain a competitive advantage, it has become a necessity to adapt according to the industry trends, and they adopt this type of software for that.

> *"Yeah, one thing would be the tendency of organizations across the globe to move to the cloud. I think most companies are trying to get to the cloud as soon as possible; something like that is being gone right now in the industry as a trend. So, I think that could be a contributing factor." (Large-BA)*

> *"Nowadays, almost all companies are moving forward to the cloud, and every service is moving forward to the cloud. So, project management is also moving to cloud-based software. That's the industrial trend nowadays. So, every company has to, you know, adjust to it and adopt such software to survive." (Small-PM/BA)*

Therefore, it can be stated that moving to cloud services could become an industry trend that could be another environmental factor affecting the adoption of cloud-based PM software.

III.III. Dedicated Internet Connectivity

A few respondents commented that having a dedicated internet connection is another factor that determines the successful adoption of cloud-based PM tools, as this software is accessed and used over the Internet. They mentioned it has become a bit challenging with developing countries like Sri Lanka.

> *"One of the negative aspects of the cloud tools is that it is dependent on, you know, certain factors such as the dedicated internet connectivity." (Medium-PM1)*

> *"We must need a good internet connection, and we would be logged in from any laptop to the Jira." (Large-PM1)*

Therefore, it can be concluded that having a dedicated internet connection can affect the successful adoption of cloud-based PM software.

A summary of the findings relevant to the environmental factors is given in Table *4*.

Table 4: Summary of Environmental Factors

Broader Category	Themes	Sub-themes (if any)
Environmental Factors	Competitor's adoption	-
	Industry trend	-
	Dedicated internet connectivity	-

IV. Vendor-specific Factors

Factors that are in the control of the vendor of the cloud-based PM software and are considered when adopting a particular software were grouped under the theme of vendor-specific factors as these factors change from vendor to vendor. Innovative features, maintenance and service support, the popularity of the brand name, and the availability of free trials have emerged through analysis as vendor-specific factors affecting the adoption of cloud-based PM software. Mostly, these factors are considered when users select a particular software vendor of cloud-based PM software to be adopted by them.

IV.I. Innovative Features

How well a cloud-based PM software vendor can introduce new features to the current versions that make it easier and more productive for users is another factor considered when selecting a particular cloud-based PM software. As having innovative features would enhance productivity, respondents stated that they select a particular vendor over the other mostly based on such factors.

> *"I think maybe one thing that the modern organization would like to consider is how much software can be innovative. For example, you know you purchased something but don't stay in the current version forever. However, the way that it can progress could be a consideration. I think at least in this, you know, most of the tools and software that we are using now get along with, like, you know, a little bit of touch of AI, generative AI." (Large-BA)*

> *"I would like to highlight the integrations with the other systems. Those will be key points for management software. I think as a developer, I would love to use those integrations." (Large-SE)*

Also, through the analysis, it was evident that one reason for Jira becoming the popular cloud-based PM software was mainly its innovative features.

> *"Jira has this functionality where there are some instances that can get our clients request and to like access to their project. And also, all the analyzing part we can do with Jira, which is much more helpful because we can adopt Jira dashboard." (Medium-PM2)*

> *"So, for the technical employees such as developers and testers, they prefer Jira with more functionalities which enables them to add in a lot of automated workflows to their tasks." (Medium-PM1)*

> *"Jira comes with its own repository management; it's something just like GitHub, and for documentation, there is Confluence. So, everything comes with these packages. So, I think that's a plus mark when it comes to choosing these PM tools." (Medium-SE)*

Therefore, it can be concluded that the innovativeness of the software is another factor considered when adopting cloud-based PM software and specifically when selecting a particular vendor.

IV.II. Maintenance and Service Support

The provision of routine updates to the software versions and proper mechanisms to handle customer inquiries, such as support teams, can be considered under the sub-theme of maintenance and service support. In cloud-based services, maintenance is provided by the vendor itself, and that has become the major reason why companies are adopting them. Through the analysis, another factor was identified when selecting a vendor for cloud-based PM software, as users expect proper maintenance and service support from them to carry out their work smoothly using these tools.

> *"They provide routine updates, and whenever we face issues, they are willing to jump on calls and support us with any issues we have. So, there are extremely good services, so we continuously use them." (Medium-PM1)*

> *"Yeah, there are zero downtimes we are made aware of such prior, so we can work around and keep that our stream. So pretty satisfied." (Large-PM2)*

Also, it was proven that small-scale companies mostly adopt cloud-based PM software because they do not need to spend money and effort maintaining their software.

> *"We used Trello previously and then introduced company-built in-house PM software. But now we are in the process of moving back to the cloud tool as it is very beneficial. They provide frequent updates and maintenance support, which we don't need to spend our time and effort on like an in-house tool. That's a great thing." (Small-SE)*

Therefore, it can be stated that maintenance and service support is another crucial factor when adopting such software and when deciding to continuously use that software.

IV.III. Popularity of the Brand Name

Respondents mentioned that the popularity of the brand name of cloud-based PM software also affects the decision on which cloud-based PM software to adopt to some extent. They highlighted that particular software is becoming popular because of its features and reliability to many users. Therefore, it is always good to adopt such software with a proper brand name in the industry. As stated by the respondents, companies carry out an analysis of software used by similar competitive firms and decide on the software the majority has adopted.

> *"So, in that aspect, if the particular thing we are introducing is well-known and popular, it means it's doing something positive there. There must be positive reasons for that thing to be popular among peer companies, right? So, I think that plays a huge role in the adoption." (Large-PM2)*

> *"The point I would say is if a particular software or any tool is popular, it is for a reason. If the reason should be that it works and it's reliable." (Medium-PM1)*

> *"When you come to this cloud-based PM software, we are looking into its popularity. When buying something, humans look into how many reviews a certain product has, how many ratings they have, and, you know, how popular they are. So that they have a good reputation implies that it's a great software with great features." (Small-PM/BA)*

Therefore, it can be concluded that the popularity of the brand name of cloud-based PM software also affects another vendor-specific factor in the decision to adopt cloud-based PM software.

IV.IV. Availability of Free Trials

Most of the cloud-based PM software comes with free trials for a certain period or with limits on users and projects. Respondents stated this as another main factor they consider when selecting cloud-based PM software because they can try to see whether the specific software could meet their requirements without any cost. Also, it was realized that it is the major factor affecting small-scale companies adopting cloud-based PM software as they can manage with the free trial until they grow and become financially stabilized and move to customized versions.

> *"Simply you can search for anything and there's a free trial. Free trial is very essential when we are actually considering buying a platform." (Medium-BA)*

> *"I would say having the free version is great because even a startup company can use this free version and manage some tasks until a certain time. They can go to the customised version when they need to upgrade it and have financials. Also, people can try out free trials, and if that platform is great for them, they can, you know, move ahead with the customizations, paid versions, integrations like that." (Small-PM/BA)*

Therefore, it can be stated that the availability of free trials also affects another vendor-specific factor during the cloud-based PM software adoption process. A summary of the findings relevant to the vendor-specific factors is in Table *5*.

Table 5: Summary of Vendor-specific Factors

Broader Category	Themes	Sub-themes (if any)
Vendor-specific Factors	Innovative features	-
	Maintenance and service support	-
	Popularity of the brand name	-
	Availability of free trials	-

4.2. Proposed Framework and Hypotheses from the Findings

After the thematic analysis, the conceptual framework in Fig. 1 can be proposed, along with factors affecting the adoption of cloud-based PM software, to achieve the main objective of this research.

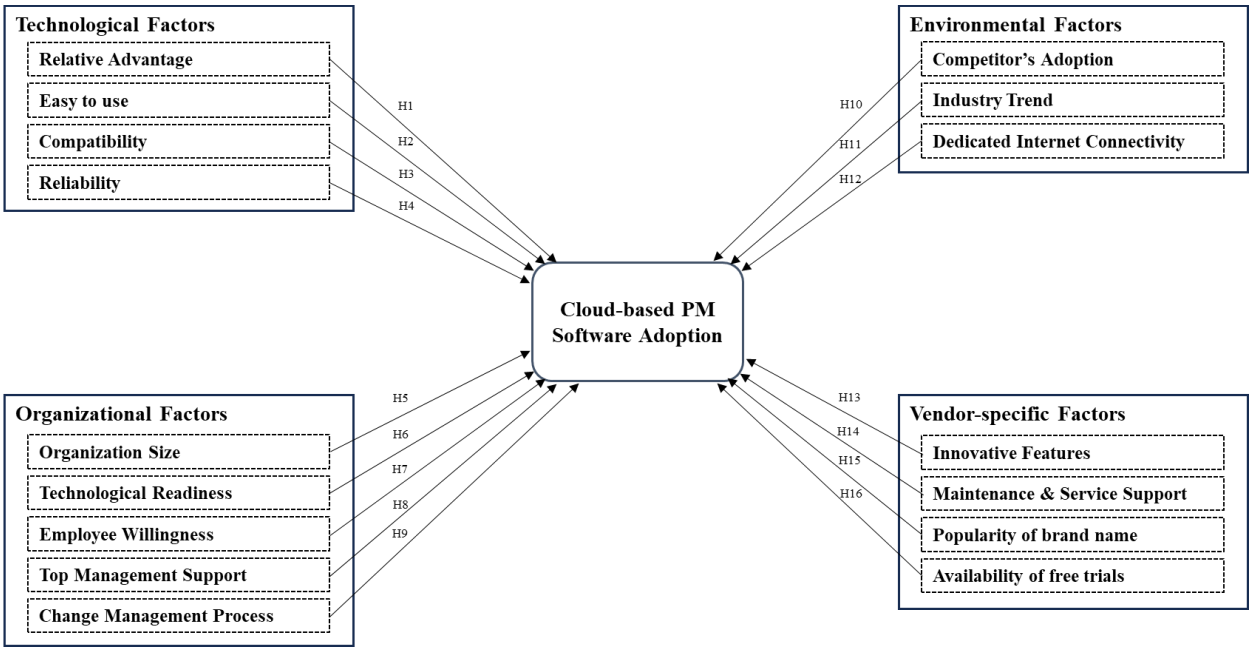

Fig. 1. A Conceptual Framework for Cloud-based PM Software Adoption

H1: Relative advantage positively affects the cloud-based PM software adoption.
H2: Easy to use positively affects the cloud-based PM software adoption.
H3: Compatibility positively affects cloud-based PM software adoption.
H4: Reliability positively affects the cloud-based PM software adoption.
H5: Organization size positively affects the cloud-based PM software adoption.
H6: Technological readiness of the organization positively affects the cloud-based PM software adoption.
H7: Employee willingness positively affects the cloud-based PM software adoption.
H8: Top management support positively affects the cloud-based PM software adoption.
H9: The change management process positively affects the cloud-based PM software adoption.
H10: Competitor's adoption positively affects the cloud-based PM software adoption.
H11: Industry trend positively affects the cloud-based PM software adoption.
H12: Dedicated internet connectivity positively affects cloud-based PM software adoption.
H13: Innovative features in the software positively affect the cloud-based PM software adoption.
H14: Maintenance and service support from the vendor positively affect the cloud-based PM software adoption.
H15: The popularity of the vendor's brand name positively affects cloud-based PM software adoption.
H16: Availability of free trials positively affects the cloud-based PM software adoption.

5. Discussion

Once compared the findings of this study with the findings of similar previous research it was evident that most of the factors identified are more in line with the factors of the Technology-Organization-Environment (TOE) framework (Ahmad & Waheed, 2015; Das & Dayal, 2016; Livera, 2017; Nedev et al., 2014; Oke et al., 2021; Sulaiman & Magaireah, 2014; Wamuyu, 2017). Technological factors such as Relative advantage, Easy to use, Compatibility, and Reliability were also proven to be factors that significantly affect the adoption of other similar cloud technologies as well (Ahmad & Waheed, 2015; Das & Dayal, 2016; Livera, 2017; Sulaiman & Magaireah, 2014; Wamuyu, 2017). Relative advantages such as collaboration, real-time updates, accessibility, cost-effectiveness, no need for dedicated storage, and scalability are also in line with the benefits identified in most similar literature (Ahmad & Waheed, 2015; Das & Dayal, 2016; Nedev et al., 2014). Through this study, it was identified that this software becomes easy to use with user-friendly interfaces, availability of necessary learning resources, and prior awareness of users with similar tools. This can be added as a novel finding to the literature. Also, Organizational factors such as Organization size, Technological readiness of the organization, Top management support, and Environmental factors such as Competitor's adoption were consistent with the findings of previous similar literature (Ahmad & Waheed, 2015; Al Hadwer et al., 2021; Das & Dayal, 2016; Livera, 2017; Nedev et al., 2014; Oke et al., 2021; Sulaiman & Magaireah, 2014). The findings of this study were consistent with the systematic review findings of Al Hadwer et al. (2021), where a majority of factors in the TOE framework were also proven to be significant in this context.

Having a better change management process and employee willingness emerged as novel findings under the broad theme of organizational factors as they are under the control of the organization and influence the successful adoption of such new technology. As novel, the environmental factors, industry trends, and dedicated internet connectivity, which can be more specific to the context of Sri Lanka, which is a developing country but famous for software development, were identified once compared with similar literature (Ahmad & Waheed, 2015; Das & Dayal, 2016; Oke et al., 2021; Sulaiman & Magaireah, 2014). Some studies have considered similar concepts to industry trends in terms of the nature of the industry (Oke et al., 2021).

Another novel theme, vendor-specific factors, was identified through this study, including innovative software features, maintenance and service support from the vendor, popularity of the vendor's brand name, and availability of free trials as sub-themes. Although trialability has been identified as a technological factor in a few similar studies (Das & Dayal, 2016), it was restructured as a vendor-specific factor under the current study as it depends on the vendor of the specific cloud-based PM software. Considering the previous literature and the significance highlighted by the respondents that they highly consider vendor-specific features, a separate category called vendor-specific factors was proposed in this study.

Therefore, this research proposed a novel framework for critical success factors of cloud-based PM software adoption, filling the gap in the literature where an exploratory study was needed to identify factors without just limiting to existing technology adoption theories. In the construction of the above framework, some factors emerged that were similar to existing findings. However, some novel factors that can be validated in new contexts have also emerged.

6. Conclusion

This research was carried out with the main objective of identifying the critical success factors of cloud-based PM software adoption to develop a proposed framework by fulfilling the gap in the literature. Therefore, this study was undertaken using the qualitative approach in the context of the Sri Lankan software development industry. Thirteen (13) interviews were held with a sample of IT professionals in the industry, and results were then subjected to thematic analysis. Findings can be categorized into four major themes: technological, organizational, environmental, and vendor-specific factors, which should be considered when adopting cloud-based PM software. Technological factors included relative advantage, Ease of use, compatibility, and reliability. Factors such as Organization size, Technological readiness of the organization, Employee

willingness, Top management support, and Change management process were identified under the major theme of Organizational factors, while Competitors' adoption, Industry trends, and Dedicated internet connectivity were identified under Environmental factors. Another theme called vendor-specific factors, including innovative features in the software, maintenance and service support from the vendor, popularity of the vendor's brand name, and availability of free trials has emerged.

This research has proposed a new technology adoption framework with a wide range of factors covering aspects such as technology, organization, environment, and vendor services. Previous research has highlighted the limitations when using existing theories to test in areas where little literature is available and this proposed framework can be adopted for such studies to overcome that limitation (Assalaarachchi et al., 2022; Bajwa & Deichmann, 2018; Irshad, 2021; Livera, 2017). The framework developed as the main outcome of this study can be adopted to identify factors that affect not just adopting cloud-based PM software but also any cloud-based service.

As a practical implication, this study supports software development firms by providing a framework of critical success factors affecting the adoption of cloud-based PM software that can be used to promote the adoption of such software within companies. Also, this framework can be adopted by other similar industries engaging in project management without limiting it to the software development industry. Therefore, they can increase the adoption of such software to manage the project successfully.

This research uses a qualitative approach to propose a conceptual framework of critical success factors of cloud-based PM software adoption. Therefore, a further study should be carried out using a quantitative approach to validate the above framework. Since a qualitative study was carried out, interviews were held only with a few samples limited to the software development industry in Sri Lanka, and future studies should be carried out with a wider sample representing different contexts.

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