KDU Journal of Multidisciplinary Studies (KJMS)
Volume 6. Issue 2 Nov 2024
DOI: https://doi.org/10.4038/kjms.v6i2.142

KJMS 2024 VOL.6 (2): 219-229

THE NEED FOR INTEGRATING CLOUD-BASED PROJECT MANAGEMENT TOOLS IN IT CURRICULA: INSIGHTS FROM SRI LANKA'S SOFTWARE INDUSTRY

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ABSTRACT

Cloud-based project management software is heavily used in the software development industry, with cloud computing advancements. As such software usage is becoming popular in the industry, empirical evidence suggests that investigating the efficient integration of cloud-based project management software into Information Technology degree programmes is crucial in bridging the gap between university education and industry requirements. Therefore, this mixed-method study was carried out in Sri Lanka, where the software development industry is a significant player in the service sector. To analyse the current uptake of such software, 102 firms were given a closed-ended questionnaire. The fact that 93% of respondents are using these tools and that they specified that their use is crucial for project success suggests that they should be integrated into the academic curricula of IT degrees. Thirteen interviews were also done with industry professionals. The thematic analysis showed that professionals who had studied using cloud-based project management software in their degrees found it easier to adopt them in the workplace than those who had not, suggesting the need for integrating them into academic curricula. Effective integration strategies included offering cloud-based project management tools as practical components required for use in projects, industry-led workshops, and online courses as assignments. These results can help higher education establishments improve their curricula, including the latest industry practices, to bridge the gap between academic and industry requirements.

KEYWORDS: *Cloud-based software, project management, cloud-based project management software, academic curricula, industry requirements*

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1. INTRODUCTION

With the latest advancements in cloud computing, Project Management (PM) software has also started to be delivered as a cloud-based or Software-as-a-service (SaaS) application. A survey conducted by Capterra Inc. (2019) in the United States revealed that 60% of 400 project management professionals shifted towards cloud-based software adoption due to their advantages. Cloud-based PM software can benefit project teams in terms of cost saving, accessibility, the latest version updates, and avoiding licensing issues (Bajwa and Deichmann, 2018).

A study has been conducted in Sri Lanka to analyse the level of cloud computing adoption considering all three models, namely Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS) during COVID-19. They have identified that 87.7% of companies adopt cloud-enabled services, and their use has increased with COVID-19 as an innovative solution to the new normal (Athambawa *et al*., 2023). Furthermore, Bala, a cloud services consultant, has elaborated that there is a growing trend in adopting cloud applications by various sectors in Sri Lanka that will continue in the coming years as well. He predicts that many businesses of scale from small to large scale will adopt such software because of the positive aspects of cost-saving, scalability, and flexibility (Bala, 2023).

With this rising adoption of the latest technologies in the software development industry, it has become mandatory for recent graduates to have knowledge and skills in using the latest software when they enter the industry for career upliftment. Further, it has become the responsibility of higher education institutes to review and develop their academic curricula frequently to match the industry demands.

One of the owners of a software development firm in Sri Lanka has mentioned in a LinkedIn article that the inability to cover the up-to-date industry practices and tools being used in the industry is a major concern where a lot of early careers lack the needed skills demanded by the industry. In the same article, he highlights the need for universities to keep in touch with industry and regularly update their curricula with the help of industry, which is essential in bridging such skill gaps. In his article, the skill of working with cloud technology was also mentioned as a highly demanded skill expected from IT degree graduates by the industry (Kalhara, 2023).

Some studies have been carried out to identify how academic curricula should be updated along with the latest technologies in the industry, such as cloud computing, agile methodologies, and DevOps technologies (Al-Mousa, 2022; Demchenko *et al*., 2019; Foster *et al*., 2018; Neyem *et al*., 2018; Patrikeos *et al*., 2023). However, they highlight that various other technologies should focus on effectively integrating into the Information Technology (IT) related degree programmes to bridge the gap between academic curricula and industry demands. Further, through a review of the literature, it was evident that similar studies have rarely been undertaken to study the need for integrating cloud-based PM software into the academic curricula of IT degree programmes.

Therefore, this research was undertaken to accomplish the objectives below and fill the gaps in identifying how cloud-based PM tools can be better incorporated to enhance IT degree programmes.

1. *To identify the requirement for integrating cloud-based PM tools into the academic curricula of IT degree programmes.*
2. *To explore how to integrate cloud-based PM tools into the academic curricula of IT degree programmes effectively.*

While adding value to the theoretical arena, which has a gap in studying how effectively cloud-based PM tools can be amalgamated to enhance IT degree programmes, this study provides valuable findings to be applied by higher education institutes when reviewing and updating their academic curricula to match industry demands.

Related Works

The process of designing, creating, deploying, and maintaining computer programmes to meet client requirements or as an automated software solution for performing regular tasks is known as software development (IBM, 2021). Project management has

evolved as a vital phase in the process of developing software as its success is constrained by scope, time, money, and quality (Schwalbe, 2015). Project management refers to "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements", as defined by the Project Management Institute (2017).

Similar literature has shown that project performance and project management tools such as Gantt charts, Work Breakdown Structures (WBS), and Network Diagrams have a significant relationship (Jugdev *et al*., 2013). One such tool is project management software, which provides several integrated project management capabilities in a single software package. It may be used to support a range of project management tasks that contribute to the success of projects, including organising, carrying out, monitoring, recording, and communicating within project teams (Bajwa & Deichmann, 2018).

With the development of networking and internet technologies, cloud computing revolutionised 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). According to Ahmad and Waheed (2015) and Palos-Sanchez *et al*. (2017), three primary cloud computing models are Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

PM software started to be provided as a cloud-based software solution as a result of the development and acceptance of the Software as a Service (SaaS) paradigm of cloud computing (Assalaarachchi *et al*., 2022; Bajwa & Deichmann, 2018). Thereby PM software is available via the internet with usage-based pricing that eliminates the need for downloads and installations.

Several well-known cloud-based PM software platforms include Jira, Zoho Projects, Wrike, and Monday.com (FinancesOnline, 2022). Due to its advantages, including cost savings, ease of collaboration, automatic software updates and maintenance, avoidance of licensing issues, and scalability, this type of software has grown in popularity among project management professionals (Assalaarachchi *et al*., 2022; Bajwa & Deichmann, 2018).

The majority of higher education institutions offer IT degree programmes to cater to the employability needs of the rapidly growing software development industry. Such degree programmes offer courses on various domains such as software engineering, database management, systems analysis, IT project management, programming, networking, etc., which are essential in shaping graduates who are well-qualified to work in the software development industry. However, due to technology advancing so quickly, IT degree programmes must constantly update their curricula to reflect the latest developments in the industry to bridge the skill gap (Foster *et al*., 2018). By doing so, IT degree programmes can offer students more updated practical exposure to the latest technologies and industry standards, enhancing degree quality and making an industry-ready workforce.

Previous literature emphasising the need to review and revise academic curricula has shown that degree programmes in IT, in particular, need to be updated frequently to incorporate new technologies and industry practices to create graduates competent to the requirements expected by industry. One such study found that although cloud technologies have advanced significantly, the curriculum development for IT-related degree programmes has not kept up at the same pace (Foster *et al*., 2018). Furthermore, software development professionals have commented in their articles that cloud-based technologies are in rising demand in industry and that graduates lack skills in better use of such technologies as degree programmes have not been updated to match such requirements in the industry (Bala, 2023; Kalhara, 2023).

Few studies have been conducted to analyse how course modules in IT degree programmes, including software engineering and project management, need to be updated along with the latest technologies like cloud computing and DevOps. The majority of those studies have identified having up-to-date practical content, hands-on projects, presentations, certification courses, and workshops as strategies to incorporate the latest technologies and practices into degree

programmes effectively (Al-Mousa, 2022; Demchenko *et al*., 2019; Foster *et al*., 2018; Neyem *et al*., 2018; Patrikeos *et al*., 2023).

The results of the analysis of the literature highlight the need for continued investigation into new technical advancements and their integration into educational initiatives. Although there is widespread agreement about the significance of tailoring IT education with industry requirements, surprisingly, few studies concentrate on integrating cloud-based PM software into IT-related degree programmes. This discrepancy is noteworthy because software of this type is widely used in the software development sector, where it is essential for effectively and cooperatively managing projects. Similarly, there is very little knowledge in the literature about the need for integrating and effective strategies for integrating cloud-based PM software into IT courses. This research attempts to determine the requirement of integrating cloud-based PM software into IT degree programmes and to investigate effective strategies for integration to bridge the gap between industry requirements and academic offerings. The research aims to close this gap in literature and improve the relevance and application of IT education so that graduates are equipped to handle the requirements of the modern workforce.

2. METHODOLOGY

A mixed method approach was followed in this research to achieve the objectives as follows by selecting the software development industry of Sri Lanka as the case. Sri Lanka was chosen based on its prominence for software development around the world and accounts for 29% of the export income of the country.

Objective 01: To identify the requirement for integrating cloud-based PM tools into the academic curricula of IT degree programmes.

Mixed-method approach was utilized to achieve the objective of identifying the need to integrate cloud-based PM software into academic curricula of the IT degree programmes. A quantitative survey was conducted to collect data on the current nature of cloud-based PM software utilisation in managing the projects of software development firms in Sri Lanka. This survey aided the researcher in identifying whether such software are trending in the industry and then in emphasising the importance of incorporating them in an academic curriculum. A Google Form was developed and shared among a sample of software development firms in Sri Lanka via E-mail, LinkedIn, and personal contacts. One hundred and two (102) valid responses were obtained in total via convenience sampling technique. They were then subjected to descriptive statistics in Statistical Package for the Social Sciences (SPSS23) to obtain valuable insights on the current nature of cloud-based PM software adoption in the industry and identify the requirement for integrating them into IT degree programmes.

To obtain further insights on the requirement for incorporating such tools into IT degree programmes, interview data was analysed using thematic analysis where software development professionals commented on the need for having cloud-based PM software integrated into academic curricula of IT degrees. This data was obtained through the same interviews carried out to achieve Objective 02 as explained below.

Objective 02: To explore how to integrate cloud-based PM tools into the academic curricula of IT degree programmes effectively.

Concerning the second objective achievement, qualitative semi-structured interviews were carried out with IT professionals in software development firms in Sri Lanka who have experience in using cloud-based PM tools. A total of 13 interviews were undertaken with IT professionals from various fields of software development using the snowball sampling technique where one professional recommended the other from their professional network. The interviews were stopped once the data reached the minimum saturation point where no novel findings were revealed in the last interviews. The transcripts of those interviews were analysed using the thematic analysis process with the aid of NVivo 14 software to derive effective strategies for integrating cloud-based PM tools into IT degree programmes. A specific code was assigned to each IT professional as "Rn", where n indicates the number of interviews held to ensure the anonymity and confidentiality of the respondents.

Some of the demographic details of the respondents are available in Table 1.

Table 1: Summary of Respondent Details of Qualitative Interviews

Respondent	Job Role	Company Scale	Adopted Cloud-based PM Software
R1	Project Manager	Large Scale	Jira
R2	Project Manager	Large Scale	Jira
R3	Business Analyst	Large Scale	Azure DevOps
R4	Software Engineer	Large Scale	Jira
R5	Quality Assurance Engineer	Large Scale	Azure DevOps
R6	Project Manager	Medium Scale	Jira
R7	Project Manager	Medium Scale	Jira
R8	Business Analyst	Medium Scale	Jira
R9	Software Engineer	Medium Scale	Jira
R10	Quality Assurance Engineer	Medium Scale	Jira
R11	Project Manager/Business Analyst	Small Scale	Asana
R12	Software Engineer	Small Scale	Trello
R13	Quality Assurance Engineer	Small Scale	Trello

3. RESULTS

To support the achievement of objective one, a survey study was conducted to analyse the current situation of cloud-based PM tool adoption in the software development industry of Sri Lanka. The findings were used to get insights on the usage of such software in the industry and highlight the importance of integrating them into curricula of IT degree programmes. One hundred two (102) responses were received with voluntary participation from companies offering various software solutions such as Enterprise applications, web applications, mobile applications, customised software solutions, and industry-specific software solutions. Also, responses were a mix of large-scale, medium-scale, and small-scale companies. Out of those responses, only 102 were used for analysis after treating any missing values available and unengaged responses.

In alignment with identifying the current situation of Cloud-based PM software adoption among software development firms in Sri Lanka, it was found that 94 companies out of 102 (92.16%) have adopted Cloud-based PM software adoption compared with the company scale given in Table 2.

Table 2: Cloud-based PM Software Adoption based on Company Scale

		Cloud-based PM Software Adoption	
		Count	Percentage (%)
Company Scale	Large Scale	34	36
	Medium Scale	43	46
	Small Scale	17	18
Total		94	100

Out of the cloud-based PM software solutions adopted, Jira can be identified as the most popular software, with 68.9% adoption Figure 1.

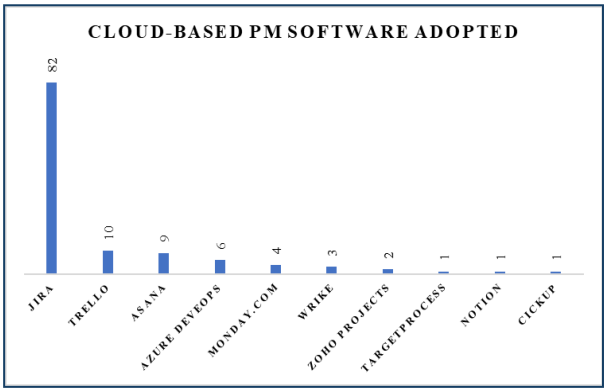

Figure 1: Cloud-based PM Software Adopted

All the firms (100%) who have adopted cloud-based PM software stated that it affects the success of their software development projects, and they would recommend this software to others. However, only

95.7% of companies have stated that they will continuously use this software in the future, while 1.1% stated that they are not sure, and 3.2% stated that they will not continue to use this in the future.

The above findings indicated that most software development firms adopt cloud-based PM software to manage their projects and thereby emphasise that it is necessary for graduates entering the industry to have prior knowledge or skills to adapt to industry trends.

The same was further validated during the in-depth interviews conducted with software development professionals as they all emphasised the fact that graduates coming to the industry with prior knowledge or skills in using cloud-based PM tools find it easier to get used to such tools in the industry than those who are not aware of such tools during their degree programme. Therefore, they recommend universities to update their curricula to match with such industry standards.

> *"I had gone through cloud-based PM technologies and educated myself about those during university, and I believe it became easier when I came to the industry." (R1)*
>
> *"I quickly adapted to work with Jira during the internship as I have been introduced to it through university degree as a trend in project management software." (R6)*
>
> *"As the industry is [more] using cloud-based PM software, I suggest universities review their degree programmes and use these tools in practical components of subjects like Project Management or Software Engineering." (R13)*

"I highly recommend giving some good understanding to university students about practical examples like Jira, how JIRA works, how confluence works, how we can collaborate with teams, how we can create tickets just to give them practical knowledge on how these tools work in the industry is a must." (R10)

Therefore, it became evident that there is a crucial need for higher education institutes to incorporate cloud-based PM software into IT degree programmes.

Objective 02: To explore how to integrate cloud-based PM tools into the academic curricula of IT degree programmes effectively

As the first objective shed light on the need for higher education institutes to incorporate cloud-based PM software into IT degree programmes, 13 interviews were held with software development professionals who use that software to explore how they can be integrated effectively into degree programmes.

Thematic analysis revealed four main modes of effectively integrating cloud-based PM software into IT degree programmes as follows.

A. Introducing a practical component of cloud-based PM tools in subjects

The majority of project managers highly recommended that incorporating a practical component of cloud-based PM tools has become a necessity with their growing use in the industry. They further suggested that this can be effectively added to subjects like Project Management or Software Engineering when teaching them the concepts of software development project management tools.

"I highly recommend giving some good understanding to university students about practical examples like Jira, how JIRA works, how confluence works, how we can collaborate with teams, how we can create tickets just to give them practical knowledge on how these tools work in the industry is a must." (R10)

"One of the best ways to integrate cloud-based PM tools into degree programmes by offering a practical component in modules such as Project Management or Software Engineering." (R13)

Based on those findings, introducing a practical component of cloud-based PM tools in subjects of IT degree programmes was themed as one way of effectively integrating such technologies into degree programmes.

B. Requesting students to follow an online course on cloud-based PM software as an assignment

During the interviews, it was requested by several project managers to introduce online courses on cloud-based PM tools as a part of continuous assessments in

subjects of IT degree programmes. As there are many short online courses with free certificates, lecturers can easily mandate students to undertake such courses and submit the completion certificate to evaluate them as a continuous assessment of subjects like project management.

"Lecturers can easily incorporate these by asking students to undertake online courses that are freely available on cloud-based PM tools and grade it as a part of their evaluation on course." (R5)

"I heard of these when I was in the university and did a few courses like Agile project management with Jira, which helped me get used to them when entering the industry. I recommend lecturers make it a mandate to follow such certificate courses as a part of the assignment in their course." (R11)

Therefore, requesting students to follow an online course on cloud-based PM tools as an assignment of the course emerged as another way to effectively integrate those new technologies into IT degree programmes.

C. Workshops on cloud-based PM tools through industry resource persons

Another set of project managers suggested carrying out workshops with the aid of resource persons from the industry as they have updated experience in using the latest technologies like cloud-based PM software. This can also be introduced as a part of evaluation in courses like Project Management, where students are given a few marks for attending mandatory workshops. This can be used as an effective way to update the practical knowledge of lecturers on how these tools are being used in industry and can facilitate train-the-trainer sessions for lecturers as well without limiting them to students.

"Universities can allocate some of the industrial resources to teach students or give some good understanding about these cloud-based PM platforms in their courses." (R7)

"I recommend providing train-the-trainer sessions on cloud-based PM tools to lecturers of subjects like project management so that they can update their knowledge to disseminate with students." (R9)

Therefore, through the analysis, conducting workshops on cloud-based PM tools with industry resource persons was identified as another effective way to incorporate these tools into IT degree programmes.

D. Making it mandatory to be used during their undergraduate development projects

Some project managers elaborated on their own experience that some degree programmes require students to use a cloud-based PM tool when they undertake development projects by groups and assign a mark for proper use in evaluation. They emphasise the fact that the experience students gain by using that can be applied easily to real-world projects of the industry, and they can quickly adapt to the latest software in practice.

"During my time at university, we were introduced to a project management tool called Trello, which we used with the team in our final year project. I would say it supported me in that aspect to have prior knowledge of a tool, and introducing those tools to be used by students in their projects will give them practice on how it works in the industry." (R8)

Therefore, making it mandatory to use cloud-based PM software during their undergraduate development projects was also analysed as another practical approach to integrating cloud-based PM tools into IT degree programmes.

As a summary of findings, it was validated through both surveys and interviews that there is a crucial need to update the IT degree programmes with the introduction of cloud-based PM tools as the industry is heavily using such tools. Introducing a practical component of cloud-based PM tools in subjects, requesting students to follow an online course on cloud-based PM software as an assignment, and workshops on cloud-based PM tools through industry resource persons, making it mandatory to be used during their undergraduate development projects were identified as means of effectively integrating it to IT degree programmes as in Figure 2.

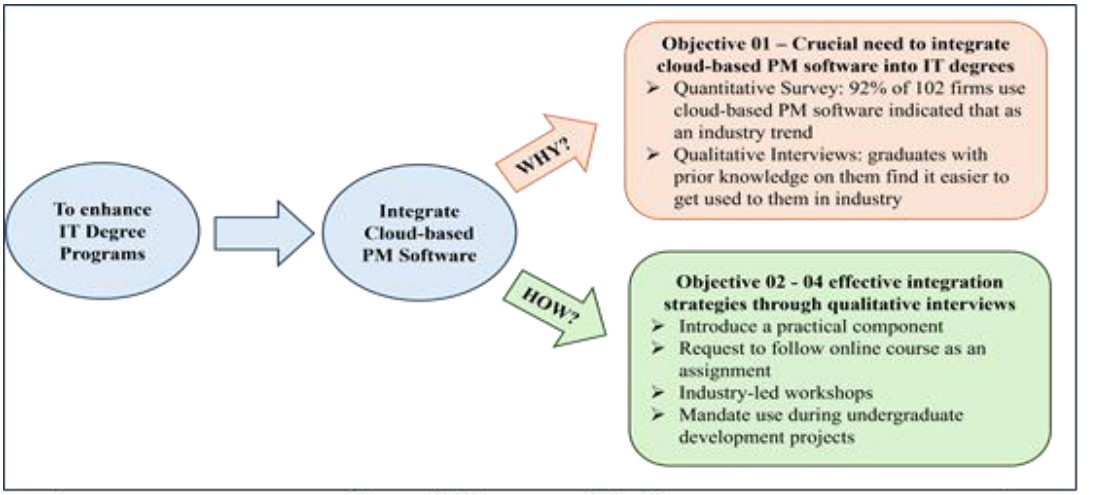

Figure 2: Summary of Findings

4. DISCUSSION

The results of this study also showed that the use of cloud-based PM software is trending, which is aligned with other similar research carried out in the Sri Lankan context and evidences from industry professionals (Assalaarachchi *et al*., 2022; Athambawa *et al*., 2023; Bala, 2023). Study revealed that cloud-based PM tools are heavily used in the industry and professionals recommend that IT degree programmes are to be reviewed to integrate these PM tools to make graduates skilful in such latest technologies when they enter the industry.

The findings from the thematic analysis of this study revealed that there is a need to integrate cloud-based PM software into IT degree programmes. Four effective integration strategies were suggested: introducing it as a practical component within relevant subjects, requiring students to complete online courses on the topic as part of their assignments, conducting workshops led by industry professionals, and making its use mandatory for undergraduate development projects.' Some strategies identified aligned with those of previous studies such as workshops, certificate courses, having updated technical content with a practical module when integrating similar technologies like cloud computing and DevOps into degree programmes (Al-Mousa, 2022; Demchenko *et al*., 2019; Foster et al., 2018; Neyem *et al*., 2018; Patrikeos *et al*., 2023). However, as a novel finding of this study, another approach for effectively integrating cloud-based PM tools was identified that mandates students to practically experience such tools in their undergraduate development projects. Thereby this study added a novel finding to the literature on effective integration of latest technologies into academic curriculum to bridge the gap between academia and industry.

Implications for Research and Practice

This work has significant implications for theoretical and practical fields. Theoretically, by emphasising the need to incorporate new technologies like cloud-based PM software into degree programmes, it advances the relatively unexplored field of academic curriculum creation. The addition broadens the theoretical landscape by offering empirical insights into how new technology tools might improve the efficacy and relevance of curricula.

From a practical standpoint, the results provide useful suggestions for higher education institutions. By adding cloud-based PM software to their curricula, these educational programmes can enhance their students' employability and prepare them for the modern workforce by providing them with modern skills that meet industry requirements. Therefore, curriculum designers who want to close the gap between academic preparation and professional ractice will find this study to be an invaluable resource.

Limitations and Future Research Directions

Universities may have difficulties integrating cloud-based PM tools due to factors such as financial constraints, lack of experience in real-world implementations, and technological needs. However, this study concentrated on the viewpoints of industrial requirements, and thus, future studies should examine these difficulties and their successful solutions by working with lecturers and students to integrate these technologies into degree programmes.

5. CONCLUSION

As evident from the previous statistical and empirical findings, cloud-based PM software has become popular among professionals of software development firms in managing their projects successfully. However, previous studies have elaborated that more studies are needed to explore effective strategies for how cloud-based PM software can be integrated into IT degree programmes by bridging the skill gap between industry requirements and academic offerings. As a result, this study was undertaken with the objectives of identifying the need to integrate cloud-based PM tools into the academic curricula of IT degree programmes and exploring effective integration strategies.

Utilising a mixed method approach, a quantitative survey was shared to analyse the requirement for integrating cloud-based PM tools into the academic curricula of IT degree programmes and further qualitative interviews to explore effective strategies to integrate cloud-based PM software into academic programmes in IT. Data analysed from both quantitative surveys and qualitative interviews revealed that the majority of firms adopt such software, and Jira seems to be the most popular service vendor. Therefore, there exists a crucial need to review and update the academic curricula of IT degree programmes to incorporate these tools effectively. Further from thematic analysis, introducing a practical component of cloud-based PM tools in subjects, requesting students to follow an online course on cloud-based PM software as an assignment, and workshops on cloud-based PM tools through industry resource persons, making it mandatory to be used during their undergraduate development projects were identified as means of effectively integrating it to IT degree programmes.

These effective strategies evolved as the major contribution of this study, which adds significant value in both theoretical and practical aspects. While filling the gap in the literature, the findings of this study shed light on curriculum review and the development of IT degree programmes incorporating cloud-based PM software as a most sought-after requirement in the industry. Academic institutes can adopt the strategies easily when they plan for updates in academic programmes to match industry expectations. However, future research needs to be carried out to explore challenges and provide recommendations to overcome such challenges that universities might face when incorporating the latest technology into their degree programmes to facilitate successful integration.

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