

Exploring Key Determinants of Job Efficiency Associated With Adoption of Private Cloud Services

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Abstract

When adopting private cloud services, companies must consider several factors including the popularity of information technology equipment, allocation of network resources, adoption of cloud platforms, and employees' perceived effectiveness of the technology. For enhancing job satisfaction and efficiency, this study explored the key determinants of the adoption of private cloud services based on favorable technology and resources, self-efficacy, and technology acceptance. We constructed a research model for conducting empirical analyses to test the related hypotheses. The results revealed that the key factors, namely resource-facilitating conditions, technology-facilitating conditions, and Internet self-efficacy had a significant effect on work efficiency. Moreover, web-specific control and perceived self-control had negligible effects on work efficiency. Herein, we provide implications for academicians and practitioners for future adoption, in addition to providing several suggestions for improvement.

Keywords: Private cloud service; key determinant factors; job efficiency; Internet self-efficacy; satisfaction.

1. Introduction

The rapid development of cloud computing and the ubiquity of smart devices have resulted in increasing numbers of enterprises adopting cloud services. Several studies have indicated that an appropriate cloud service is a critical consideration in the success of a network service system [1-6]. Cloud services not only offer advantages such as convenience and low-cost processing efficiency between an enterprise and employees but also provide flexibility and adaptability for using computing resources on demand [7].

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Stieninger, and his colleagues [8] reported that cloud computing is an important area for information technology (IT) innovation and business investment. Cloud computing, such as cloud services, has received increasing attention in both practice and research.

Several enterprises have introduced new services that will replace many types of computational resources currently used. Thus, the key determinant factors are considered to play a fundamental role in defining how cloud services are adopted. The rapid growth of cloud computing services has attracted the attention of both the public and private sectors. Several studies have reported on the development of cloud services in the application stage. Enterprises adopt various cloud services for mobile applications with the objective of facilitating various business operations for employees and in turn improving business performance and competitiveness [4, 9-11]. Therefore, understanding the antecedents and consequences of the adoption of cloud services in companies for job efficiency promotion is important from a practical viewpoint.

Enterprises use private cloud services such as cloud storage, cloud-based email accounts, calendars (for team time planning), intranet connections, collaboration platforms, document management, applications, line groups, and video calls. Thus, employees can connect and access private cloud services through mobile devices to manage tasks [1, 4]. Accordingly, enterprises intending to adopt cloud services must consider whether their internal resources are sufficient to support cloud services. For example, for smooth Internet connections, improving the broadband speed may be necessary. Updating computer hardware may also be necessary to enable employees to run complex software functions. Specifically, cloud services focus on information streams and require well-equipped hardware and software environments to ensure that employees can access services.

Relevant studies conducted on cloud services have focused on topics such as cloud computing architecture, establishment of service platforms, applicable areas for cloud computing services, research and development of cloud technologies, potential benefits of cloud computing, integration with internal IT, and performance issues [1, 4, 9-13]. These topics indicate that cloud services have become a prominent focus of research. Their ubiquity and high profile have driven a constant stream of suppliers that will continue to provide related products and services to meet business and user needs [4, 14]. Nevertheless, performance improvements achieved by enterprises adopting private cloud services cannot solely provide clear information. Therefore, the objective of the present study was to explore key determinants of employees' adoption of private cloud services and to determine how the adoption process effectively improves the employees' job efficiency, which also affects the willingness of enterprises to adopt private cloud services. Few studies have focused on the adoption of cloud services by employees. In this study, we explored key determinants of enterprises' adoption of private cloud services and demonstrated how employees benefit from the adoption of private cloud services with respect to their job efficiency.

2. Literature Review and Hypothesis Development

2.1. Cloud Services

Cloud computing is a novel means of delivering IT services to individuals and organizations. The adoption of cloud computing, especially among organizations, is encouraged by the public availability of cloud services that

provide multiple benefits such as increased flexibility and agility [8]. Because of its efficiency and convenience, cloud computing provides dynamically scalable computing resources such as storage, computing power, and applications delivered as a service [15]. Technically, cloud computing enables computer software and hardware resources to be accessed over the Internet without the need for any detailed or specific knowledge of the infrastructure used to deliver the resources [16]. Thus, the continuing development of cloud computing globally has caused companies to focus increasingly on cloud services. Major information software vendors must aggressively promote cloud building and cloud services for mobile applications. Moreover, smart mobile devices (e.g., notebooks, tablets, and smartphones) have become ubiquitous. These devices can be used to set up multifunction software such as document management, instant messaging, browser, email, GPRS mobile Internet access, multimedia content download, photography and filming, audio and video player, GPS navigation, and software update download applications.

Driven by market forces such as diversified development that combines mobile applications, cloud computing has become an important technology for corporate IT applications. Therefore, for using cloud services, enterprises must understand cloud computing architecture and its application environments. Cloud computing reduces the costs of information equipment and management by delivering scalable computing resources [4, 16]. It offers dedicated computing resources and services through the rapid deployment and configuration of innovative application tools and services through the Internet. Additionally, cloud computing allows access to computing resources and services through the Internet without the need of complex back-end management and operations models. It allows access to remote resources through the Internet and has the capability to expand in scale. Therefore, enterprises can introduce cloud services and integrate them with related internal systems. Employees can connect to their internal information systems through cloud service platforms anywhere and anytime to manage various tasks [17]. Cloud services can help developers build, deploy, and distribute Internet services and applications on the Internet. Long-term use of cloud services by employees enables companies to reduce capital expenses and operating costs required to maintain their existing applications and conduct cost planning in alignment with the reduced requirements for new services [5, 18, 19].

In our study, the use of cloud services was expected to engender convenience for employees. Regarding the measurement of perceived efficacy and behavioral control in terms of the use of private cloud services by employees, we reviewed the relevant literature. Research has suggested that perceived behavioral control (PBC) refers to people's belief in the ease of controlling their own behaviors and that it has a direct effect on people's behaviors [20, 21]. Ajzen [22] reported on people's beliefs in their ability to perform a given behavior or their having the resources or opportunity to perform a given behavior. In particular, in the age of information networking technology, to remain updated and increase their effectiveness and competitiveness, enterprises introduce several IT products such as mobile equipment into organizational processes. Thus, PBC affects individuals' ability to use their resources or opportunities. Similarly, PBC can strongly affect an employee's actual behavior and control. Therefore, in this study, PBC was defined as the effect of the use of private cloud services for mobile devices on employees' control, including prediction of control efficacy and measures for interpreting control efficacy.

This study focused on the adoption of private cloud services, which are considered a type of innovative

technology. Organizational and social systems such as perceived behavioral influence and self-efficacy in computer or Internet resource constraints play an important role in determining the adoption of private cloud services. Consequently, an extension of the technology acceptance model (TAM) with Internet self-efficacy and the theory of planned behavior (TPB), including PBC, was required to comprehensively examine the adoption of private cloud services. In this extension, satisfaction was included as an important determinant of job efficiency.

2.2. Relationship Among Resource-Facilitating Conditions, Usefulness, and Ease of Use

PBC reflects a person's perception of ease or difficulty toward implementing a behavior. According to the TPB, a person's actual behavior in performing a certain action is directly influenced by the person's behavioral intention, which may in turn be influenced by beliefs about the presence of control factors that may facilitate or hinder the behavior. Teo [23] revealed that PBC has a relational effect on technology acceptance (such as usefulness and ease of use) regarding the use of computer services. Thus, control beliefs regarding resources and technologies are the underlying determinants of PBC and can be depicted as control beliefs weighted by perceived power of the control factor. Control beliefs can be classified into three dimensions: perceived self-control (PSC), resource-facilitating conditions (RFCs), and technology-facilitating conditions (TFCs) as potential variables [24]. The decomposed TPB should provide a more complete understanding of IT adoption, compared with the more parsimonious TAM, such as ease of use and usefulness [25]. On the basis of the preceding statement, it is more favorable to extend the TAM model with the TPB or decomposed TPB in order to extensively consider the potential underlying determinants, system features, organizational members, and social system, for better predicting the intention toward the initial adoption of online services [24]. Horst and his colleagues [26] argued that the TAM may promote users to perceive behavior of e-services. Users may also adopt services because of the level of resource facilitation. Moreover, RFCs affect the usefulness and ease of use of online services. In this study, we considered that for increasing job efficiency, employees can control and access the utilization and acquisition of external resources and information associated with hardware and software updates. RFCs collated in this study included human, financial, technical, and management resources. This implies that employees can control specific resources, while the latter can also fully support the former with their need to use the equipment and systems. Mitra and his colleagues [27] further indicated that enterprises consider a variety of resources to access cloud information, such as system services and operational processes. Studies have reported that resources facilitating the tasks of online users can satisfy their perceived cloud efficiency through experience, further affecting their adoption intention [28, 29]. Thus, the higher the degree to which the resources are controlled by an employee under facilitating conditions, the more likely is the employee to succeed in performing the behavior [30]. This study investigated the effect of RFCs on job efficiency in the adoption of private cloud services by employees. The following hypotheses were proposed:

- H1: RFCs have a positive effect on usefulness in the adoption of private cloud services.
- H2: RFCs have a positive effect on ease of use in the adoption of private cloud services.

2.3. Relationship Among TFCs, Usefulness, and Ease of Use

TFCs refer to situations in which technology can fully support employees in using cloud service resources (such

as cloud storage and calendar) and system resources (such as collaboration platforms and instant messaging groups). Moreover, TFCs refer to degree to which users believe that the existing social system infrastructure can support the use of cloud computing services [5, 15, 24, 25]. Zhang [31] reported that the import of technology is an effective means of facilitating technological progress to medium-sized industrial enterprises, thereby enhancing their productivity. Adnan and his colleagues [32] reported technology-aided operation as an important efficiency to link relative job advantages. Studies have revealed a higher degree to which the information service control can facilitating conditions and provide technical support. This indicates that the easier it is to control the equipment, the higher is the usefulness of performing the behavior [30]. This study investigated the effect of TFCs in the adoption of private cloud services by employees on the usefulness and ease of use of cloud services. Therefore, TFCs were defined as the effect of employees adopting private cloud services with the ability to control TFCs on the usefulness and ease of use. The following hypotheses were thus proposed:

H3: TFCs have a positive effect on usefulness in the adoption of private cloud services.

H4: TFCs have a positive effect on ease of use in the adoption of private cloud services.

2.4. Relationship Among Perceived Self-Control, Usefulness, and Ease of Use

PSC refers to an individual's belief that an action can be controlled or an individual's expectations to achieve a goal or accomplish a task [33]. Specifically, the higher a person's perceived control efficacy is, the greater the amount of resources the person obtains for the behavioral control. In particular, self-control involves not only computer skills but also the use of Internet services. In our study, we defined PSC as a person's judgment regarding the control of computers and services. The judgment can affect the efficacy of the person after use; efficacy is based on the user's self-assessment of his or her ability to accomplish a given behavior or task (e.g., using a computer to collect data or perform data analysis) [34]. In the discussion of the relationships between PSC, usefulness, and ease of use, several researchers have considered that PSC has a direct effect on usefulness and ease of use [23, 26]. Wu and Chen [35] discovered in an online service research that users' self-control task has a positive effect on usefulness and ease of use. In addition, with respect to professional business services, Arslanagic-Kalajdzic and Zabkar [36] further indicated that users' perceived control function positively influences technology adoption. Studies have revealed that users with greater control abilities can also personally create and maintain tasks for different needs by applying basic computer skills through the Internet; this thus demonstrates the ease of computer control in such users [26, 37]. This study investigated the degree to which the adoption of cloud services by corporate employees affects their PSC over job efficiency. Therefore, PSC was defined as how employees assess their job efficiency in relation to their adoption of private cloud services [38]. The following hypotheses were thus proposed:

H5: PSC has a positive effect on usefulness in the adoption of private cloud services.

H6: PSC has a positive effect on ease of use in the adoption of private cloud services.

2.5. Relationship Among Web-Specific Control, Usefulness, and Ease of Use

The TPB has also been applied to explain an individual's adoption and use of a new technology [39]. Internet self-efficacy refers to a person's beliefs in his or her ability to effectively use or execute Internet services after using such services [34, 40]. Studies have revealed that the perceived efficacy from self-judgment by users after the use of Internet services can be considered Internet efficacy [41, 42]. Thus, users cognitively assess in favor of usefulness and ease of use, which boosts their confidence and affects their intention to adopt Internet services. Torkzadeh and van Dyke [43] reported that Internet self-efficacy is a potentially important factor in the use of e-services. In particular, understanding the acceptance pattern and role of Internet self-efficacy in e-service adoption is an important research concern. Studies have supported the relationship between computer self-efficacy and decisions involving computer usage and adoption [37, 44-46]. Chiu and Tsai [47] reported that Internet self-efficacy can predict users' performance in job task in web-based instructions. Thus, web-specific self-control refers to an individual's perception of his or her ability to use specific web application services within the scope of general Internet computing. Web-specific control (WSC) is the web-specific self-efficacy generated by users making subjective judgment while using Internet service platforms. Researchers revealed that users' perceived efficacy generated after the use of web-specific services can be considered web-specific efficacy; users cognitively perceive efficacy, believing that services provided by the website are useful and easy to control [48]. Ariff and his colleagues [49] argued that self-efficacy can be used to extend the TAM to the use of web service systems. Therefore, the following hypotheses were proposed:

H7: Web-specific self-control has a positive effect on usefulness in the adoption of private cloud services.

H8: Web-specific self-control has a positive effect on ease of use in the adoption of private cloud services.

2.6. Relationship Among Internet Connection Control, Usefulness, and Ease of Use

The TPB can explain and predict an individual's acceptance of new IT, and its extended model is suitable for further understanding the acceptance of e-services because of its strong theoretical foundation and inclusion of self-efficacy [41]. By integrating factors with the TAM, Park and Kim [15] reported several cognitive factors that contribute to shaping user perceptions toward cloud computing services. This concept was extended to the generated efficacy with usefulness and ease of use after the adoption of cloud services by users through the Internet. Thus, Internet connection control (ICC) is the assessment on Internet efficacy by users after their connection to cloud services through the Internet and the generated efficacy with usefulness and ease of use will affect their intention to use. Smith [50] argued that Internet connection quality may promote users' perceived value of adopting online services acceptance. Users may also adopt cloud services due to the control of Internet connection. In addition, Simsim [51] revealed that the factor influencing Internet service adoption may be related to users' preference of Internet access times, communication system used for the connection, and technical attributes of the Internet connection. In our study, we created causality between ICC, usefulness, and ease of use regarding the adoption of private cloud services. Scale adoption was based on the theories introduced by Hsu and Chiu [41]. On the basis of the scale proposed by Hsu and Chiu [41], we modified a scale appropriate for measurement in this study. Therefore, the following hypotheses were proposed:

H9: ICC has a positive effect on usefulness in the adoption of private cloud services.

H10: ICC has a positive effect on ease of use in the adoption of private cloud services.

2.7. Relationship Among Usefulness, Ease of Use, and Job Efficiency

Efficiency can be extended from Bandura's self-efficacy theory and refers to a person's verified high efficiency in handling a specific task based on the person's experience of several successes and failures managing the task [33]. In recent years, enterprises have used IT to improve the working efficiency of employees considerably [52-55]. Employees' efficiency was usually the will that was dependent on IT [56]. Aznoli and Navimipour [57] reported that a higher perceived efficiency can motivate employees to adopt cloud services. Job efficiency is the employees' expectation of applying self-efficacy and refers to an individual's belief in the ability to succeed in accomplishing a given task or behavior [58]. Studies have revealed that the TAM is a suitable theoretical model to verify the adoption of IT [59, 60]. Thus, usefulness and ease of use can be derived from the TAM, which has been used to verify the adoption of online service in the literature [61-64].

In particular, Park and Kim [15] revealed that ease of use is significantly affected by the usefulness of mobile cloud services. In our study, we considered that employees can accomplish their online operations more rapidly if they find that private cloud services can provide the information they need while using these services. Thus, the more users can realize the usefulness of private cloud services, the easier it is for them to focus on the use of these services. Chen and his colleagues [65], Muñoz-Leiva and his colleagues [66] have argued that the higher the usefulness and ease of use are after use, the better is the use efficacy and intention to adopt. Studies have reported that user-perceived IT usefulness and ease of use affect the efficacy of use and intention to use.

The present study applied this concept to the development of research variables regarding the adoption of private cloud services and created causality between usefulness, ease of use, and job efficiency. Therefore, we developed a scale appropriate for this study by citing and modifying Davis [60] theory and test items for usefulness and ease of use [33] and test items for job efficiency. The following hypotheses were proposed:

- H11: Ease of use in the adoption of private cloud services has a positive effect on usefulness.
- H12: Usefulness in the adoption of private cloud services has a positive effect on job efficiency.
- H13: Ease of use in the adoption of private cloud services has a positive effect on job efficiency.

2.8. Relationship Between Satisfaction and Job Efficiency

This study extended the TAM by including an additional factor, namely satisfaction. Previous research showed that satisfaction is a key factor that affects adoption intention [67]. In recent years, several studies on the adoption of Internet services have revealed that users' intention to adopt is mainly determined by how satisfied they are with the resulting efficacy after system adoption [68-73]. These studies have further verified that satisfaction is well related to users' intention to adopt online services [15, 74]. Duan [6] argued that cloud service performance may be crucial and beneficial to enterprises' adoption intention. Moreover, the mentioned studies have verified that user satisfaction with online services and post-adoption efficiency affects their intention to adopt services. Thus, the following hypothesis was presented:

- H14: Satisfaction with the adopted private cloud services has a positive effect on job efficiency.

3. Methodology

3.1. Research Model

On the basis of the literature review and hypotheses, this study developed an extended research model (Fig. 1). The proposed model is based on the extended TAM. Dishaw and Strong [75] reported that the TAM focuses on a particular IT developed by users based on the perceived usefulness and ease of use of the IT. The TAM is considered to be an independent concern for enterprises [76, 77]. Recently, Bach and his colleagues [59], Sternad and Bobek [78] have suggested that significant factors are not included in the TAM. For increasing the external validity of the TAM and more clearly understanding the factors that influence usefulness and ease of use, the inclusion of other significant factors is necessary. Thus, in our study, the TAM postulated that external variables intervene indirectly by influencing the perceived ease of use and usefulness. External variables considered with respect to individual acceptance of IT include situational involvement and intrinsic involvement [79].

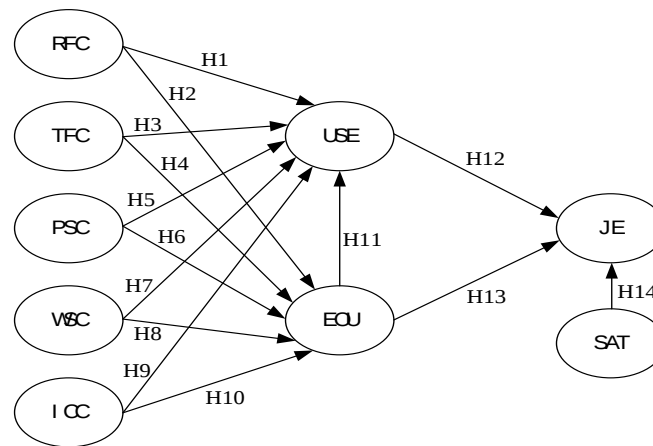


Figure 1: Research model

We constructed the external variables from two theories, PBC and Internet self-efficacy. PBC involves three dimensions, namely RFCs, TFCs, and PSC. Internet self-efficacy involves two dimensions, namely WSC and ICC. The individual factors are necessary because the acceptance of private cloud services is an individual decision. Efficiency is expected to affect task effort, persistence, and the level of goal difficulty selected for performance [80]. Employees appear to evaluate information about their abilities [42, 58]. Hence, in this study, we considered that job efficiency can determine the adoption of private cloud services by employees and their effect. Satisfaction was applied to assess employees' perceptions regarding the operational and relational efficiency of private cloud services as well as their own satisfaction and loyalty to their company [58, 81, 82]. Dvořáková and Faltejsová [83] reported that this helped to ensure that job efficiency measures evaluated employee perceptions, contributing to the overall reliability and face validity of the measurement process by reflecting the efficiency attributes as perceived by the employees. Constructs of questionnaire forms were obtained from previous studies. These constructs were then modified to develop initial questionnaires based on the features of the adoption of private cloud services.

3.2. Descriptive Statistics Analysis

The questionnaire responses comprised responses from the employees of 367 profitable small and medium enterprises (out of 480) who were eligible for the analysis. The overall response rate for the study was 76.46%, which was regarded as relatively high, especially because the respondents were employees who are supposed to be too busy to answer questionnaires. The SPSS 18 was used for the statistical analysis of the survey data. Basic descriptive statistics analysis is shown in Table 1.

Table 1: Demographic Profile of Respondents

Profiles	Sample composition	Frequency	Ratio (%)
Gender	Male	180	49.05%
	Female	187	50.95%
Age	20 or less	21	5.72%
	21-30	144	39.24%
	31-40	158	43.05%
	41-50	32	8.72%
	51 or over	12	3.27%
Education	Below Senior high/ Vocational school	34	9.26%
	University & Junior college	262	71.39%
	Graduate school and above	71	19.35%
Industry type	IT	104	28.34%
	Manufacturing	136	37.06%
	Services	89	24.25%
	Finance	13	3.54%
	Public sector	6	1.63%
	Healthcare	19	5.18%
Average time of using private cloud services per day	Less than one hour	87	23.71%
	1-2 h	195	53.13%
	3-4 h	56	15.26%
	5-7 h	21	5.72%
	More than 8 h	8	2.18%
Tools for using private cloud services (multiple choices allowed)	Mobile phone	351	95.64%
	Notebook	156	42.51%
	Desktop	235	64.03%
	Tablet	87	23.72%
Experience of using private cloud services	Less than one year	76	20.71%
	1-3 years	197	53.68%
	4-6 years	42	11.44%
	7-9 years	34	9.26%
	More than 10 years	18	4.90%
Understanding of efficacy of private cloud services	Good	107	29.1%
	Average	229	62.6%
	Poor	31	8.4%
Acceptance of security of private cloud services	Trust	277	75.5%
	Distrust	90	24.5%
Type of private cloud service used (Multiple choices allowed)	Company cloud storage	196	53.41%
	Company dedicated cloud-based email account	81	22.07%
	Calendar (for team time planning)	62	16.89%
	Internal system	175	47.68%
	Collaboration platform	67	18.26%
	Document management	175	47.68%
	Company APP	165	44.96%

Instant messaging group	206	56.13%
Instant video call	127	34.60%

In all, by gender, 180 males (49.05%) and 187 females (50.95%); by age, majority of the respondents were in the age range of 31–40, numbering 158 (43.05%); by education, predominantly university graduates, numbering 262 (71.39%), by occupation, a concentration on manufacturing, numbering 136 (37.06%); majority using private cloud services for 1–2 h,

numbering 195 (53.13%); majority used private cloud services on mobile phones, numbering 351 (95.64%); majority had experience of using private cloud services for 1–3 years, numbering 197 (53.68%); and majority had good understanding of the efficacy of private cloud services, numbering 229 (62.6%). Regarding the acceptance of the security of private cloud services, 277 respondents (75.5%) expressed trust. Regarding the type of private cloud services, majority used instant messaging groups, numbering 206 (56.13%), followed by cloud storage used by 196 respondents (53.41%).

3.3. Reliability Analysis

Table 2: Matrix of items in each construct and their item–total correlations and Cronbach’s α

Constructs	Measurement items	Item-total correlation	Cronbach’s α
Resource Facilitating Conditions (RFC)	RFC1: I think resource distribution in private cloud services is very even. RFC2: I think resource distribution in private cloud services is efficient. RFC3: I am satisfied with resource distribution in private cloud services. RFC4: Overall, I think resource distribution in private cloud services is appropriate.	0.705 0.668 0.643 0.656	0.899
Technology facilitating conditions (TFC)	TFC1: I am confident about the private cloud services technology. TFC2: I think the private cloud services technology is efficient. TFC3: I am satisfied with the private cloud services technology. TFC4: Overall, I am satisfied with the private cloud services technology.	0.751 0.748 0.780 0.746	0.908
Perceived self-control (PSC)	PSC1: I have the ability to control private cloud services. PSC2: I have confidence in the control over private cloud services. PSC3: I have the efficacy to control over private cloud services. PSC4: Overall, I have good control over the private cloud services.	0.697 0.716 0.721 0.697	0.895
Web-specific control (WSC)	WSC1: I think the information in the private cloud service platform is correct. WSC2: I can accomplish tasks effectively using the private cloud service platform. WSC3: I have great confidence in the operation of the private cloud service platform. WSC4: I have confidence in using the functions of the private cloud service platform.	0.697 0.678 0.739 0.716 0.733	0.910

	WSC5: Overall, I am satisfied with the control over the private cloud service platform.		
Internet connection control (ICC)	ICC1: I think the Internet connection control in private cloud services is stable. ICC2: My control over the Internet connection to private cloud services is very efficient. ICC3: I have confidence in my control over the Internet connection to private cloud services. ICC4: I am satisfied with the Internet connection to the private cloud services. ICC5: Overall, I am satisfied with my control over the Internet connection to the private cloud services.	0.785 0.760 0.750 0.755 0.732	0.931
Usefulness (USE)	USE1: The functions in private cloud services can help task accomplishment. USE2: The functions in private cloud services can meet task demands. USE3: The functions in private cloud services can improve work efficiency. USE4: Overall, the functions in private cloud services are helpful for work.	0.796 0.760 0.763 0.773	0.907
Ease of use (EOU)	EOU1: The interface for private cloud services is easy to operate. EOU2: The use of private cloud services is easy to understand. EOU3: The function settings in private cloud services are easy to use. EOU4: The functions in private cloud services are easy to control. EOU5: Overall, I think the operation in private cloud services is easy to use.	0.702 0.685 0.677 0.717 0.704	0.916
Job efficiency (JE)	JE1: The use of private cloud services is helpful for work. JE2: The use of private cloud services enables improved job efficiency. JE3: The use of private cloud services enables higher speed at work. JE4: Overall, the use of private cloud services is helpful to improve job efficiency.	0.748 0.709 0.723 0.777	0.904
Satisfaction (SAT)	SAT1: The use of private cloud services is satisfactory. SAT2: I am satisfied with the functions in private cloud services after use. SAT3: I have a satisfactory experience in using private cloud services. SAT4: I have a pleasant experience in using private cloud services. SAT5: Overall, I am very satisfied with private cloud services.	0.717 0.726 0.688 0.724 0.711	0.892

In the reliability test, the results reached the required stability and consistency. Hair and his colleagues [84] suggested that the Cronbach α value must be greater than 0.7 and the corrected item–total correlation must be greater than 0.5; a value of less than 0.5 indicates removal of the corresponding item. Items in each construct in the study met these standards: The Cronbach α value was greater than 0.7 and the item–total correlation was greater than 0.5, indicating high reliability of the questionnaire in the study. Moreover, there was no need to

remove any item, as shown in Table 2.

3.4. Validity Analysis

In this study, validity testing followed the construct validity introduced by Fornell and Larcker [85], which was divided into two categories: convergent and discriminant validity. Regarding convergent validity, Fornell and Larcker [85] suggested that the standardized factor loading (SFL)

should be greater than 0.5, component reliability (CR) should be greater than 0.7 in the ideal case, and average variance extracted (AVE) should optimally be greater than 0.5. The study met all of these standards, as presented in Table 3.

Regarding discriminant validity, for testing the degree of cross-construct correlation, a lower degree of correlation indicates higher discriminant validity. Chin [86] suggested that the square roots of the AVE on the diagonal line must be greater than all the cross-construct correlations on the non-diagonal lines. The square roots of the AVE in the study were all greater than the cross-construct correlation coefficients, indicating good discriminant validity, as shown in Table 3.

On the basis of the aforementioned data analysis results, the internal quality of the research model was mainly used for evaluating the significance of parameters for estimation and the reliability of individual constructs and potential variables. The described evaluation results show that all of them had component reliability levels greater than 0.7 and AVE values greater than 0.5. This implies that this model has a good internal fit. Overall, most of the indices met the suggested standards, indicating a good overall model fit in this study [84].

Table 3: Summary of Discriminant Validity Analysis, CR, and AVE

Constr uct	RFC	TFC	PSC	WSC	ICC	USE	EOU	JE	SAT	AVE	CR
RFC	0.828									0.685	0.897
TFC	0.631	0.834								0.696	0.901
PSC	0.382	0.383	0.801							0.641	0.877
WSC	0.501	0.536	0.455	0.869						0.755	0.939
ICC	0.426	0.493	0.507	0.585	0.822					0.676	0.913
USE	0.616	0.599	0.412	0.560	0.526	0.787				0.619	0.866
EOU	0.539	0.514	0.421	0.540	0.474	0.561	0.794			0.631	0.895
JE	0.554	0.656	0.434	0.521	0.517	0.647	0.505	0.812		0.660	0.886
SAT	0.452	0.527	0.521	0.563	0.599	0.559	0.481	0.554	0.788	0.621	0.891

Note: Diagonal line displays the square roots of AVE.

3.5. Confirmatory Factor Analysis

Results of Harman's single-factor test revealed that common method bias is not a concern in this study [87], as shown in Table 4.

Table 4: Confirmatory Factor Analysis for the Full Sample (N = 367)

Items	RFC	TFC	PSC	WSC	ICC	USE	EOF	JE	SAT
RFC1	0.833	0.445	0.064	0.188	0.232	0.128	0.196	0.264	0.231
RFC2	0.838	0.424	0.118	0.109	0.055	0.045	0.067	0.345	0.387
RFC3	0.758	0.450	0.109	0.069	0.073	0.102	0.057	0.304	0.397
RFC4	0.825	0.406	0.173	0.235	0.215	0.295	0.025	0.304	0.284
TFC1	0.310	0.806	0.077	0.068	0.144	0.322	0.074	0.394	0.288
TFC2	0.309	0.764	0.103	0.087	0.104	0.149	0.067	0.329	0.341
TFC3	0.325	0.855	0.201	0.196	0.064	0.144	0.184	0.443	0.339
TFC4	0.291	0.787	0.184	0.182	0.135	0.192	0.177	0.336	0.324
PSC1	0.380	0.064	0.807	0.259	0.061	0.112	0.223	0.349	0.333
PSC2	0.342	0.135	0.810	0.235	0.012	0.062	0.011	0.276	0.409
PSC3	0.362	0.035	0.845	0.194	0.088	0.129	0.013	0.205	0.207
PSC4	0.252	0.201	0.752	0.301	0.021	0.002	0.309	0.315	0.256
WSC1	0.219	0.077	0.188	0.819	0.022	0.174	0.003	0.098	0.404
WSC2	0.289	0.058	0.109	0.789	0.054	0.123	0.201	0.014	0.298
WSC3	0.203	0.097	0.069	0.853	0.064	0.079	0.173	0.028	0.318
WSC4	0.353	0.057	0.005	0.835	0.065	0.073	0.061	0.069	0.237
WSC5	0.245	0.019	0.068	0.767	0.015	0.085	0.012	0.053	0.272
ICC1	0.267	0.096	0.087	0.064	0.841	0.073	0.088	0.391	0.213
ICC2	0.371	0.008	0.196	0.118	0.751	0.069	0.021	0.313	0.342
ICC3	0.278	0.114	0.182	0.109	0.803	0.078	0.022	0.349	0.397
ICC4	0.309	0.064	0.198	0.173	0.792	0.094	0.054	0.391	0.225
ICC5	0.412	0.135	0.049	0.077	0.841	0.428	0.064	0.387	0.174
USE1	0.309	0.247	0.033	0.103	0.188	0.765	0.065	0.415	0.265
USE2	0.412	0.263	0.019	0.201	0.109	0.851	0.015	0.252	0.166
USE3	0.333	0.223	0.038	0.205	0.069	0.803	0.062	0.322	0.261
USE4	0.293	0.292	0.003	0.184	0.005	0.792	0.287	0.347	0.153
EOF1	0.198	0.317	0.035	0.201	0.068	0.068	0.819	0.332	0.176
EOF2	0.145	0.381	0.103	0.086	0.087	0.315	0.828	0.286	0.019
EOF3	0.010	0.074	0.074	0.284	0.196	0.302	0.793	0.238	0.017
EOF4	0.033	0.381	0.102	0.301	0.182	0.266	0.834	0.439	0.098
EOF5	0.073	0.226	0.101	0.331	0.198	0.168	0.882	0.457	0.433
JE1	0.172	0.302	0.056	0.327	0.049	0.302	0.169	0.815	0.441
JE2	0.233	0.152	0.072	0.042	0.033	0.069	0.044	0.782	0.463
JE3	0.262	0.225	0.075	0.241	0.019	0.159	0.083	0.866	0.47
JE4	0.298	0.109	0.028	0.103	0.038	0.182	0.222	0.868	0.401
SAT1	0.205	0.203	0.112	0.126	0.003	0.048	0.233	0.435	0.898
SAT2	0.246	0.041	0.188	0.348	0.035	0.102	0.274	0.403	0.805
SAT3	0.318	0.127	0.109	0.519	0.103	0.112	0.319	0.246	0.846
SAT4	0.213	0.291	0.069	0.718	0.074	0.191	0.366	0.269	0.866
SAT5	0.321	0.268	0.105	0.693	0.002	0.168	0.169	0.432	0.869

3.6. StructuralEquationModeling

In this study, basic goodness of fit was used as a criterion mainly for evaluating the research model. If the estimated coefficient yielded in a structural model exceeds the defined acceptable range, it implies that the estimation in the entire model is not good.

The test results showed that the SFLs were all greater than 0.5 and less than 0.95, with the standard errors (SEs) being within the nonsignificant range of 0.040-0.070, indicating a good fit in the study (Table 5).

Table 5: Analysis of Basic Goodness of Fit

Construct	Item	SFL	SE	t value	Construct	Item	SFL	SE	t value
Resource Facilitating Conditions (RFC)	RFC1	0.790	0.070	11.927	(ICC)	ICC4	0.785	0.067	11.843
	RFC 2	0.834	0.055	11.220		ICC5	0.804	0.063	11.966
	RFC 3	0.861	0.049	10.554	Usefulness (USE)	U1	0.854	0.040	10.520
	RFC 4	0.824	0.059	11.419		U2	0.738	0.065	12.333
Technology facilitating conditions (TFC)	TFC1	0.834	0.058	11.189		U3	0.800	0.054	11.690
	TFC2	0.828	0.049	11.576		U4	0.750	0.064	12.232
	TFC3	0.842	0.054	11.033	Ease of use (EOU)	EOU1	0.759	0.063	12.084
	TFC4	0.832	0.053	11.512		EOU2	0.812	0.055	9.959
Perceived self-control (PSC)	PSC1	0.878	0.054	7.226		EOU3	0.740	0.062	12.267
	PSC2	0.797	0.055	11.163		EOU4	0.832	0.044	10.895
	PSC3	0.763	0.053	11.812		EOU5	0.823	0.053	9.708
	PSC4	0.759	0.061	10.213	Job efficiency (JE)	JE1	0.836	0.042	10.921
Web-specific control (WSC)	WSC1	0.908	0.042	9.251		JE2	0.809	0.050	11.462
	WSC2	0.888	0.043	10.169		JE3	0.762	0.051	12.105
	WSC3	0.830	0.050	12.695		JE4	0.840	0.046	10.816
	WSC4	0.841	0.049	12.542	Satisfaction (SAT)	SAT1	0.789	0.057	11.572
	WSC5	0.874	0.054	8.954		SAT2	0.805	0.055	11.312
Internet connection control	ICC1	0.829	0.053	11.562		SAT3	0.793	0.066	11.508
	ICC2	0.800	0.065	10.622		SAT4	0.768	0.067	11.852
	ICC3	0.890	0.049	9.119		SAT5	0.786	0.062	11.616

3.7. Overall Model Fit

The research model used in the study had a chi-square/degree of freedom of 2.941, less than 3, indicating that the model has a good fit [88]. The normed fit index (NFI), non-normed fit index (NNFI), comparative fit index (CFI), relative fit index (RFI), and incremental fit index (IFI) must all be greater than 0.9; the indices met these standards (Table 6). Overall, most of the indices met the theoretical standards, indicating a good overall model fit in the study [84]. As shown in Fig. 2, “job efficiency” had 74% explanatory power ($R^2 = 0.740$) and included the factors of “usefulness,” “ease of use,” and “satisfaction,” of which usefulness (standardized coefficient = 0.786) was greater than satisfaction (standardized coefficient = 0.246) and ease of use (standardized coefficient = -0.077), indicating that “usefulness” the most important factor that affects job efficiency. “Usefulness” has 83.2% explanatory power ($R^2 = 0.832$) and is most affected by TFCs (standardized coefficient = 0.581),

followed by RFCs (standardized coefficient = 0.241), indicating that TFCs are the most important factor that affect usefulness. “Ease of use” has 56.1% explanatory power ($R^2 = 0.561$) and is most affected by RFCs (standardized coefficient = 0.407), followed by ICC (standardized coefficient = 0.306), indicating that RFCs are the most important factor affecting the ease of use.

Table 6: Summary of Overall Model Fit

Index	Chi-square/degree of freedom			Absolute fit index				
Testing standards	χ^2	df	χ^2/df	GFI	AGFI	RMSEA	SRMR	
	---	---	<3	>0.9	>0.8	<0.05	<0.08	
Results	2082.168	708	2.941	0.903	0.872	0.065	0.029	
Determination	p value not reaching insignificance	---	Excellent	Excellent	Excellent	Slightly higher	Excellent	
Index	Incremental fit index					Parsimoious fit index		
Testing standards	NFI	NNFI	CFI	RFI	IFI	PNFI	PGFI	CN
	>0.9	>0.9	>0.9	>0.9	>0.9	>0.5	>0.5	>200
Results	0.976	0.982	0.984	0.974	0.984	0.886	0.693	246.724
Determination	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent

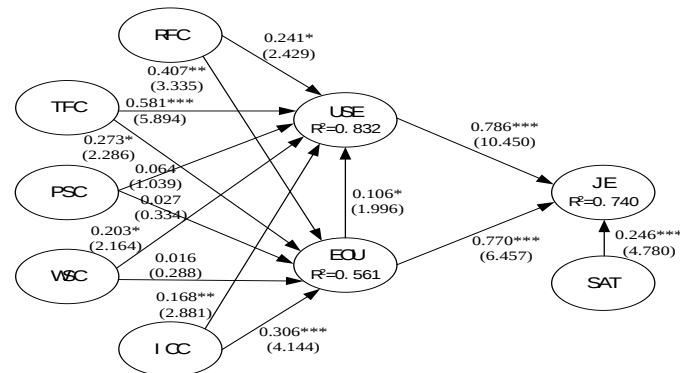


Figure 2: Results from the research model

4. Discussion

This study investigated the key determinants of employees' adoption of private cloud services. Job efficiency was the key job demand for employees, and examining the key determinant factors could help improve their job effectiveness. Therefore, a research model was created based on a literature review to verify how these key determinants affect the way private cloud services help employees and how this affects job efficiency.

(1) The hypothesis that RFCs in employees' adoption of private cloud services have a positive effect on the employees' perceived usefulness and ease of use was supported. This is consistent with the results of Teo [23]. The results reveal that under existing resource conditions, employees can access resources in the adoption of

private cloud services and can also experience improved job efficiency with the help of these services (such as company cloud storage, collaboration platform, and instant messaging group) when engaging in knowledge sharing and tasks. Thus, employees perceived these services as positive and useful. The results further reveal that the adoption of private cloud services and ease of use in their access indeed affect employee-perceived value of these services; additionally, ease of use of functions related to these services is a determinant of employee adoption. Therefore, when employees adopt functional operations in private cloud services, external resources can promote their intention to adopt. The employees participating in the study reported that they could adopt private cloud services by resource conditions to improve their job efficiency. Such company-provided resources that facilitate employee adoption include education and training programs, operations documentation, and support from service people, all of which help improve employee efficiency in handling tasks.

(2) The hypothesis that TFCs in employees' adoption of private cloud services have a positive effect on employee-perceived usefulness and ease of use was supported. This is consistent with the findings of Teo [23]. Our results show that the variable TFCs had a full effect on employees' perception of the usefulness of private cloud services. Employees believed that cloud-based service functions engendered by technological advancements can improve their execution efficiency at work. Moreover, they have positive identification with the use of mobile devices by employees and support provided by their companies, which increase the application value of private cloud services. Thus, useful support provided to employees by private cloud services is also important for the ease of use of the functions of such services. This study results reveal that the greater is the support provided to employees for the information equipment and technology they control, the easier the service function is to control or use. Therefore, the study results show that TFCs in employees' adoption of private cloud services can positively affect ease of use.

(3) The hypothesis that ICC in employees' adoption of private cloud services has a positive effect on employees' perceived usefulness and ease of use was supported. After using private cloud services through an Internet connection, employees subjectively perceived the work efficacy because of these services and the quality, stability, and speed of the Internet connection to be satisfactory. The study results reveal that after employees are connected to the Internet, their perceived efficacy based on their judgment is related to the efficacy in ICC and causes employees to perceive usefulness, thereby positively affecting the extent to which the Internet is used to connect to services. The results also reveal that cloud platforms' connection control could be accomplished by employees using their own expertise. In particular, employees can determine the roots of connection problems they may encounter and seek problem-solving resources. This means that Internet connection can be easily controlled. Thus, the employee-perceived value of ease of use of ICC produces a positive effect.

(4) The hypothesis that in employees' adoption of private cloud services has a significant effect on employees' perceived usefulness was supported; however, the hypothesis that WSC has no effect on ease of use was not supported. The results show that employees can use private cloud services on their computers using an Internet connection and can also access these services from any computer or mobile device without being restricted to specific computers. They perceive the benefit of such use and the value of self-efficacy generation. The study results show that employees perceive that controllability in private cloud services should be convenient and easy to use because they can adopt these services through an Internet connection from any computer, and different

controls of computer equipment would not make considerable differences. In particular, to smoothly connect to websites, employees may have to adapt to the computer's operating environment. Therefore, employees may consider that the ease of use of the computer environment must be strengthened. Thus, the test results show that ease of use of ICC in the adoption of private cloud services does not affect the intention to use in employees who adopt these services.

(5) The hypothesis that PSC in employees' adoption of private cloud services does not have a significant effect on employees' perceived usefulness, and ease of use was not supported. The results show that PSC is based on the judgment made by employees while using their computers to control the private cloud services, and employees may perceive that they need more educational support for functional control in private cloud services. These findings also indicate the importance of information staff. Thus, the results show that PSC has no positive effect on the perceived usefulness. The results are consistent with those of previous studies on perceived control [26, 37, 48]. This implies that companies need to plan education and training programs or have responsible personnel to train employees in order to help them understand the functional features while using their private cloud services, thereby improving the usefulness of these services. Moreover, PSC was determined to have no significant effect on the ease of use of private cloud services. This indicates that for functional control in private cloud services to be sufficiently easy to use for employees, companies should provide the necessary resources, such as education and training or online tutorial programs, so that employees can easily use private cloud services and have better control over the efficacy of services, facilitating their adoption of these services.

(6) The hypothesis that ease of use in employees' adoption of private cloud services has a positive effect on the employees' perceived usefulness was supported. Consistent with the findings of previous studies, our results verify the argument that perceived ease of use has a positive effect on usefulness [23, 66]. This implies that both the usability of information provided by the system and the ease of use of functions in private cloud services affect employee-perceived value.

(7) The hypothesis that usefulness and ease of use in employees' adoption of private cloud services have positive effects on the employees' perceived job efficiency was supported. The results show that both usefulness and ease of use had positive effects on job efficiency. This is consistent with the findings of previous studies. Private cloud services provided by companies can be effectively applied at work to help employees manage tasks and capture information. However, companies should also provide learning methods for employees who are not familiar with the use of these services to promote the effective use of the services. Muñoz-Leiva and his colleagues [66] suggested that users' perceived usefulness of IT affects the use efficacy, and that there is a close relationship between usefulness and job efficiency. Furthermore, ease of use has a positive effect on the use and control of private cloud services. Therefore, easy-to-use private cloud services are helpful for employees. (8) The hypothesis that satisfaction in employees' adoption of private cloud services has a positive effect on employees' perceived job efficiency was supported. The results show that private cloud services provided by companies had a significant effect on their employees. This implies that the use of private cloud services by employees is helpful and enhances their efficacy. These results are consistent with those of previous studies on job satisfaction [58, 89]. The study also verified positive employee attitudes toward further adoption.

5. Conclusions and Implications

The cloud computing service is a popular online platform among enterprises' employee because of its high efficiency and convenience. This industrial market provides great profit potential for mobile commerce enterprises. Thus, many enterprises have adopted cloud computing services. Our study found that almost employees are accepted the security of private cloud services based on present network architecture. However, many of these private cloud services are not well adopted by employees and they only have a little service shares. These companies are eager to know what factors determine an employee's adoption of private cloud services for job efficiency. With this research, we find that an employee's job efficiency towards private cloud services is mainly determined by resource facilitating conditions, technology facilitating conditions, web-specific control, Internet connection control and additionally affected by usefulness, ease of use and satisfaction. Results illustrate that the integrated model can fully reflect the spirit of the technology acceptance model and take advantage of perceived behavioral control and internet self-efficacy. Employees want to get a variety of resources, such as information equipment and self-control ability, as well as the basic operation function when adopting private cloud services.

5.1. Implications for management

This study has two implications for management: First, our findings suggest that companies should effectively educate employees on the functions of private cloud services in order to increase their use efficacy. Moreover, companies should provide online learning and instructions or plans and organize training programs, together with private cloud services, for employees. Thus, employees can more clearly understand the use of various functions and processing methods. This can also help companies improve the layout of the interface for private cloud services, such as the extended use of wizard icons for display, which makes the entire interface more easy to use and operate, thereby boosting employee intention to use private cloud services and preventing employee resistance. Second, companies should provide private cloud services to improve the job efficiency of employees according to the rollout strategies. To achieve more favorable results, companies should provide a variety of strategies that can improve job efficiency rapidly and effectively. Specifically, private cloud services help employees to adopt and access these functions any time, from anywhere, and using any device. Thus, integration of cloud computing services into business settings may promote employees' job efficiency, task effectiveness, and satisfaction.

5.2. Implications for academia

This study provides three implications for academia: First, the study proposed new constructs and causal relationships for adopting an innovative service, particularly private cloud services. Our study model, which extends the TAM, was determined to explain a substantial variance in job efficiency associated with the adoption of private cloud services. The findings reveal the effects of innovative services on employee satisfaction and efficiency. Second, the extension of the TAM provides information for enterprises adopting private cloud services to achieve a job, whereas the proposed model was applied to verify key determinants by using situational variables such as RFCs, TFCs, PSC, WSC, ICC, satisfaction, and job efficiency. The result for

job efficiency is not consistent with those in previous studies, and key determinants can be adopted as a different approach for verification, such as a contrastive study between online service adopting and cloud service adopting. Third, this study demonstrated that the key determinants of employees' adoption of cloud services were associated with two theoretical foundations, namely PBC and Internet self-efficacy. They not only expect a useful and easy-to-use private cloud services, but also aspire to experience satisfaction and smooth operation in the adopted services. Additionally, we suggest that adoption as a comprehensive concept warrants more research attention in the context of cloud service platforms and mobile commerce.

5.3. *Implications for practice*

The findings of this study have three implications: First, on the basis of our findings, companies are encouraged to adopt private cloud services to help manage corporate data, documents, and transfer important information (such as orders and contract records). Employees can use these services and share resources directly through the Internet and smart devices. This has a significant effect on the overall business strategies of companies, particularly instantaneous tasks. Private cloud services may enable faster information transfer and improve both company-wide information optimization and professionalism. Second, companies should actively adopt private cloud services; they should simultaneously convey the advantages of these services, organize learning seminars, and as demonstrate the benefits of using functions and improved job efficiency. Thus, managers should clearly and fully explain these services to increase their usefulness and promote a more convenient and user-friendly mode of operation so that employees have greater satisfaction after the adoption of these services. Third, the study proposes a new cloud concept that can help an entire company become mobility service-oriented. Thus, companies should adopt private cloud services by leveraging technological advancement in combination with their resources, such as existing Internet connection architecture and employee control over the Internet environment. These findings allow companies to provide private cloud services accordingly. This can not only improve overall job efficiency but also boost employee intention to further adopt new private cloud services in the future. The fact that private cloud services have become the focal point of companies and fierce industry competition indicate that companies should find their own paths.

5.4. *Limitations and further research*

This study has three limitations: First, the sample was limited to Taiwanese enterprises, and a larger sample size is required to further generalize the findings to cross-national enterprises. Second, the private cloud services adopted by employees may affect the outcomes of the study and act as a moderator. In the future, a multi-group analysis (e.g., into gender and age) that differentiates the participants (e.g., into service industry and SOHO groups) with regard to their adoption experience with private cloud services may lead to improved insights. Third, focusing only on employees' adoption mindset but neglecting the different levels of industry people's readiness is a limitation because this is a critical point in technology integration in practice.

Thus, future research should focus on enterprises' perceptions regarding the actual process of integrating such services into cloud computing systems; this is because such an integration must be addressed with regard to the various practical aspects, including cost analysis, employee resistance, change management, and industry

competition. To achieve such an integration, employees are expected to be supportive of the new technology model and corporations and industries must be equipped with the required new concepts and skills to deliver on promises of the emerging technologies.

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