Antecedents of Cloud Computing Adoption in the Malaysian Context: A Systematic Literature Review

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Abstract: In a competitive marketplace, the competitiveness and survival of any corporation are often attributed to its ability to adopt innovative technology which bestows a competitive edge and reduced costs, improves the quality and the efficiency of its business processes. Cloud computing is a platform for the development of computational solutions for multiple fields of knowledge, as it offers cost-saving mechanisms and increased efficiency to organisations. Despite its maturity and enhancement, reviews pertaining to antecedents of cloud computing adoption in the Malaysian context are scarce. Thus, a systematic literature review usingScopus database for retrieving the related-articles was carried out to shed light on the antecedents of cloud computing adoption in the Malaysian context. The review revealed that the antecedents influencing cloud computing adoption includes technological context elements (relative advantages, technological readiness, cost saving and compatibility), organisational context elements (top management support) and environmental context elements (competitive pressure, external support/trading partner support/regulatory support, vendor reputation and trust). Understanding the antecedents of cloud computing adoption is crucial towards strengthening cloud computing adoption and, in turn, will improve the performance and competitiveness of corporate sectors.

Keywords: Cloud computing adoption, Malaysia, systematic literature review

1. Introduction

Today, corporations need to be able to make decisions at the right time, spend efficiently and appropriately in order to succeed and survive. In a competitive marketplace, the competitiveness and survival of any corporation are often attributed to its ability to adopt innovative technology which bestows a competitive edge and reduce the costs, improves the quality and the efficiency of its business processes (Ming et al., 2018). As such, work has become highly contended, needs to be quickly set up and effective collaborative networks must be formed to ensure improved work quality (IDC, 2020). Therefore, a strategic move should be carried out drastically by corporations to grasp a technology that permits them to alter business processes and formulate a new way of doing business. One of the extensively recognised innovative technologies that has enticed many corporations for adoption is cloud computing (Ming et al., 2018).

Cloud computing is being predicted as one of the 25 technology trends that will define the next decade (Marr, 2020; Patwary et al., 2021). With regards to IDC (2020), the worldwide cloud IT infrastructure market forecast by deployment type from 2018 to 2024 revealed that cloud computing will continue to grow and overhaul into the share of traditional IT from an approximate 32% in 2018 to an approximate 45% in 2024.

Cloud computing is a platform for developing computational solutions for multiple fields of knowledge, as it offers cost-saving mechanisms and increased efficiency to organisations (Cunha et al., 2017) and influenced business performance (Raut et al., 2018). Certainly, cloud computing is not a new form of information system technology that was just recently introduced as ample research has been conducted on cloud computing-related topics such as cloud computing adoption (Aydin, 2021; Yoo & Kim, 2018). Nevertheless, despite its maturity and enhancement, studies pertaining to antecedents of cloud computing adoption in the Malaysian context are scarce (Hassan et al., 2017; Ming et al., 2018). Thus, a systematic literature review was carried out to shed light on the antecedents of cloud computing adoption in the Malaysian context.

2. Methodology
2.1 Search Strategy

A systematic search strategy was implemented via a single electronic database, namely Scopus. The keywords used to search article titles and abstracts include "cloud computing", "cloud adoption", and "cloud computing adoption". This search process generated a total of 86911 documents from the Scopus database. To narrow down the search results, an additional keyword "Malaysia", was added, which reduced the number of documents from the Scopus database down to 125. The last search was carried out on 1 May 2021. The search query string is presented below:

TITLE-ABS-KEY ("cloud adoption" OR "cloud computing" OR "Cloud computing Adoption" AND "malaysia") AND (LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016)) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (AFFILCOUNTRY, "Malaysia")).

2.2 Inclusion and Exclusion Criteria

As per Table 1, the first search inclusion criterion is the timeline. Since cloud computing is a technology-related topic, only articles published in recent years were considered. Thus, relevant documents published from 2016 to 2021 were selected. The second and third inclusion criteria were document type and publication stage, respectively, targeting articles in the final stage. The fourth selection was the language of the publication, which is the English language. The final inclusion criterion was the country and territory, where Malaysia was chosen as the focus of this study. Overall, 88 out of the 125 articles were excluded based on the above criteria, leaving 37 documents for the next stage of physical screening.

2.3 Eligibility

Thirty-seven articles were prepared for the third screening stage, also known as the eligibility stage. In this stage, the abstract and the entire content of the articles were physically examined to ensure the articles were suitable and relevant for this study. During the eligibility screening, duplicated articles were also removed. However, in this study, all 37 articles were unique articles; hence there were no duplicated articles. With this eligibility screening, 24 of the articles were found not suitable and not relevant to this systematic literature review study, while the full content of 1 article could not be accessed, so all 25 articles were removed, leaving a final 12 articles for the next stage, which is data abstraction and analysis.

Table 1 - Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Timeline	2016-2021	<2016
Document Types	Article	conference paper, book chapter, review, conference review, book, editorial, short survey, note, retracted
Publication Stage	Final	Article in press
Language	English	Non-English
Country/Territory	Malaysia	Non-Malaysia

2.4 Data Extraction & Analysis

After the eligibility process, the 12 remaining articles were evaluated, reviewed and analysed. The data were extracted to identify the relevant antecedents influencing cloud computing adoption across Malaysian industries via an in-depth study and analysis of the entire content of the articles. During the review process, the following aspects were identified: (a) research design, (b) theory involved, (c) type of influencing antecedents, (d) sampling method, (e)

industry, (f) university and (g) results. From the search strategies above, 37 articles were identified but 24 articles were removed due to irrelevance, while 1 article was removed due to the difficulty to access its full content. The remaining 12 articles were then summarised and the results were presented in the following section (as per Fig. 1).
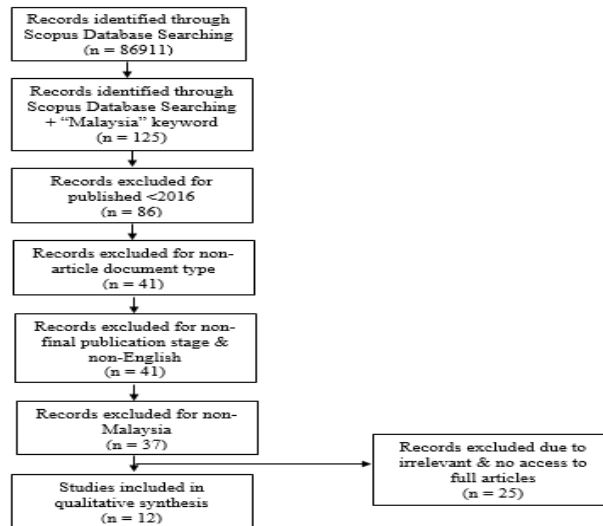

Fig. 1 - Flow diagram for systematic literature review process

3. Results

3.1 Industries, Universities, Year of Publication and Theory Setting

As shown in Table 2, twelve articles were included in this review. Most of the cloud computing-related articles selected in this study was based on small and medium enterprises, followed by the education sector, financial service industry, manufacturing and government sector.

Table 2 - Industries covered in the research

Industries	Total
Small and Medium Enterprises	8
Education	2
Financial Service Industry	1
Manufacturing	1
Government	1
Total	**12**

The breakdown of the universities for the selected 12 articles is presented in Table 3. All these studies were conducted by researchers from different universities.

Table 3 - Authors' by Universities observed

Universities	Number of Studies
Universiti Teknologi MARA	3
Universiti Teknologi Malaysia	2
Universiti Sains Malaysia	2
Universiti Kebangsaan Malaysia	1
Universiti Putra Malaysia	1
Universiti Utara Malaysia	1
Universiti Malaysia Sabah	1
UCSI University	1
Total	12

Table 4 revealed the breakdown of the publication year whereby it is quite average, where 1 to 4 cloud computing adoption in Malaysia related articles released yearly and so far, no publication in the year 2021 yet.

Table 4 - Year of publication of articles

Year	Number of Studies
2021	0
2020	1
2019	4
2018	4
2017	1
2016	2
Total	12

Of these 12 articles, the theories, frameworks and models involved including the Technology-Organisation-Environment (TOE) framework, the Diffusion of Innovation (DOI) theory, the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT) model and Technology Acceptance Model (TAM) and Diffusion Theory Model (TAM-DTM). Technology-Organisation-Environment (TOE) is the most popular framework in all 12 studies, as well as other technology-related studies, due to its straightforward concept (as per Table 5).

Table 5 - Models & theories of the studies

Models/Theories	Number of Studies
Technology-Organisation-Environment (TOE) framework	4
Diffusion of Innovation (DOI) theory	1
Technology-Organisation-Environment (TOE) framework, Diffusion of Innovation (DOI) theory	2
Technology-Organisation-Environment (TOE) framework, Diffusion of Innovation (DOI) theory, Technology Acceptance Model (TAM)	1
Diffusion of Innovation (DOI) theory, Technology Acceptance Model (TAM)	1
Technology-Organisation-Environment (TOE) framework, Unified Theory of Acceptance and Use of Technology (UTAUT)	1
Technology Acceptance Model (TAM)-Diffusion Theory Model (DTM)	1
Not specified	1
Total	12

3.2 Research Design of the Articles

All 12 articles were based on a cross-sectional design, and none of them adopted a longitudinal design (as per Table 6). Accordingly, 10 out of the 12 studies used the quantitative methodology, while two studies used the qualitative methodology.

Table 6 - Research design

Research Design	Number of Studies
Cross-sectional design	12
Longitudinal design	0
Total	12

Author	Industries	Model/Frame	University	Methodology	Sample Size	Cost Saving	Pay Per Use/Opex	Technology Readiness	Cloud Deployment Model	System Nature	Operational Requirement	Innovativeness	Relative Advantages	Reliability	Usefulness	Ease of Use	Complexity	Compatibility	Sustainability	Trialability	Top Mgmt Support	Competitive Pressure	Trading Partner Pressure	External Support	Cloud Service Provider	Vendor Reputation	Trust	Service Level Agreement	Infrastructure Readiness	Internet Reliability
Mokhtar et al., 2020	SME	DOI, TAM	UPM	Quantitative	114								NS/S*				NS/S*	NS/S*												
Asiaei & Rahim, 2019	SME	TOE, DOI, TAM	UTM	Quantitative	465																									
Isa et al., 2019	Education	TOE, DOI	UiTM	Qualitative	10	S	S		S	S	S		S		S			S	S	S	S				S	S			S	S
Isa et al., 2020	Education	TOE, DOI	UiTM	Qualitative	10																									
Alam et al., 2018	SME	Generic	UKM	Quantitative	383																									
Khairuddin & Harun, 2018	Governme	TOE	UiTM	Quantitative	93																									
Fook Ming et al., 2018	SME	TOE	UMS	Quantitative	170	S		S					NS								S	NS		NS						
Ooi et al., 2018	Manufactu	TOE, UTAUT	UCSI	Quantitative	188																									
Asadi et al., 2017	FSI	TAM-DTM	UTM	Quantitative	162	S																					S			
Hassan & Nasir, 2017	SME	DOI	UUM	Quantitative	132																									
Karkonasasi et al., 2016	SME	TOE	USM	Quantitative	41	S								S							S	S	S							
Qian et al., 2016	SME	TOE	USM	Quantitative	102																									

Author	Industries	Model/Frame	University	Methodology	Sample Size	Knowledge & IT Skillset	Regulatory Support	Governance	Guide & Policy	Geographical	Data Security	Data Privacy	Social Influence	Attitude	Firm Size	Absorptive Capacity	Determination	Opportunity	Independent	Achievement	Creativity	Locus of Control	Org Age	Org Type	Org Location	Performance Expectancy	Effort Expectancy	Perceived Benefit	Perceived Usefulness	Perceived Ease of Use
Mokhtar et al., 2020	SME	DOI, TAM	UPM	Quantitative	114																								S	S
Asiaei & Rahim, 2019	SME	TOE, DOI, TAM	UTM	Quantitative	465																									
Isa et al., 2019	Education	TOE, DOI	UiTM	Qualitative	10	S	S	S	S	S	S	S																		
Isa et al., 2020	Education	TOE, DOI	UiTM	Qualitative	10																									
Alam et al., 2018	SME	Generic	UKM	Quantitative	383												S		S		S	NS	NS	NT						
Khairuddin & Harun, 2018	Governme	TOE	UiTM	Quantitative	93																									
Fook Ming et al., 2018	SME	TOE	UMS	Quantitative	170																									
Ooi et al., 2018	Manufactu	TOE, UTAUT	UCSI	Quantitative	188																									
Asadi et al., 2017	FSI	TAM-DTM	UTM	Quantitative	162						S*	S*	S*	S														S*	S	S
Hassan & Nasir, 2017	SME	DOI	UUM	Quantitative	132																									
Karkonasasi et al., 2016	SME	TOE	USM	Quantitative	41						S	S																		
Qian et al., 2016	SME	TOE	USM	Quantitative	102																									

Fig. 2 - Influencing Factors (S: Supported, S*: Supported via Mediator/Moderator. NS: Not Supported, Blank/NT: Not Tested)

3.3 Influencing Antecedents

With reference to Fig 2, the 12 articles presented a total of 50 independent, mediating and moderating constructs and analysed the influence of these constructs on cloud computing adoption. These antecedents are cost savings, pay-per-use, technology readiness, the cloud deployment model, nature of the system, operational requirements, innovativeness, relative advantages, reliability, usefulness, ease of use, complexity, compatibility, sustainability, trialability, top management support, competitive pressure, trading partner pressure, external support, cloud service providers, vendor reputation, trust, Service Level Agreement, infrastructure readiness, internet reliability, knowledge & IT skillset, regulatory support, governance, guidance and policy, geographical aspects, data security, data privacy, social influence, attitude, firm size, absorptive capacity, determination, opportunity, independence, achievement, creativity, locus of control, organisation age, organisation type and perceived ease of use. All 50 antecedents could be categorised into technology contexts, organisational contexts, and environmental contexts, mediating constructs or moderating constructs, whereby some are quite identical but just named differently.

4. Discussion

4.1 Technology Contexts

Technology factors are termed as the technical disputes that will affect the decision of cloud computing adoption. In this study, four factors were identified, which are relative advantages, technology readiness, cost savings and compatibility. As noted by Wang, Wang & Yang (2010), expected benefits can bestow motivation for innovation technology adoption and expansion since employee appreciation of the relative advantages of the new system to enhance work efficiency. Relative advantages refer to greater advantages over other technologies for the organisation (Alharbi, Atkins & Stanier, 2016) which reveals that the organisation is satisfied with the advantages and enhances performance by utilising cloud computing (Qian et al., 2016). The relative advantage of cloud computing services execution can enhance the rapidity of business communications, the effectiveness of coordination among firms, customer communications and access to market information mobilisation (Armbrust et al., 2010). However, Isa et al.'s (2019) study did not find a link between relative advantage and cloud computing adoption, in contrary to Ming et al.'s (2018) and Hassan & Nasir's (2017) study. Additionally, another study (as per Fig. 2) found that relative advantage had no significant direct influence on cloud computing adoption, but it had an indirect influence on cloud computing

adoption when using perceived ease of use and perceived usefulness as the mediating construct (Mokhtar, Mahomed, Aziz & Rahman, 2020). Perceived usefulness is the extent to which an individual believes that utilising a particular technology enhances job performance (Asiaei & Rahim, 2019). Whereas perceived ease of use is the extent to which an individual believes that utilising a specific technology is free of effort (Asiaei & Rahim, 2019).

Several scholars (as per Figure 2) revealed that technology readiness is a facilitator of cloud computing adoption (Asiaei & Rahim, 2019). Technology readiness refers to the extent to which technological infrastructure and human resources influence the adoption of new technology (Khayer et al., 2021). The technological infrastructure, for instance, is comprised of installed hardware, software, network technologies and resources which are mandatory to deliver a platform for the operation, management of cloud computing services within an organisation. Human resources refer to the availability of knowledge and skills among employees to execute, operate and manage cloud computing associated services (Lian, Yen & Wang, 2014). Technological infrastructure and human resources with information technology competencies are essential in ensuring the technology can be supported by the internal IT team rather than fully relying on cloud computing vendors, to avoid technology lockdowns or unnecessary spending (Avram, 2014; Lehrig et al., 2017; Yoo & Kim, 2018). Consequently, organisations that have a greater extent of technological infrastructure and pertinent personnel resources may be prepared for the adoption of cloud computing (Khayer et al., 2021).

As a result of the literature search analysis (as per Figure 2), cost savings play an important role in cloud computing adoption (Asadi et al., 2017; Isa et al., 2019; Isa et al.,, 2020; Karkonasasi et al., 2016). This shows that the majority of the corporations are aware that cloud computing bestows recognisable benefits such as reduced operating costs, energy costs, environmental costs as well as lower maintenance costs. However, some scholars have found no link between cost savings and cloud computing adoption, which is quite surprising, as the main advantage of cloud computing is that it offers significant cost reduction over traditional on-premises data centre solutions (Alghushami, Zakaria & Aji, 2020).

Compatibility issues comprised of the extent of compatibility with the technical facets of a corporation as well as customisation of existing applications to cloud systems (Géczy, Izumi & Kôiti, 2012). It is a real challenge for the corporation when adopting cloud solutions, as they should be able to move their application or data with no compatibility issue (Marston et al.,, 2011). With regard to compatibility, it has been found that several corporations may have concerns about the compatibility of cloud computing with the organisations' information systems (Isa et al., 2019; Isa et al., 2020; Khairuddin & Harun, 2018). Compatibility also has been found to not have a significant effect on cloud computing adoption (Hassan et al., 2017). However, Mokhtar et al. (2020) found that compatibility indirectly influences cloud computing adoption. These contradictory results could be due to the organisation's decision priorities (for example, cost or business processes) (Lim & Chen, 2012), variations in organisations' cultures and policies could be another reason (Wu et al., , 2013).

4.2 Organisational Contexts

Organisational factors are termed as the internal factors of an organisation that are controlled by the organisation itself (Lin & Chen, 2012) such as top management support. Top management support portrays an important role in cloud computing adoption. Several empirical researches (as per Fig. 2) have revealed a positive association between top management support and the adoption of cloud computing. (Asadi et al., 2017; Isa et al., 2019; Isa et al., 2020; Karkonasasi et al., 2016; Asiaei & Rahim, 2019; Qian, Baharudin & Kanaan-Jebna, 2016). Top management support refers to the extent of commitment and resource support bestowed by the top management (Yigitbasioglu, 2015). Precisely, it is being regarded as the readiness of the top management to endorse adequate financial investment, human resources and technological competencies which is important for enabling the adoption (Hassan et al., 2017). It is essential for top management, as the organisation's decision-makers to be familiar with the advantages of the innovation and how it can generate competitiveness (Alshamaila, Papagiannidis & Li, 2013).

4.3 Environmental Contexts

Environmental factors are associated with the external world in which the corporation conducts its business. In this study, three factors were considered, which are competitive pressure, regulatory support and trust. Competitive pressure is another contradictory factor, where Karkonasasi et al. (2016) and Asiaei & Ab. Rahim (2019) found a linkage between competitive pressure and cloud computing adoption, compared to Ming et al.'s (2018) and Qian et al.'s (2016) studies. Competitive pressure is being regarded as the level to which competitors put forth pressure on a specific organisation (Jayaraman et al., 2019). As the high-tech industry has the features of rapid changes, firms face pressure and become gradually aware of and follow their competitors' adoption of new technologies. By adopting cloud computing, firms gain intensely through an enhanced understanding of market visibility, enhanced operation efficiency, and more precise data collection (Misra & Mondal, 2010). Additionally, many firms rely on trading partners for their IT design and implementation tasks (Pan & Jang, 2008).

With regards to constructs associated with environmental elements, most of them are similar but only termed differently; for example, Ming et al. (2018) introduced a construct called external support, which Karkonasasi et al.

(2016) referred to as trading partner support and Isa et al. (2019) and Khairuddin & Harun (2018) referred to as regulatory support. Organisations adopt cloud computing depending on whether they have been influenced by convincing power, such as financial incentives for their trading partner, or through compulsory power, whereby the organisation with more bargaining power has requested that the organisation with less bargaining power adopt cloud computing. This indicates that when firms face robust competition, they tend to implement changes extensively.

Vendor reputation and trust too were found to be associated with cloud computing adoption. Both antecedents are supported by Isa et al. (2019), Khairuddin & Harun (2018) and Asadi et al. (2017). Cloud service providers ought to tackle vendor reputation issues while bestow their services. Moreover, trustable support is the fundamental demand for problem resolution in the case of cloud computing and on-premises computing for which enterprise, as well as end users, pay to the cloud service providers. Thus, cloud computing vendors are expected to hire and train adequate and trustable support staff to bestow the best possible support to their clients (Kim & Suwon, 2009).

4.4. Additional Elements

With reference to Fig. 2, some of the constructs, which are only available in one article, were not discussed in this study since they were not regarded as common factors, such as social influence, attitude, firm size, absorptive capacity, determination, opportunity, independence, achievement, creativity and locus of control. Additionally, elements such as performance expectancy, effort expectancy, perceived benefit, perceived ease of use and perceived usefulness were found to have a mediating influence on cloud computing adoption.

5. Limitations and Recommendations

All 12 articles that were reviewed are unique and different in regard to the industry, the theory and the framework applied, as well as the sample size, the methodology and the defined constructs. Hence, it is quite difficult to generalise the search results, although the articles written from 2016 to 2021 are associated with cloud computing adoption in Malaysia. Some articles covered the intention or influence of cloud computing adoption and the actual usage of cloud computing, which are beyond the scope of this study. Future related studies are recommended to narrow down the study scope to a specific industry to determine and better understand the antecedents influencing cloud computing adoption in different industries. Several contradictory and non-supported antecedents could be revalidated with mediating or moderating constructs to re-examine their influence on cloud computing adoption. Additionally, the study also implies that most past works rely on Technology-Organisation-Environment (TOE) framework, the Diffusion of Innovation (DOI) theory, Technology Acceptance (TAM) model, the Unified Theory of Acceptance and Use of Technology (UTAUT) model and Diffusion Theory Model (TAM-DTM), which identify factors for cloud computing adoption. This research expanded current works of literature by proposing to consider the Resource-based Theory (RBV) to understand the antecedents of cloud computing adoption in the Malaysian context.

6. Conclusion

This paper presented the results of a systematic literature review of recent researches on antecedents of cloud computing adoption in the Malaysian context which covers published research between 2016 and 2021. 12 articles were reviewed using the systematic literature review technique to capture the antecedents of cloud computing adoption in the Malaysian context.

From the theoretical standpoint and theory building, this study has contributed to identifying the antecedents of cloud computing adoption in Malaysia. This study has attempted to improve the understanding of the factors that can facilitate cloud computing adoption in the Malaysian context. Also, it deepen our understanding of the underlying mechanisms that are responsible for the direction/strength of the association between cloud computing adoption and its associated antecedents. Based on the search carried out, few factors were found to play a crucial role in cloud computing adoption such as technological context elements (relative advantages, technological readiness, cost-saving and compatibility), organisational context elements (top management support) and environmental context elements (competitive pressure, external support/trading partner support/regulatory support, vendor reputation and trust). The search results provide a better understanding of the antecedents that play an essential role in strengthening cloud computing adoption among Malaysian corporations to improve corporations' performance with better time-to-market, cost-effectiveness and competitiveness.

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