Cloud Computing Adoption in Organizations: A Literature Review and a Unifying Model

Isaac Ogunlolu
INTERACT Research Unit, Faculty of ITEE
University of Oulu, Oulu, Finland *ogunlolui@gmail.com*

Dorina Rajanen, corresponding author
INTERACT Research Unit, Faculty of ITEE
University of Oulu, Oulu, Finland *dorina.rajanen@oulu.fi*

Abstract

Cloud computing is an attractive proposition to organizations because of its expected benefits. However, its perceived risks and challenges may discourage adoption. This trade-off between benefits and risks creates a dilemma on whether or how to approach cloud adoption. This study aims to advance the understanding of cloud computing adoption in organizations and proposes a unifying model of cloud adoption. A systematic literature review was employed to investigate the adoption factors studied in previous empirical settings. The review identified 41 primary studies and yielded a hierarchical cloud adoption model. The identified factors are in line with the technology-organization-environment framework and with the diffusion of innovation model, but new insights into the dimensions relevant to cloud adoption emerged from literature. For example, system availability and reliability, cost effectiveness, privacy and security, top management support, and market pressure are among the factors influencing adoption. Implications and future research are discussed.

Keywords: Cloud computing adoption, organizational adoption, technology adoption models

1. Introduction

An organization's competitiveness is attributed to its ability to adapt innovations that give a competitive edge and improve the quality, reduce the cost, and improve the efficiency of its business processes [62]. Cloud computing (CC henceforth) represents a paradigm shift in the way information technology resources and services are delivered [52]. The US National Institute of Standards and Technology defined CC as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources which can include: networks, servers, storage, applications, and services, that can be provided on demand and released with very little management effort or service provider interaction [42].

The characteristics of CC reflect benefits for organizations in terms of costs and investments in technology accorded to organizational computing resources needs [20], [42], [69]. These technological benefits result further in competitive advantage in terms of resource management, agility, decreasing costs [68], as well as higher customer satisfaction determined by the improvement in pricing and transparency of service with respect to resource monitoring [42]. It should however be noted, that CC is by no stretch a silver bullet and this is mainly due to performance, security, and trust issues [33]. Organizations face various challenges and decision problems when dealing with adopting or migrating to CC (see e.g., [10], [39], [43]).

Thus, CC is an attractive proposition to organizations because of the benefits that come with adopting it; however, CC's risks and challenges discourages adoption, due to increased security vulnerabilities, reduced control over resources, limited portability between providers, and geographical compliance and legal issues [20]. Given this trade-off between benefits and risks, decision makers have to consider carefully their

organization's readiness and rationale to adopt CC. This study aims to increase understanding of CC adoption by providing an overview of the factors that could be useful to decision makers to analyze before CC adoption. Hence, the research question in this study is *What factors should be considered when adopting cloud computing?* Currently there are many studies focusing on CC adoption, however, they are focused on adoption within a specific niche – e.g., governments, SMEs, large organizations. Other studies focus on specific factors such as benefits or barriers to CC adoption, or specific issues such as security, costs, risks and opportunities (e.g., [11]). Moreover, the literature provides various empirical perspectives such as model- or theory-driven or exploratory and qualitative analyses. Previous literature reviews focused on specific issues and contexts such as education [30], outsourcing [54], or business perspective [28]. In the same time, there is a lack of a unifying framework of adoption factors to provide an overview and increased understanding of CC adoption.

This paper presents first an overview of technology and innovation adoption models and theories in Section 2. Then, the systematic literature review of empirical studies on CC adoption and the results are described in Sections 3 and 4, respectively. Section 5 discusses the extracted CC adoption factors and the proposed unifying model of CC adoption. The paper ends with concluding remarks and future work ideas in Section 6.

2. Technology Adoption Models

Different theories in information systems research have been used to explain technology adoption. At individual level, the technology acceptance model (TAM, [19]) is the most prevalent theory. At organizational level, the diffusion of innovations theory (DOI, [51]) and technological-organizational-environmental model (TOE, [61]) are the most common frameworks. Both indicate that the characteristics of the technology, organization, and external environment influence the adoption decisions.

Human factors are also very important in determining if adopting an innovation would be successful [32]. Jeyaraj et al. [31] pointed out that there is a lack of integration and a lack of understanding of the linkages between individual and organizational adoption of information technology (IT). Thong [60] recognized this by adding the characteristics of the decision makers to his proposed information systems adoption model in addition to the technology, organizational, and environmental characteristics in line with Rogers (1995) [51] who noted that the decision to either adopt or reject a technological innovation is taken based on an individual's attitude to the technology.

At the organizational level, the TOE and DOI frameworks are consistent with each other and are commonly used together to explain innovation adoption (see e.g., [14], [46], [60], [65], [69]). Both frameworks have a solid theoretical base and strong empirical support [46], [65]. Thus, for synthesizing the literature review the following factors are used for categorizing the findings: technological, organizational, environmental, and human factors in accordance with the TOE, DOI, and TAM models.

3. Systematic Literature Review Approach

A systematic literature review (SLR) was carried out on empirical studies on CC adoption to obatin an overview of the factors that influence organizations to adopt CC as well as to obtain an overview of empirical research on this topic. The SLR followed the guidelines by Kitchenham & Charters [35,36]. A search protocol was defined accordingly. Six databases were selected as sources: IEEE Xplore, ACM Digital Library, Scopus, Web of Science, ProQuest, and ScienceDirect. The following search terms were employed in each of the selected databases: "cloud adoption factors", "cloud adoption determinants", "cloud acceptance factors", and "cloud acceptance determinants", which were derived from the research question, relevant keywords, and through several preliminary searches.

The search was performed in November 2016 according to the pre-defined search protocol. Table 1 shows the main steps and results of the search process. At step 1, each database was searched using the predefined keyword phrases and the resulted references

were exported in RefWorks. At step 2, the duplicates in RefWorks were filtered out. For steps 3 and 4, the following *inclusion* criteria were applied. Articles should be peer reviewed to guarantee quality. Articles should focus on "cloud computing" in general, a "cloud computing model" or a "cloud service and its adoption/acceptance". There was no limitation in the year of publication included. Papers were *excluded* based on the following criteria: 1) Not written in English; 2) Focus on CC characteristics, benefits, models without mentioning of CC adoption or intention to adopt; 3) Focus on personal adoption of individuals rather than an organization (including group, company, government, health center, etc.); and 4) No empirical data has been collected and analyzed.

Quality assessment was performed using the Kitchenham's and Charters' guidelines [35,36]. The analysis of the research approach (data collection, data analysis, and reporting) and the identification of the strength of evidence provided by a study have been used as the main criteria for quality assessment [35,36], [45]. A checklist was defined based on [36] and applied at step 4 to assess how rigorously and clearly each study was formulated. The strength of evidence was assessed further at step 5 to gauge the reliability and validity of the results. Both qualitative and quantitative empirical studies have been included in the SLR synthesis. Exploratory, qualitative studies generate new insights and dimensions regarding cloud adoption even though their generalizability is limited. When the same dataset has been used in multiple studies for the same inferences, only the study with the most details was retained. Studies were discarded if empirical results could not be separated from the literature findings or if the results were not found reliable.

Table 1. Study selection process

Selection Process	**Result**
Step1: Search as of November 2016	1623
Step 2: Remove duplicates	928
Step 3: Exclude articles based on titles and abstracts	171
Step 4: Exclude articles based on quality assessment and full text scanning	51
Step 5: Exclude articles based on strength of evidence and full text scanning	41

For synthesis, 41 primary studies were retained. These are referred to in text, and listed and marked in the reference list with indices R1 … R41. The data extraction addressed the following information: authors, type of publication (journal or conference), year of publication, research methods employed (data collection method, sample size, sampling method, target population, data analysis approach), technology adoption theories utilized, country of research, organizational and cloud technology context, and adoption factors studied. The results of the data extraction are summarized in the next section.

4. Results

4.1. Overview of Research Studies

The selected studies were evenly published in journals and conferences forums (51% in journals, 49% in conference proceedings) between 2011 and 2016 (see Fig. 1). Most studies employed the survey research method for data collection and quantitative analysis methods (see Fig. 1). Qualitative studies used in-depth interview and semi-structured interview for data collection and content analysis for data analysis. Samples sizes varied from 5 interviews in qualitative studies to 369 survey responses in quantitative studies. The level of analysis was in most cases organization (company or firm). In some cases, the decision maker was the unit of analysis (e.g., R30). Organizational contexts varied across studies as well as within studies. Thus, different business sectors were covered such as oil and gas, ICT, manufacturing, financial services. Some studies focused on specific sectors such as healthcare, education, and government, while other spanned over a range of sectors. Studies included both private and public companies, as well as companies of different sizes. Some studies focused on specific cloud solutions such as software as a service (see

R27, R40) or cloud enterprise resource planning (see R14, R15). Overall, a wide range of countries was covered: Australia, China, England, Ethiopia, Germany, Ghana, India, Iraq, Jordan, Malaysia, Oman, Portugal, Saudi Arabia, South Africa, Taiwan, Turkey, UK, USA, as well as regions such as Europe, Asia-Pacific, Sub Saharan countries. Two studies have not specified the country of reference and two studies addressed companies worldwide.

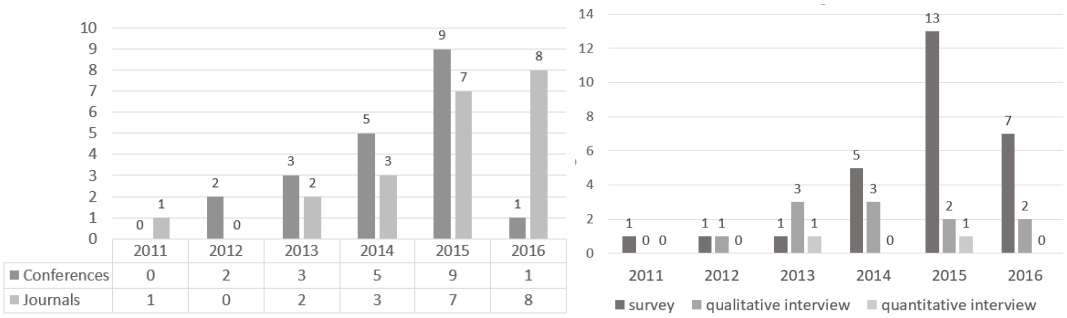

Fig.1. Overview of articles. *Left*: Conference and journal articles distributed by year of publication. *Right*: Data collection methods employed

Among the theories employed, the most utilized were TOE (32 studies), DOI (13), and TAM or variants (7). Other theories or frameworks employed were institutional theory (4), dynamic capability (3), task-technology fit (2), and human-organization-technology fit (2), information systems triangle, absorptive capacity, contingency theory, information technology governance structure and processes framework.

4.2. Cloud Computing Adoption Factors

Most studies utilized the TOE framework and/or other theories as shown above, thus many extracted factors were drawn from these theories or some variants of them. However, combining different theories as well as conducting in-depth interviews in qualitative studies yielded new factors in the primary studies. In total, 497 specific factors in 41 primary studies were identified (of which 217 were unique) which were further coded and grouped in categories. Based on content analysis of the factors, a three-level factor hierarchy was conceived as follows. *Primary factors* are the first level factors corresponding to the four factor dimensions identified in the literature on technology adoption models; *technological*, *organizational*, *environmental*, and *human* factors. *Secondary factors* are the *categories* that resulted from grouping the specific factors by similarity and content analysis (e.g., relative advantage, availability and reliability, organizational readiness, vendor trust). *Tertiary factors* are the *specific factors* encountered in the primary studies.

Table 2 shows the factors grouped in a hierarchical structure by primary factors (technological, organizational, environmental and human) and high-level categories, along their relevance and coverage in the reviewed literature. With bold, the most frequent tertiary factors in their category are highlighted (i.e., factors that occurred in more than one study such as **availability**, **perceived usefulness**, **organization readiness**). The third column lists the studies where the factors are identified and assessed. Three categories of studies are distinguished based on whether the *factors are relevant*, *not relevant*, or *inconclusive*: 1) studies where *factors are found relevant* or statistically significant, 2) studies where *factors are not found relevant*, and 3) studies where results are *inconclusive*. Some of the identified factors were not found to statistically significantly influence the CC adoption in some of the empirical contexts and retrieved studies (e.g., *complexity* was not found significant in R5 and R11, but it was significant in R14, R21, and R37). In addition, in qualitative studies it is only possible to identify relevant factors, without inferring on their generalizability in other contexts (see e.g., R4, R14, R36). Based on relevance in each category, a **relevance ratio** was calculated as the percentage of studies where the tertiary factors were found relevant relative to the total number of studies addressing the corresponding category of factors (e.g., in the *availability and reliability* category, the specific factors were found relevant in all 16 studies, yielding a relevance ratio of 100%).

Table 2. Cloud computing adoption factors – hierarchy, studies, and relevance ratio

TECHNOLOGICAL FACTORS		
Secondary factors	**Tertiary factors**	**Studies**
Availability and Reliability ***100%***	**Availability** (support; risk of losing access), **Backup and disaster recovery** (capability; management security; data back up in case of disaster/power outage; service outages), Quality of service, System downtime reduction, R**eliability** (error-free data & consistent data; business continuity; updates; maintenance outsourcing)	16 studies *Relevant*: R1, R6, R7, R13 - R16, R18 - R20, R22, R24, R28, R31, R36, R39
Innovation Characteristics ***100%***	Back-end analysis functions, **Customization** (application specificity; limitations), Integration, Interoperability, Easy maintenance, Meeting environmental standards, On demand service, Output quality, **Performance** (meeting technical and service quality requirements), Portability, Production timeliness (time to go live), Provision of IT resources when required, Reduce deployment time, **Scalability** and flexibility, Stability of information system and communication, Systems performance (bandwidth; latency), Ubiquitous access, Virtualization	10 studies *Relevant*: R1, R14 - R16, R19, R22, R24, R30, R31, R39
Trialability and Observability ***100%***	Experienceability, **Observability** (of results), Result demonstrability, **Trialability**, Trialability and observable result	9 studies *Relevant*: R2, R7 - R9, R14, R28, R30, R33, R40
Cost effectiveness ***94%***	**Costs**, Cost benefits, **Cost effectiveness /efficiency**, Cost of bandwidth, (Perceived) **Cost saving /reduction**, Hidden costs after implementation, Minimize SW license costs, Pay-per-use pricing model, Rationality of service costs, IT costs, IT employee costs, Sunk cost	16 studies *Relevant*: R1, R4, R8, R13, R15, R16, R19, R20, R22, R24, R27, R29, R31, R32, R39 *Not relevant*: R25
Relative Advantage ***90%***	Benefits (characteristics), Benefits and meeting IT needs, Perceived benefits of technology, P**erceived usefulness**, **Relative advantage**	30 studies *Relevant*: R1 - R11, R14, R18, R21 - R24, R26 - R31, R33, R37, R38, R40 *Not relevant*: R21, R25, R34
Privacy and Security ***84%***	Control of information systems, (**Data) Privacy**, Cloud vulnerability, Data concerns, Ensuring transparency of processes, Fear of data loss, Fear of losing control over IT environment (data and services), Increased traceability and auditability of data, Meeting security standards, **Security** (data; cloud; service; data storage; information transmission; risks; threats), Trust (customers can trust the service)	25 studies *Relevant*: R1, R4, R6, R7, R13 - R16, R18 - R20, R23, R25, R28, R31 - R33, R36 - R39 *Not relevant*: R8, R18, R27, R29, R34
Business Alignment of Technology ***82%***	Business case and budget, Business concerns, Confidentiality, Consistency with corporate goals, Customer service and marketing functions, Incompatibility, Job relevance, **Productivity**, Functionality fit, **Financial analysis**, Satisfaction (end-user; job), Service quality guarantee, Task-technology fitness, Underperformance	11 studies *Relevant*: R15, R16, R22, R24, R36, R39 *Not relevant*: R2, R3
Complexity ***74%***	**Complexity (**/simplicity**)**, Complexity of migration, Documentation, **(Perceived) Ease of use**, Easily analyze data on Internet, Easy set-up, Ignorance of benefits, Learnability and training, Modularity and flexibility, User interface, User satisfaction	31 studies *Relevant*: R4, R6, R8 - R10, R14, R16 - R18, R20 - R22, R24, R27 - R31, R33, R37 - R40 *Not relevant*: R2, R3, R5, R7, R11, R12, R25, R26
Compatibility ***70%***	**Compatibility**, Compatibility with existing system, Compatibility with values, practices, and needs	27 studies *Relevant*: R2 - R9, R14, R16, R17, R23, R25, R28, R31, R33, R38 - R40 *Not relevant*: R11, R12, R21, R26, R27, R29, R34, R37
ORGANIZATIONAL FACTORS		
Secondary factors	**Tertiary factors**	**Studies**
Organization Readiness ***100%***	Organization process innovation and design capacity, **Organization readiness**, Organization trust in cloud, Organizational competency, Satisfaction with current system, Slack resources	7 studies *Relevant*: R5, R15, R16, R17, R23, R39, R41
Organization Strategies ***100%***	Centralized and efficient management and infrastructures, Core competencies focus, Implementation measures, Information intensity, Key/critical business processes focus, Measurement performance, Strategic value	6 studies *Relevant*: R4, R14, R16, R19, R22, R31
Top Management Support ***87%***	Administrative approvals, Convincing IT managers, Executive support, Executive's attitudes, Follow up and will to adopt CC, IT managers support, Organizational change support, Process reengineering, Support of senior managers, **Top management support**, Top management team belief, Top management team participation, Willingness to invest	30 studies *Relevant*: R2 - R13, R16, R17, R23 - R29, R32, R35, R36, R38 - R41 *Not relevant*: R21, R34, R37
Internal Expertise ***82%***	Employee's knowledge, **Internal expertise**, IT expertise of business users, IT human resources, Lack of knowledge, Perceived technical competence, Personnel skills and experience, Prior technology experience, Required technical expertise in cloud computing, Training and education	11 studies *Relevant*: R3, R4, R14, R16, R17, R19, R31, R36, R39 *Not relevant*: R11, R25

Organizational Culture ***80%***	Absorptive capacity (innovation capability), Attitude towards change, Coordination between departments, Culture, Employee mobility, Formalization, IT governance processes, IT governance structure, Sharing and collaboration practices and culture	10 studies *Relevant*: R3, R7, R12, R16, R19, R23, R28, R33 *Not relevant*: R11 *Inconclusive*: R20
Technology Readiness ***67%***	Adequate resources, Annual budget for IT department, IT capability, IT infrastructure, IT resource, **Technological readiness**, Number of servers, server age, Virtualization, Technology competence, Technology-organization capability	18 studies *Relevant*: R4, R6 - R8, R21, R22, R25, R27, R29, R33, R35, R36 *Not relevant*: R3, R26, R34, R38, R40 *Inconclusive*: R2
Organizational Size and Structure ***59%***	Centralization, Organization scope, Organization **size**, Number of IT employees, Organization structure (distributed geographically), Organization systems, Type (private, public)	17 studies *Relevant*: R4, R6 - R9, R16, R19, R23, R26, R29, R39 *Not relevant*: R11, R12, R21, R22, R34, R40 *Inconclusive*: R40
EXTERNAL (ENVIRONMENTAL) FACTORS		
Secondary factors	**Tertiary factors**	**Studies and Relevance ratio**
Industry properties ***100%***	Future system development, **Industry**, Market scope	4 studies *Relevant*: R7, R9, R16, R39
National Infrastructure and Physical Location ***90%***	Data center location, Geo-restrictions, Internet (dependency; bottleneck; reliability; access and connectivity), National infrastructure, Network connectivity, Physical location, **Technical infrastructure of the region** (broadband; power supply)	10 studies *Relevant*: R6 - R9, R16, R19, R22, R32, R39 *Inconclusive*: R2
Vendor Trust ***88%***	Familiarity with provider or brand, Loss of control (over data and systems), Magazines, Market reports and industry studies, Provider's reputation, Relationship with service providers, Service providers support, Service providers' ability, Supplier availability, Supplier computing support, **Trust** in providers, Trusted brands, Uncertainty, **Vendor credibility**, **Vendor lock-in**, Vendor support, Vendor trust, Vendor's clients, Vendor's expertise and experience	16 studies *Relevant*: R1, R6, R7, R8, R9, R9, R10, R15, R16, R19, R22, R23, R24, R39 *Not relevant*: R37, R38
External Expertise ***80%***	Bureaucracy, **External expertise**, External support, Lack of awareness, Lack of knowledge, Perception of the term cloud	5 studies *Relevant*: R7, R13, R28, R31 *Not relevant*: R3
Competitive and Trading Partner Pressure ***70%***	(Business ecosystem/trading) **partners pressure**, Business requirement, **Coercive pressure**, **Competition/competitive** (intensity; edge; **pressure**), Image, **Mimetic pressure** (adoption among competitors; perceived success of competitor adopters), **Normative pressure (**adoption among suppliers/customers), Participation in professional, trade and business bodies, Peer pressure, **Perceived industry pressure**, Social influence, **Subjective norm**, Successful implementations at similar institutions, Degree of adoption, Trading partner support	30 studies *Relevant*: R4, R5, R8, R11, R12, R14, R16, R17, R21, R23, R25 - R27, R30, R32 - R34, R36, R39 - R41 *Not relevant*: R3, R6, R7, R9, R12, R22, R27, R29, R35, R37, R41 *Inconclusive*: R2, R14
Legislation and Regulations ***62%***	Advocating and promotion of policy, **Compliance with regulations**, **Government policies (**and regulations; support), Lack of political will, Laws and decrees, **Legal/regulatory environment/support**, **Legal issues**, Legislation and regulations, National and regional regulations for data handling, Political matters, Regulations, Sector specific regulations, Security protection through contracts and legal agreements	21 studies *Relevant*: R1, R4, R6, R7, R13, R16, R18, R19, R28, R31, R35, R36, R39 *Not relevant*: R3, R8, R11, R22, R25, R29, R34, R37
HUMAN FACTORS		
Secondary factors	**Tertiary factors**	**Studies and Relevance ratio**
Decision Maker's IT Experience ***100%***	Prior IT experience and familiarity of decision makers, IT knowledge of decision makers, Top management awareness, Attitude towards using technology	4 studies *Relevant*: R9, R10, R36, R38
Decision Maker's Innovativeness ***100%***	**Innovativeness** (CIO's; decision maker's), Attitude towards technology and innovation, Top management intention to adopt innovation	5 studies *Relevant*: R3, R9, R24, R25, R39

In some studies, the factors were rather broad in meaning. An example is *relative advantage* which refers to added benefits that cloud computing can bring to the business. In most studies this was conceptualized as a factor (see e.g., R3, R5, R14), while in others, various aspects of the relative advantage were identified and tested such as *cost savings*, *productivity*, *security* (see e.g., R39, R35, R32, R22). In some studies, the models were simple, consisting of a set of factors influencing the intention to adopt or the acceptance of CC. In other studies, the models were more complex; some factors had moderating or indirect effects through mediating variables (see e g., R22 vs. R23). All factors considered in the primary studies were included in this SLR synthesis. In the following section, the results of the literature review are discussed by primary factors.

5. Discussion

5.1. Technological Factors

The primary studies covered technological factors more than any other primary factor and 9 secondary factors were identified in 39 studies (Table 2). Many factors retrieved from literature can be traced back to the DOI and TOE models such as *relative advantage*, *compatibility*, *complexity*, *trialability*, and *innovation characteristics*. Relative advantage and innovation characteristics are multidimensional and broad factors covering various perspectives including cost benefits (see R31). Among innovation characteristics one emerging feature was environmental impact (see R31). Moreover, scalability and timeliness dimensions are found among the most appreciated **characteristics** of CC. Emerged factors such as *availability and reliability*, *cost savings*, and *privacy and security* show also high relevance ratios, showing the importance decision makers place on these issues. Privacy and security act both as barriers and enablers (see e.g., R31), while cloud computing is most frequently associated with **cost reductions** (94% of the studies examining this factor found it as influencing the adoption decisions). The top technological factor influencing adoption appears to be **availability and reliability** which was found relevant in all 16 studies examining this factor. Moreover, though not highly examined in the literature the **trialability and observability** of the technology and results show great importance to decision makers and adopters. *Business alignment* dimension reflects the fit between technology and business cases, tasks, users, productivity, and performance in terms of service quality and job relevance. Moreover, where data plays a crucial role in business, confidentiality and data concerns represent crucial elements for business alignment of technology. Complexity and compatibility have been extensively researched, but they show contradictory effects which points out to the need of further research on the mechanisms that underlie these factors' influence.

5.2. Organizational Factors

Seven organizational factors were retrieved from 38 studies (Table 2). Among them, *organizational size and structure* were identified in the original adoption models. In the review, organizational size and organizational structure were merged to indicate characteristics of the organization in terms of human resources and type of organization. This factor was found as being the least relevant. SME's are more flexible due to their decentralized nature and lack of bureaucracy, they are therefore more likely to adopt CC (see R8; R40). However, large organizations, because of slack resources, can afford to adopt CC opting usually for private cloud (see e.g., R19) in line with their strategic plans. ***Top management support*** was the most studied factor, and among the most relevant ones. Only in three studies out of 30, this factor was not found relevant or significant. ***Organization readiness*** in terms of innovative capacity, trust, competency and resources showed that it is important for organizations to be ready to accommodate the technology by having the resources for it as well as the mindset. *Organizational culture* was also found relevant in most studies through innovativeness and attitude towards change. However, cloud computing adoption is especially influenced by the fit with the ***organization strategy*** and focus on business process improvement. Also, while the configurations and maintenance of the cloud environment are handled by the cloud support, it is however important for the adopting organization to possess the *internal expertise* to help with navigating issues that come with CC. Therefore, the experience of employees with IT and CC is a factor that should be considered before adopting CC. Similarly, *technological readiness* of the organization in terms of IT resources, IT infrastructure, technology competence plays also a role in the adoption, however to a lesser extent, as CC is adopted to overcome the limitations of a firm in terms of IT resources and expertise.

5.3. Environmental Factors

Environmental factors refer to the external environment of an organization. Six categories of environmental factors were retrieved from 39 studies (Table 2). In the categorization, the *legislation and regulations*, *national infrastructure*, and *industry properties* replace the government regulation, technology support infrastructure, and industry characteristics and market structure, respectively in the TOE framework. *Competitive and trading partner pressure*, *vendor trust*, and *external expertise* emerged from the literature review. The most examined factors are **competitive and trading partner pressure**, and **legislation and regulations**. These were found to be both relevant and not relevant indicating that other factors are interacting with these dimensions as well as that they reflect various aspects which influence differently the adoption decision (e.g., R12, R27). This points to a relationship between CC adoption and the context to which is applied. In this line, the industry properties factor shows a high relevance ratio, however only 4 studies have examined this relationship. The **national infrastructure and physical location** appear to be a significant factor in developing countries (see e.g., R8, R19, and R32). The role of the service provider and the need for the service provider to allay the issues adopters may have with CC cannot be understated. Accordingly, vendor trust and external expertise are found relevant. Cloud service providers need to earn the trust of the adopter through credibility and availability in providing external support when needed. Furthermore, cloud service providers should educate organizations and be as transparent as possible as to where their data are being stored and what methods and techniques are being used.

5.4. Human Factors

Human factors refer to the characteristics of decision makers that are determinant for making adoption decisions. These factors had the least coverage in the literature, only 8 studies addressing them (Table 2). Primary studies included human factors, but these were typically referring to the internal expertise in the organization. In this review, human factors were identified as 1) *decision maker's prior* ***technology experience***, and 2) *decision maker's* ***innovativeness***. These factors are related to *top management support* to some extent, as higher innovativeness and technology experience and knowledge are associated with higher top management support for cloud computing (see e.g., R3, R9, R36, R38).

5.5. Unifying Cloud Computing Adoption Model

The categories of CC adoption factors emerged in the SLR are merged in a unifying model that acts as 1) a blueprint for decision makers to assess their readiness and rationale for CC adoption, and 2) a model for future research on CC adoption (see Fig. 2). It was established that the intent to adopt originates from an individual - the decision maker in an organization. From an organizational point of view, before adopting any technology, the decision maker needs to perceive the CC as being useful and helpful in achieving the organizational goals. This is the first phase of every adoption process, it is kick-started via human factors. The inclusion of human factors is supported by earlier works [31,32], [51], [58], [60] as well as by the empirical evidence reviewed in this study. However, further research is needed to study the exact mechanism through which human factors influence adoption as these were not extensively studied. After this comes the technological, organizational, and environmental considerations. A positive conclusion from these considerations would usually lead to adoption.

Among the technological factors, the characteristics of CC that offer benefits to business are preeminent including the availability and reliability of the information systems, scalability and customization (innovation characteristics). Thus, companies choose to adopt CC if the benefits CC provides are in line with the business objectives. However, the adoption decision is largely influenced by the organizational conditions for such technology investment as the CC adoption will affect the business processes. Moreover, the external environment plays a role in adoption from multiple perspectives: the national infrastructure and physical location should permit the migration to cloud and

performance of the systems, the service provider and external expertise should be credible and reliable (vendor capability in [54]), companies act in conformance with their competition and partners to stay competitive (subjective norm in [28]), and not the least the legislation and regulations should offer support for data security and protection.

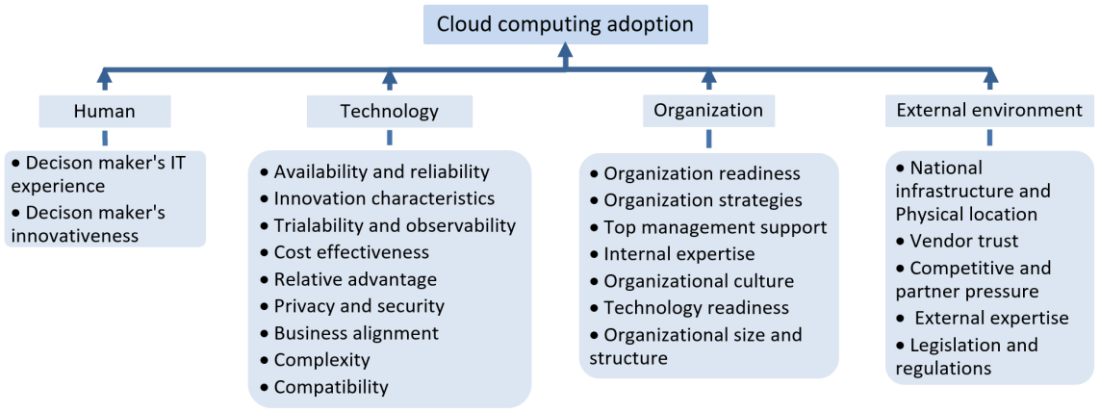

Fig. 2. A unifying cloud adoption model

6. Conclusion

This study employed a systematic literature review to identify and summarize the factors which affect cloud computing adoption in organizations to increase understanding of cloud computing adoption. An overview of factors supported by 41 empirical studies as well as an overview of empirical research on this topic have been provided. The literature review indicated that the technological factors are the most important for decision makers. These reflect the capabilities of cloud computing to meet the business needs in terms of information systems and data availability and reliability, cost savings, privacy and security, complexity, and compatibility. Business alignment, relative advantage, and innovation characteristics are broad factors that also reflect the fit between business and technology. On the other hand, organizational and environmental factors reflect the conditions of the organization and the external environment's forces that affect the adoption. Most of the reviewed studies proposed various adoption models based on existing frameworks and theories. These models varied in their scope and focus. Our study contributes to the research by formulating a unifying adoption model for cloud computing in organizations that is built on existing theories and examined empirical evidence. Moreover, the study identified a gap in the literature in that there is a lack of research on the impact of individuals on cloud computing adoption within organizations, namely the role of decision makers is not systematically addressed. On the other hand, top management support and internal expertise have been widely recognized and studied. As practical implications, the study provides a blueprint for organizations looking to adopt cloud computing.

Further research is proposed to address the influencing mechanisms and interdependencies of different factors (e.g., complexity, compatibility), as well as the impacts of different individual roles such as hierarchical position in the organization on the adoption of CC in organizations. Moreover, this study can be extended with a follow-up of the literature to update and compare the results with the most recent empirical findings as well as to integrate in the proposed model findings from other literature reviews.

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