From the Ground to the Cloud – A Structured Literature Analysis of the Cloud Service Landscape around the Public and Private Sector

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Abstract

Based on a structured literature analysis, this review paper takes stock of the current landscape of cloud service research: 66 IS journals and conference proceedings were examined on the topic of cloud services and the identified 158 relevant articles were systematically categorized on ten perspectives from the whole world, the industry, the organization, the IT department to the single cloud service. The descriptive findings show a focus of cloud service studies on private organizations as primary user group of the cloud in the information and communication industry pointing out the lack of cloud service research in the public sector and administrations and the need for e-government specific implications. Results at the service level further show that the majority of all existing articles refer to infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS) in general and hence, neglect to explicitly specify the particular cloud capability provided.

1. Introduction

Information technology (IT) market researchers like Gartner [5] predict a steady increase in the worldwide organizational adoption and use of public cloud computing services. Using cloud services enables administrations, enterprises and citizens to ubiquitously access scalable, elastic, and shared computing capabilities over the Internet provided on-demand as a metered self-service [38]. Commonly, three cloud service models are defined based on different abstraction layers of the underlying computing resources. The first concept is infrastructure as a service (IaaS) spanning the delivery of data storage, computing power and communication capabilities as a utility. Platform as a service (PaaS) allows consumers to develop and deploy applications onto the cloud infrastructure without the expense and complexity of purchasing and managing the underlying hard- and software systems. Finally, the most renowned model is software as a service (SaaS). Instead of installing various applications on their own systems, clients can access and use the provider's applications running on the multitenant cloud architecture through a web browser [38]. Furthermore, there are distinctions between four deployment models depending on whether the cloud infrastructure is provisioned exclusively for a single organization (private), for a group of entities with shared interests (community), for open use by many organizations of all sizes (public) or it represents a composition made up of the preceding models (hybrid) [38].

The standardized and scalable cloud solutions offer public and private organizations many direct advantages, such as more flexibility, enhanced interoperability, easier information sharing, the reduction of energy [36] or the transference of risk [6]. The United States Government, the world's greatest consumer of IT, bet on the cloud as key component of the federal IT transformation [32] with the aim of solving some of the public sector's unique characteristics, such as the fragmented and complex governmental environment consisting of a variety of IT systems and differing agencies subjected to conflicting objectives, opposing regulations, and changing legislations, which all influence the implementation and operation of services [21].

Nevertheless, the shift towards the cloud also raises many known and new e-government specific challenges, for instance, security, transparency and accountability concerns [11,21] or the impact on IT governance [42,59] within federal organizations, but also the uncertainty regarding compliance and jurisdiction [55] at the global stage due to the distributed and cross-border nature of cloud services, which rather demand a wait-and-see attitude of governments [42]. To encounter those technological, organizational and human challenges relating to the innovative cloud business model and to support administrations in the assessment of what should be done and what the impact is with regard to cloud services scientific guidance in the organization and management of cloud-sourcing processes continues to be needed [26,60].

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Therefore, the objective of this paper is to firstly take stock of the current landscape of cloud service research by providing a structured analysis of the present state of the art in the information systems (IS) field in order to give researchers an orientation among the existing cloud service concepts, frameworks and designs, in particular concerning e-government, the public sector and its organizations, and to identify directions for future research on the multifaceted challenges emerging with the adoption and use of cloud services with specific emphasis on the governmental perspective. In particular, the following two research questions guide our literature review:

RQ1: How have cloud services been studied so far in both, enterprises and administrations, from the global to the resource perspective?

RQ2: Which recommendations for future cloud service research concerning the public sector evolve from these approaches?

To address these questions, the remainder of the paper is structured as follows. The next section begins with an overview of existing cloud-related review papers. In section 3, we introduce the research method of our structured literature analysis. Subsequently, in section 4, the results of the concept-centric review approach based on the identified articles are presented. Finally, the limitations of our work, findings and future research directions with precise examples for cloud-based e-government are discussed.

2. Related work

In this section, we present prior literature reviews of the field of cloud computing to delimit and focus our own approach.

Hoberg et al. [26], the most recent of the three review papers, survey literature on cloud computing from the business perspective spanning 60 research articles of altogether 33 leading IS journals and conference proceedings and categorize the findings according to four research streams of cloud computing characteristics, adoption determinants, governance mechanisms, and the business impact. Likewise, Yang and Tate [60] descriptively assess the existing body of knowledge of cloud computing by analyzing 205 peer-reviewed publications covering 44 IS journals. Besides of an investigation of the publication outlet and year (2008-2011), they focus on the distribution of papers by topic and classify them into four broad categories comprising of technological issues, business issues, domains and applications (including the subcategory of e-government), as well as conceptualizing cloud computing. Both anticipate an increasing number of cloud service literature in future and primarily show the need for approaches with respect to the business value of cloud computing, its impact on private-enterprise processes and governance as well as cloud computing adoption and innovation.

Finally, Martens et al. [37] scan 40 scientific articles spanning relevant IS journals, the proceedings of four international IS conferences as well as practitioner-oriented articles from magazines and websites in order to investigate the cloud computing ecosystem. By means of a software-based quantitative content analysis the authors contrast the theoretical and practical perspectives with respect to key terms, major themes, and the trend of sentiments reflected in the field. They reveal the predominance of a positive mood concerning cloud computing and room for discussion about the three negative associated topics personnel, security, and compliance with legal requirements set by governments.

This review paper examines 66 relevant IS journals and conference proceedings and analyzes the results of 158 cloud service articles published from 2009 to the first quarter of 2012. Thus, we concentrate on a scientific, comprehensive literature scope that includes commentaries and conceptual research papers. We apply a concept-centric approach [56] encompassing perspectives from the whole world, the industry, the organization, the IT department to the single cloud service and especially pay attention to public sector research. Our detailed and stage-focused categorization enables descriptive evaluations and discussions at the various levels as well as a systematic and understandable identification of research gaps, in particular, through the lens of e-government. The applied research method of our structured literature review is presented in the following section.

3. Review method

As methodological approach a structured literature analysis was conducted on the basis of Webster and Watson [56]. In order to ensure the meaningfulness of the results, we established a three-step procedure consisting of the search process, the selection of relevant articles and the categorization.

Within the search process, we examined all major IS journals of the field. In particular, we referred to the MIS Journal rankings[1] up to an average rank point of 25 and the Business Information Technology and Information Management sub-ranking of JourQual2[2],

[1] MIS journal rankings: http://ais.affiniscape.com/displaycommon.cfm?an=1&subarticlenbr=432.

[2] German Academic Association for Business Research (VHB) JourQual2: http://vhbonline.org/service/jourqual/jq2/teilranking-wirtschaftsinformatik-und-informationsmanagement.

published by the VHB in 2008 with the addition of IT- and IS-related outlets put down in 2011. Within the latter, all peer-reviewed A, B, and C rated journals and conference proceedings were selected to ensure the high quality and width of the literature base. In total, the literature review includes 66 publication outlets.

Within these outlets, we applied the Boolean expression 'cloud AND service' to the search engines provided and/or those of the publisher of independent databases such as EBSCO Host (Business Source Premier) or SpingerLink. Using that simple, but straight, search term guarantees both or at least some reference to cloud and service and provides a wide extent of resulting articles. This preliminary search process resulted in 854 articles across 45 IS journals and conference proceedings.

Within the second step, papers without any obvious content-related reference to cloud computing (e.g., articles that referred to cloud in relation to the weather), interviews, panel discussions, teaching cases, editorial notes, book reviews or viewpoint articles were eliminated. The remaining 422 articles were subsequently fully scanned and filtered as to their contentual relevance with respect to cloud services, i.e. the IT artifact discussed within each paper had to explicitly refer to a cloud-based service to some extent. Therefore, it was neither satisfactory to only mention cloud computing as an example (e.g., [61]) or as future research extension (e.g., [1]) nor was it enough if the concept or framework was discussed in a related context, such as grid technology or ASP (e.g., [52]). After this additional filtering, 158 cloud service articles out of 26 publication outlets were identified as final sample.

Table 1. Categorization example

Categories (adapted from [2,46])	Study of Sarkar and Young [48]
Place of observation	Australia
Industry	Prof. and scientific activities
Primary user group	Public institution (ind. user)
Org. hierarchy	Managers
Functional department	IT department
IT decision domain	IT investment
Stage of e-government	Integration
Deployment Model	Private cloud
Service Model	SaaS
Resource	Collaboration

Subsequently, all authors independently categorized each of those contributions within an Excel sheet according to the perspectives at focus. Most concepts were adopted from prior similar literature reviews in the IS discipline [2,46], to which further categories relevant to the topic were added. Divergences and uncertainties about any facet of any article initiated a discussion of the paper among all authors until consensus was achieved. As a final point, in order to attain maximum reliability of the findings, the coding results were jointly checked for sense by random re-categorizations. Table 1 exemplifies the categorization procedure by showing the classification resulting from the article published by Sarkar and Young [48].

4. Analysis of findings

This section presents the findings of the obtained classification sheet based on the final sample of scientific contributions on cloud services. After introducing the distribution of articles across publication outlet and time, the cloud service landscape is depicted by descriptively investigating the structure of the research field from the global, the industrial, the organizational, the functional, the service and the resource level.

4.1. Outlet and year of publication

The identified 158 cloud service articles spread across a time span of four years, gradually growing from 16 papers in 2009, 47 in 2010, 70 in 2011 to 25 articles in the first quarter of 2012, and across 26 publication outlets (see Table 2 for the most publishing outlets). Most of them, i.e. 29, were published in the Lecture Notes in Informatics, followed by 23 articles in the proceedings of the HICSS[3]. The first practically oriented journal is CACM[4], which has 15 contributions. Besides of these, we further found four articles within the top five IS journals based on the MIS journal ranking (< 5 rank points).

Table 2. Top five of 26 publication outlets

Outlet	# of articles
01. Lecture Notes in Informatics	29
02. HICSS[3]	23
03. Communications of the ACM	15
04. ICIS[3]	14
05. VLDB[3]	13

4.2. Map of the cloud service landscape

Looking closer at the frame and the content of the discipline, initially, the cloud service landscape from a

[3] HICSS=Hawaii International Conference on System Sciences; ICIS=International Conference on Information Systems; VLDB=Conference on Very Large Data Bases.

global, and as such the broadest, point of view describes the place of observation by continent, where MIS scholars have surveyed so far, illustrated in Figure 1. Black areas represent a high density of cloud service examinations. Almost half of the 45 research papers that localized their investigations explicitly (in contrast to 113 of the 158 relevant articles that did not mention a specific place) collected data in Europe (44.4%). North America (42.2%) and Asia (17.8%) come second and third. Within the scope of our review, there was just one observation in South America and Australia, and none in Africa.

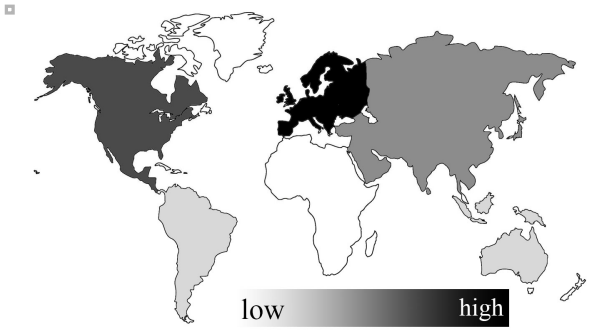

Figure 1. Observations by continent

By going down a stage, we explore the distribution across industries categorized according to the United Nations Statistics Division's International Standard Industrial Classification (ISIC) of All Economic Activities, Rev.4[4] (see Figure 2). The expected preponderance of cloud service contributions concentrated on the information and communication sector (36.1%), followed by surveys of professional, scientific and technical activities (7.6%). Based on interviews and reports of the Dutch public sector, Janssen and Joha [28] identify main challenges for adopting SaaS from the government perspective and thus, represent one of merely two articles (1.3%) focusing on the branch of public administration and defense. 11.4% of the cloud-and-service articles gathered data across multiple industries, but only Koehler et al. [29] used those for comparisons by analyzing the impact of the industry type on customers' preferences regarding cloud services, which however, could not be observed.

At the lower organizational level, we analyze three different concepts, which we consider to be interesting for the cloud service community in order to reveal more details about this most studied research perspective within the IS discipline. At first, we identify the primary user group of the cloud service (see Table 3). Here, we differentiated between the private organization, representing the majority with 57.6%, and the public institution as a whole as well as the individual user within the respective entity or the private user of a household, i.e., the citizen, resulting in the minority of merely 2.5%.

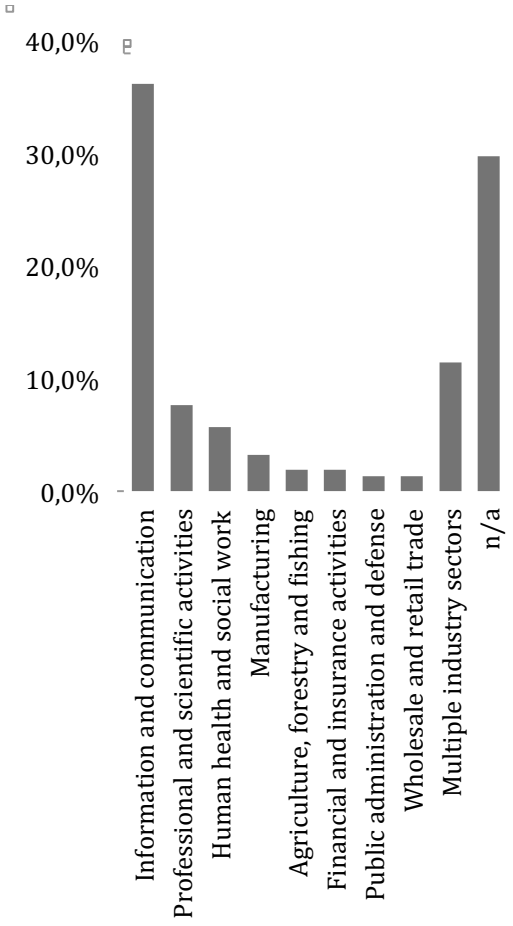

Figure 2. Distribution of cloud service articles across industry

Second, as far as applicable, we categorize the cloud service contributions according to the organizational hierarchy by exploring the function of survey respondents or interviewees within the organization (see Table 3). By asking both, C-level executives and managers most of the data, i.e. 47.9%, was collected, whereas only 4.1% of the cloud service researchers focused on questioning employees or civil servants.

Third and finally, we take a closer look at the functional departments of the organization. 4.4% of the identified cloud service investigations explicitly included multiple units, either in order to generally enhance the significance and validity of their survey results, such as Pallud and Elie-Dit-Cosaque [41] for

[4] ISIC Rev.4: http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27&Lg=1.

specifying users' patterns of IT adoption, or to make comparisons within and across various divisions. For an interesting example, Winkler et al. [59] interview both business and IT representatives to analyze the influence of cloud-based SaaS on the IS governance allocation. Most of the articles, however, could be assigned to a single department, such as the production and service creation (4.4%; e.g., the performance study of Amazon EC2 by Schad et al. [49]), logistics (6.3%; e.g., the exploration of factors influencing the adoption of cloud-based interorganizational systems by Steinfield et al. [51]), research and development (6.3%; e.g., research on evaluation tools for design artifacts simulating the resource allocation in cloud computing by Lang et al. [33]) or marketing and sales. From the marketing perspective, for example, Messerschmidt and Lilienthal [39] identify critical adoption determinants of a WebOS as a cloud service to foster its promotion and to attract potential customers. The remaining 19 contributions classified within the 12.7% of the sales department mainly deal with pricing strategies of cloud services from both, the customer's perspective by investigating the impact of client preferences for cloud services on the pricing model (e.g., [29]), and from the provider's point of view, for instance, regarding customer differentiation and dynamic pricing to enhance resource and revenue management (e.g., [43,44]). None of the articles within the scope of our review considers the purchasing, the finance and accounting, the human resources or the legal department to evaluate function-specific implications concerning cloud services. By contrast, the preponderance of 53.2% refers to activities of the technical operations management and thus, as expected to the IT department (e.g., [11,48]).

That is why we regard it as both important and interesting to provide a more detailed overview of the IT function within a company. As an appropriate and suitable classification scheme at the functional level, we adopted the five major IT decisions large enterprises need to make according to Weill [57] and adjusted each domain to the cloud service research field. 19.6% of the cloud-and-service articles deal with IT principles, i.e. with high-level declarations about how cloud services are used in private and public organizations (e.g., [27,35]). Baru et al. [8] and Motahari Nezhad et al. [40], both propose a conceptual architecture for an e-business environment enabling the usage and integration of cloud-based solutions and hence, represent examples for the altogether 20.3% of contributions referring to the domain of IT architecture, whereas merely 6.3% discuss cloud-infrastructure approaches (e.g., [24,45]). Strategic cloud service investment systems and pricing tactics reflect 13.9% (e.g., [13,29]). Eventually, 29.1% and thus, most research papers specify business needs for and with respect to cloud-based services (e.g., [12,16]). Moreover, we identify and add an additional cloud research-specific decision domain concerning the requirements of the delivered cloud service capabilities, in particular, to enable the categorization of articles applying revenue management concepts to cloud services from the provider's point of view (7.6%; e.g., [4,43]).

Table 3. Classification and frequency of occurrence of articles by primary user group of the cloud and organizational hierarchy

Primary cloud user group	**%**
Private Organization (whole)	57.6%
Private Organization (individual user)	4.4%
Public Institution (whole)	5.1%
Public Institution (individual user)	1.3%
Private & Public Organization	2.5%
Private households	2.5%
All	19.6%
n/a	7.0%
Organizational hierarchy	**%**
C-level executives	4.1%
Managers	31.5%
Employees/Civil servants	4.1%
C-level executives & Managers	47.9%
Managers & Employees	1.4%
All	11.0%

In the end, we analyze the single cloud service, which researchers within the scope of our reviewed articles focused on. At first, we outline the purpose of the cloud service by assigning the discussed type of service to one of six stages of e-government systems proposed and adapted by Siau and Long [50], as far as applicable. 7.6% of the reviewed articles regard the cloud as basic tool to supply information for e.g. employees or citizens (e.g., [16,47]), whereas 3.2% and 1.9% intend cloud services to exchange information without (e.g., [22]) and with (e.g., [41]) immediate response possibility, i.e. interaction of the communication partner, respectively. Furthermore, sourcing from the cloud is debated as facilitator of service or financial transactions through targeted data transfer (12.7%; e.g., [7,33]) and as transformer of traditional IT and business processes to more efficient and unified services, for example via virtualization (3.2%; e.g., [14,17]). Far and away the most articles, however, emphasize the integration purpose of the cloud, for instance, by enabling the mergence of various actors, exchange services, and information and data flows in value networks (33.5%; e.g., [10,35]).

Besides, in line with Mell and Grance [38], we roughly classify according to the four deployment models, i.e. private (22.2%; e.g., [28,48]), community (8.2%; e.g., [45,54]), public (37.3%; e.g., [16,49]), and hybrid (13.3%; e.g., [37,40]) cloud as well as the three levels of abstraction the cloud service model consists of, i.e. IaaS (48.7%), PaaS (42.4%) and SaaS (51.9%) (all of them including the possibility to refer to more than one model/layer) revealing a more or less balance at the service level as well as just a slight excess of SaaS-based contributions. Moreover, 58.9% and 17.7% of the explored studies do not explicitly concentrate on a specific cloud infrastructure provision respectively service layer and 20.8% and 23.4% merely discuss all four respectively three models in general.

To enhance the expressiveness and to further disclose the structure and substance of the investigated cloud-based solutions in more detail, we therefore break each layered cloud service down into its component parts at the resource level. For IaaS we choose the distinction between data storage, computing power and communication capabilities (e.g., [38,58]). With regard to PaaS, we adopt the core as well as the additional elements of the PaaS platform proposed by Beimborn et al. [10]. Due to the fact that we have not been able to identify an analogue classification scheme for SaaS, we extract any explicitly as SaaS specified cloud-based software solution from the scope of our analyzed cloud-and-service contributions and develop a systematic nomenclature of SaaS appliances by collecting and grouping the obtained cloud services according to closely related function- and task-based fields of application. Table 4 presents the resulting SaaS terminology as well as the clusters for IaaS and PaaS, together with selected examples of the provided capability, the respective references and its frequency of occurrence within the sample of reviewed papers.

Table 4. Classification, exemplary references and frequency distribution among the three service layers of the cloud computing model

Service Models [38]		Exemplary Cloud Services and References	Frequency of Occurrence
Infrastructure as a Service (e.g., [38,58])			*48.7%*, consisting of
Not explicitly specified			77.9%
Computing resources		e.g., Hedwig et al. [25], Pueschel and Neumann [44]	10.4%
Data storage		e.g., Cachin et al. [19], Rieger et al. [45]	11.7%
Network communication		-	0.0%
Platform as a Service [10]			*42.4%*, consisting of
Not explicitly specified			65.7%
Application runtime environment		e.g., Böhm and Kanne [14]	2.5%
Integrated development environment		Koziolek [31]	1.5%
Application-based PaaS		e.g., anything relationship management [18] , ERP platform [30]	9.0%
Additional value-added PaaS services		e.g., detection and repair of data corruption [16], index mechanisms [20]	19.4%
PaaS Marketplace		cloud-based data market and data pricing [7]	1.5%
Software as a Service Nomenclature [self-developed]			*51.9%,* consisting of
Not explicitly specified			59.8%
Function-based	Enterprise systems	e.g., SCM [52], ERP [23], CRM [59]	9.8%
	BI systems	e.g., decision support systems [47], data-management service [3]	7.3%
Task-based	Collaboration	e.g., portfolio of collaborative web applications [41], communications & email service [34]	8.5%
	Security	e.g., enterprise fraud management [54], policy management [53]	6.1%
Multiple application software		e.g., sustainability benchmarking app and ERP [30], networked appliances/social media [15]	8.5%

4.3. Limitations

Before we discuss the findings of our concept-centric research approach, we acknowledge some limitations. First of all, our results are restricted by time and by scope of the surveyed literature. Our review is based on 54 internationally high-ranked and peer-reviewed MIS journals and conference proceedings published up to the first quarter of 2012. Thus, we certainly investigated a comprehensive, sound, and convincing range of cloud service articles but we were not allowed to access 20 publication outlets listed within the quoted ranking lists and we did not include scientific books on cloud services such as Baun et al. [9]. Furthermore, our selection is limited due to the applied keyword search of 'cloud AND service' and the subsequent filtering processes, which however, draw a clear dividing line between our review scope and former or related technological computing paradigms or service delivery models and hence, ensure an exact focus and satisfied target of our approach. Finally, we recognize that we could have made mistakes in categorizing each identified contribution according to the various perspectives of the cloud service landscape. Nevertheless, we are convinced that the consistent understanding and the independence of all coders guarantee a high reliability and validity of our findings.

5. Discussion

Retaining the previously mentioned limitations in memory, our results show the true facts of what exactly MIS researchers have already been explored of the cloud service landscape at the various analyzed levels (RQ1) and therefore, enable interesting discussions and the identification of future research directions with specific emphasis on the governmental perspective (RQ2). Our findings provide some remarkable numbers that point out two major shortcomings of the current cloud service research field.

First, our results demonstrate the lack of attention to the distinction between the four deployment models, the three cloud service layers and the exact resource offered. Around 20% of articles neither distinguish between private, community, public or hybrid cloud nor between SaaS, PaaS, or IaaS although there are fundamental differences between those types of cloud service offerings. Even more troubling is the fact that very few IS researchers (between 20% and 40% depending on the cloud service model IaaS, PaaS or SaaS; see Table 4) describe the exact service each model offers. However, a user of SaaS, such as MS office 365, faces much less risk and satisfies completely different needs than a customer storing its sensitive data in the cloud by using, for instance, cloud-based public infrastructure services like Amazon S3. Therefore, bundling these service models in a single study strongly limits the validity of the results. To overcome that negligence and sloppiness of the IT artifact when it comes to cloud computing research, more approaches that concentrate on a specific provisioning and service model and at best, even on a precise cloud service within each abstraction layer are necessary. Only that way cloud service research does justice to the various characteristics of each provided capability by working out differences in adoption drivers and barriers and thus, fostering the use of every single cloud service individually.

Second, taking a closer look at our depicted map of the cloud service landscape from a federal perspective, we identify a general lack of cloud service studies focused on the governmental level, the public sector, its institutions and citizens. However, exactly those investigations might be essential and valuable because of the specific and different objectives, values, motivations and expectations within the e-government compared to the e-business environment [21]. For example, one key issue concerns IT governance and compliance in order to successfully implement cloud services within governmental IT und policy structures. Scientific guidance with respect to an appropriate governance structure that guarantees the effective identification, evaluation and mitigation of tangible and intangible cloud service risks (see, e.g., [42] for more details), which are both unique for public sector operations but also specific to each state, regional and local agency and which have effects on all citizens, might be required. Besides of this, cloud services enable the accessibility of e-government services at any time through the Internet and hence, should have the potential to improve the relationship between government, enterprises and citizens by providing more service- and citizen-orientation, simplifying feedback loops and shortening political processes, for instance, due to enhanced and easier e-participation opportunities of stakeholders. There is also the interesting question, whether cloud technology helps to increase e-government service acceptance and hence, helps to solve the digital divide by fostering equally access and rights to e-government services across all businesses and citizens or whether it further excludes disabled users without Internet access. Future research may shed light on such repercussions of cloud services on e-government service delivery.

By considering and combining those shortcomings identified above as well as throughout our paper, Table 5 integrates and concludes with the most significant recommendations for future cloud service studies in

general and examples of how to approach them adopting the lens of e-government. We hope that these five recommendations together with the provided examples will support IS and, especially, public sector researchers building on the current status of cloud service literature, keeping pace with the government practice and enhancing administrations' ability to fully benefit from shared services in future.

Table 5. Agenda for cloud service research exemplified for e-government

Recommendations for cloud service research	Examples for e-government research
1. Researchers should investigate cloud services at the global level across countries	Compare cloud service usage of governments and study the repercussion on economic development und culture in industrial, but especially in developing countries
	Investigate the impact of international and national jurisdiction and compliance, e.g., with privacy or tax law, on federal cloud service adoption due to cross-border data storage
2. Researchers should move beyond the ICT sector within one country	Investigate cloud service usage within the public compared to private sectors with particular concentration on the e-government unique characteristics resulting from the regulative area, e.g., with respect to public governance
	Study cloud service usage across administrations within the public sector and focus on benefits of interoperability and shared services versus security and privacy concerns
	Explore cloud service adoption and usage of public organizations and help to identify regulatory issues in order to enable thoughtful legislation by governmental agencies
3. Researchers should analyze the individual users of cloud services	Analyze the cloud service adoption behavior of government officials and civil servants to exploit interoperability of technology, interaction and collaboration
	Study the attitude and behavior of citizens concerning cloud services to ensure e-government service acceptance at the G2C-level
	Investigate the repercussions of cloud services on the social inclusion of all citizens and businesses in e-government services and the potential negative effects on the digital divide
4. Researchers should focus on a precise model of cloud services	Study how cloud services can contribute to more participation and citizen-oriented public administration systems in order to promote e-democracy as the highest stage of g-government development according to Siau and Long [50]
	Analyze and compare different deployment models, such as public cloud versus private cloud infrastructure commercially hosted versus private or hybrid governmental clouds, to recommend the most appropriate for the e-government environment, considering, e.g., a clear delineation of liability or secure storage of sensitive personal data of citizens
	Explore the ability to integration and interoperability of fragmented state, regional and local public systems based on the deployment of cloud-based platform services
5. Researchers should describe the exact service each cloud model offers	Study the deployment of cloud-based software services, like collaboration tools or BI systems, within administrations to lay out the foundation for the subsequent outsourcing of public core systems containing citizens' personal data
	Investigate the appreciation of potential extra value-added services, such as comprehensive payment and billing services and its appropriateness for e-tax payments

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You can obtain the complete list of all outlets included within our literature analysis as well as the as relevant identified articles, together with the complete classification on the various levels on request by the authors.