Cloud Driven Organizational Transformation – Rethinking IT-related Roles and Structures

Seminar Paper

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Abstract

In recent years, many organizations have employed cloud computing as a cornerstone of their digital strategy. Even though the technology is well established and still faces ever increasing popularity, its organizational impact is still poorly understood, because research on cloud computing primarily focuses on a solely technical perspective. As shifting from on-premise to the cloud has significant influence especially on IT-related roles and structures, it is surprising that no overview of cloud-induced changes in this domain exists in the information systems community. Addressing this research gap, we conduct a structured literature review to systematically synthesize the challenges and best practices for IT-related roles and structures that arise from transitioning to the cloud. Our review contains 32 articles that focus on the organizational impact of cloud computing. Our findings reveal how the challenges that cloud computing poses relate to the individual, team, and organizational level. Further, we unfold how these challenges can be tackled at the respective levels. Thus, our study contributes to research on the organizational impact of cloud computing and helps practitioners to assess challenges and implement best practices in their cloud migration initiatives.

Keywords

Cloud Computing, Cloud Migration, Digital Transformation, IT Roles, Literature Review, Organizational Impact, Qualitative Research

1 Introduction

Over the last years, digital transformation has established itself as a significant topic both in academia and practice (Vial, 2019). The term refers to "a company-wide phenomenon with broad organizational implications in which, most notably, the core business model of the firm is subject to change through the use of digital technology" (Verhoef et al., 2021, p. 892). To illustrate, companies undergo such a transformation in response to evolving digital technologies, intensifying digital competition, and changes in customer behavior (Verhoef et al., 2021).

To achieve a successful digital transformation, organizations can rely on a wide spectrum of technologies. One of those technologies is cloud computing, which is commonly defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell & Grance, 2011, p. 2). The technology is well-established in practice. To illustrate, in a 2022 survey of 500 US firms, 88% of the respondents stated that they see this technology as the cornerstone of their digital strategy (Domes et al., 2022). Similarly, a 2023 study on 554 German enterprises revealed that 89% of them are actively employing cloud computing (Rohleder, 2023). Even though cloud computing is already of high importance, the same study further found that firms are willing to strongly expand their cloud usage. These results show that cloud computing fulfills the demands that organizations today have in a digital landscape. Advantages of cloud computing encompass support in data analytics, increased productivity and collaboration (McAfee, 2011).

However, organizations face several challenges when adopting cloud technology (Ali et al., 2015; Dillon et al., 2010; Zhang et al., 2010). Among others, research has paid much attention to technological, financial and security-related aspects (Sabi et al., 2016), while the organizational impact of cloud computing received

less scrutiny (Vithayathil, 2018). This is especially true for the influence of cloud migration on traditional information technology (IT) structures like an in-house IT department (Vithayathil, 2018). To illustrate, the swift rise of cloud computing is transforming IT service procurement, deployment, and management (Sabi et al., 2016; Vithayathil, 2018), compelling organizations to reconsider conventional IT governance methods (Vithayathil, 2018). Given that cloud computing is such an important technology in practice, it is surprising that today's information systems (IS) research, which sits at the intersection of technology and people, does not provide a comprehensive overview of the influence of cloud computing on IT-related roles and structures. In this context, *IT-related roles* encompass the positions in an organization that are concerned with managing and operating IT matters. Examples are system administrators, software developers and IT project managers. *IT-related structures* pertain to the hierarchical organization of these roles within a company, for example a traditional IT department or IT project teams. We address the research gap not only by pointing out the implications of cloud migration, but we also strive to guide practitioners in their organizations by identifying potential problems and how to overcome them. Consequently, we pose the following research question: *What are challenges and best practices in planning and implementing cloud migration-induced changes in IT-related roles and structures?*

To answer this research question, we conduct a structured literature review as proposed by Webster and Watson (2002) to systematically search and synthesize the existing body of literature. We document this process in a traceable manner according to vom Brocke et al. (2009). The study provides insights from 32 scientific articles published in high quality outlets. Our results are valuable to both the IS research community and practitioners, as we contribute to the understanding of cloud-induced changes on IT-related roles and structures and outline challenges as well as best practices to deal with these challenges. Based on our literature review, scholars can further explore the impact of cloud computing on IT structures within an organization. To this end, we provide a research agenda that highlights unexplored aspects which, in our opinion, are worth focusing on in the future. Practitioners can leverage our results by ensuring awareness of the challenges we identify and employing the best practices we outline to avoid or overcome these challenges. Overall, organizations that incorporate our findings can facilitate a more seamless transition of their systems to cloud-based environments, ultimately helping them attain a successful digital transformation.

2 Theoretical Background

2.1 Cloud Computing

According to the National Institute of Standardization and Technology, cloud computing allows for convenient access to shared, adjustable computing resources like storage, servers, and applications, with quick setup and minimal management required (Mell & Grance, 2011). This institute also lists five essential characteristics of the technology:

- On-demand self-service: Computing resources, including server time and network storage, can be allocated independently by users, eliminating the need for direct interaction with service providers.
- Broad network access: Services can be accessed over the network through standard mechanisms, facilitating their use on various client platforms such as mobile phones, tablets, laptops, and desktop workstations.
- Resource pooling: Leveraging a shared environment, the cloud provider amalgamates computing resources to cater to multiple clients using a multi-tenant framework. Based on customer needs, both physical and virtual resources are allocated. While the precise location of these resources remains generally undisclosed to the customers, they do have the opportunity to indicate a preference for a more general location, such as a specific country.
- Rapid elasticity: Resources are capable of flexible allocation, often automatically, allowing for rapid scaling up or down based on demand. This provides users with a sense of seemingly unlimited and readily available capabilities.
- Measured service: Cloud systems utilize automated management and optimization of resources, incorporating metering at an appropriate level of abstraction that differs according to the type of service, such as storage, processing, bandwidth, or user accounts. This approach enables effective monitoring, control, and clear reporting of how resources are used, benefiting both service providers and users.

To realize these characteristics, cloud computing leverages a variety of technologies. A key principle in this domain is virtualization, which allows for the effective distribution and use of physical computing resources across numerous virtual machines on a single physical server (Bourguiba et al., 2013).

Over the last years, cloud vendors have established different service models, each designed to meet specific technological and business needs. A service is hereby ability "to use reusable, fine-grained components across a vendor's network" (Velte & Elsenpeter, 2010, p. 11). Services are generally characterized by scalability, multi-tenancy, and device-independence (Velte & Elsenpeter, 2010). Mainly three service models are of high relevance in practice, namely Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). The IaaS model offers basic IT infrastructure components such as storage, processing, and networking resources (Dillon et al., 2010). Examples of IaaS include AmazonEC2 and Rackspace Cloud. The PaaS goes one step further by hiding the underlying infrastructure and providing a platform of tools, services and frameworks that support developing applications and services (Velte & Elsenpeter, 2010). Examples of PaaS are Microsoft Azure and Google App Engine. Lastly, the SaaS model allows the user to utilize ready-to-use software applications operated by the provider on a cloud infrastructure (Mell & Grance, 2011). Examples of SaaS include Google Docs or Salesforce.

2.2 IT Functions, Roles, and Project Management

To put IT-related roles and management into context, we first discuss the different characterizations of the IT function in organizations. Guillemette and Paré (2012) propose five ideal IT management profiles, each representing a primary mission of the IT function. In the *partner* profile, the IT department is responsible for reengineering business processes and implementing IT applications, while in the *systems provider* profile, IT staff has the task to develop and acquire IT applications to implement them. Another profile is the *architecture builder* profile, where the IT department develops an integrated IT architecture in addition to implementing IT applications. IT teams can also function as a *technological leader* and experiment with modern technologies to implement IT applications. The last profile is called *project coordinator*, where the IT department is mainly responsible for managing and coordinating IT projects by outsourcing them. (Guillemette & Paré, 2012)

Depending on the specific profile, IT staff performs different activities and the importance of business, interpersonal and technical skills vary (Guillemette & Paré, 2012). Consequently, different IT staff with different skillsets might be hired. To illustrate, a study by Berg (2019) researched the most demanded job roles in the German job market in 2019 and found software developers (32%), IT application administrators (18%), data scientists (13%), IT project managers (12%), and IT consultants (10%) to be the top five.

When it comes to managing IT projects, different procedural models exist, of which we introduce two. A procedural model "organizes the methods and tools of project management into project phases or processes in a standardized manner" (Thesing et al., 2021, p. 747). The procedural model used in traditional project management is the *waterfall* model (Thesing et al., 2021), where every goal is determined in the beginning of the project and a holistic plan is created describing "work packages, responsibilities, and deadlines" (Thesing et al., 2021, p. 747) from the start to the end of the project.

As an alternative, the *agile* model can be used. The plan in this model is not complete and linear, but rather includes only general goals. Instead, in multiple, regular iterations, intermediate results are synchronized with the customer. This allows them to discover new and adapt existing requirements of the project accordingly. In comparison to the waterfall model, this provides the teams implementing the project with more flexibility to work towards the desired result even with changed requirements. (Thesing et al., 2021)

Additional benefits of the agile model are that, because of the shorter feedback cycles, errors can be identified more quickly, and the risk of false developments is reduced. However, from a practitioner's viewpoint, its iterative nature does not fit well into corporate culture, while the classical waterfall model with its clear responsibilities and stable planning is seen as a benefit. (Thesing et al., 2021)

3 Method

To address our research question, we conducted a literature review. We chose this research method to consolidate the existing body of knowledge in academia, pinpointing challenges and best practices that cloud computing adoption poses on organizations. This approach offers a comprehensive overview and sets

a robust foundation for future research. Conducting a literature review in the domain of IS is often a complex endeavor due to the vast and continuously growing volume of articles published annually across various journals, conference proceedings, and other outlets (Vom Brocke et al., 2009). Hence, it is beneficial to use a framework that serves as a guide for writing such a review. Vom Brocke et al. (2009) provide a framework that is widely adopted in the IS research community. We followed this framework and document how we approached each of its five phases in the following, as documenting the review process thoroughly is vital to enable readers to evaluate the review's quality (Vom Brocke et al., 2009).

Phase 1 - Definition of Review Scope: We draw on a taxonomy proposed by Cooper (1988) to define the scope of our literature review. This taxonomy consists of six characteristics (focus, goal, organization, perspective, audience, and coverage) and their respective categories. The taxonomy is depicted in Table 1. The grey cells indicate which category applies to the respective characteristic in our literature review. Our work focuses on research outcomes and their practical applications, rather than analyzing the methods used or the theories developed in the articles that we selected. Our goal is to integrate the findings of the literature and to find central issues. We do not set out to critique the selected literature. We organize our analysis of the literature based on their presented concepts rather than by their used methods or historically. We analyze the literature neutrally as we do not have a predefined hypothesis. Our audience are specialized scholars that are interested in the organizational impact of cloud computing as well as practitioners who can apply the knowledge created by our review. We strive to cover the topic representatively by searching outlets of high quality.

Characteristic	Categories			
Focus	Research Outcomes	Research Methods	Theories	Applications
Goal	Integration	Criticism		Central Issues
Organization	Historical	Conceptual		Methodological
Perspective	Neutral Representation		Espousal of Position	
Audience	Specialized Scholars	General Scholars	Practitioners	General Public
Coverage	Exhaustive	Exhaustive & Selective	Representative	Central/Pivotal

Table 1. Scope of the Literature Review

Phase 2 - Conceptualization of Topic: We began our study by familiarizing ourselves with key concepts of cloud computing like the different service and deployment models, reading highly cited articles like Mell and Grance (2011) and Armbrust et al. (2009). Next, we searched for publications that explicitly address the influence of cloud adoption on the responsibilities or structure of traditional in-house IT departments. This way, we found a key publication by Vithayathil (2018) which describes several challenges IT departments face and related best practices. We then applied a forward and backward search to broaden our knowledge on the wide range of changes that cloud computing poses on organizations, focusing on IT-related roles and structures.

Phase 3.1 - Literature Search - Outlet selection: To find relevant articles of high quality, Webster and Watson (2002) suggest starting a literature review in the leading journals. In the field of IS, one set of highly reputed journals is the Association for Information Systems (AIS) Senior Scholars Basket of Premier Journals (AIS, 2011). These journals served as an entry point for our review, as we anticipated them to contain articles on the socio-technical aspects of cloud computing. In addition, the AIS lists several special interest groups (SIGs), each of which recommends additional high-quality journals in their respective field. We identified two SIGs as possibly relevant (*Leadership in IT* and *Cognitive Research*) to cover the organizational context of cloud computing and searched the four additional journals they recommended. To enhance our data set with recent research, we incorporated proceedings from the top five IS conferences, namely the International Conference on IS (ICIS), the European Conference on IS (ECIS), the Americas Conference on IS (AMCIS), the Pacific Asia Conference on IS (PACIS), and the Hawaiian International Conference on System Sciences (HICSS). Finally, we searched for high quality cloud-specific journals by searching the Web of Science Master Journal List and the list of IEEE Xplore indexed journals for the term “cloud”. This way, we found four journals of which we selected three. We discarded one journal because we assessed it to be of inadequate quality as it had a low impact factor and cite score.

Phase 3.2 - Literature Search - Data Collection: We searched the previously defined categories of outlets (AIS Senior Scholars Premier Journals, AIS SIGs recommended journals, top IS conferences, and cloud-specific journals) one after another. First, we searched the Premier Journals on Scopus, Web of Science, and IEEE Xplore by searching for "cloud" in title, abstract and keywords, as a more specific search term would have generated too few results. This search revealed 111 hits. Next, we searched the four recommended journals of the two previously mentioned AIS SIGs with the same search term in the same databases. This search yielded another 109 hits. We then searched the five leading IS conferences in the AIS eLibrary, as it offers a more comprehensive coverage on AIS conferences than Scopus, Web of Science, and IEEE Xplore. In contrast to the aforementioned outlets, a search for "cloud" in title, abstract and subject yielded too many results to analyze. Thus, we formulated a search string by combining the term "cloud" with synonyms for *migration* and *roles*. This search term led to 107 hits and is described in Figure 1.

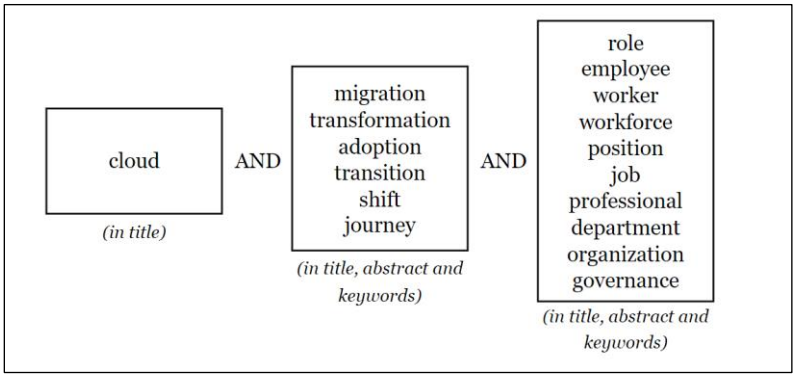

Figure 1. Search String for AIS Conferences

Next, we searched the three previously identified cloud-specific journals. For this, we used the same search string as for the IS conferences shown in Figure 1, except for searching "cloud" in the title, as the association to cloud technology was already given because these were cloud-specific journals. This approach yielded 36 additional hits.

To summarize, searching (a) the leading IS journals, (b) SIG recommended journals, (c) leading IS conferences and (d) cloud-specific journals resulted in a set of 363 articles. We analyzed this set regarding their titles and abstracts to reveal the importance for understanding the impact of cloud computing on IT-related roles and structures. As we found that only few articles specifically focus on these aspects, we employed an iterative approach. First, we established a broader set of articles by selecting those that examine the impact of cloud computing on any roles and structures that exist in an organization, for example end users or specific business units. In the next iteration, we narrowed down the previously obtained set of articles by filtering those that do not contain a relation to IT roles and structures at all. For example, we did not include articles that dealt with cloud usage of end users or the cost structure of cloud services. When we were in doubt whether to include a given article in any of the iterations, we did not only focus on the title and abstract, but also read the introduction, results, discussion, and conclusion of the respective article. This way, we selected 25 articles. As Webster and Watson (2002) suggest, we conducted a forward and backward search, resulting in another 7 articles. In sum, our final set consists of 32 research articles published between 2010 and 2023 (see Table 2). We included all these articles in the reference section and marked them with an asterisk. We conducted the literature search in November 2023.

Outlet group	Outlet	Initial Search Hits	Selected	FW/BW Selected
Senior Scholars Basket	Management Information Systems Quarterly	7	0	-
	Information Systems Research	17	0	-
	European Journal of Information Systems	6	1	-
	Journal of Management Information Systems	13	3	-
	Journal of the Association for Information Systems	3	0	-
	Journal of Information Technology	13	0	-
	Journal of Strategic Information Systems	4	0	1
	Information Systems Journal	5	1	-
	Information & Management	19	0	-
	Decision Support Systems	23	0	-
	Information and Organization	1	0	-
AIS SIG	IEEE Transactions on Engineering Management	45	1	-
	Information Technology and People	12	1	-
	Computers in Human Behavior	51	1	-
	Organizational Behavior and Human Decision Processes	1	0	-
AIS conf.	ICIS	12	5	1
	AMCIS	42	5	-
	ECIS	20	2	-
	PACIS	26	1	-
	HICSS	7	1	1
Cloud relevant journals	IEEE Transactions on Cloud Computing	9	0	-
	Journal of Cloud Computing: Advances, Systems and Applications	19	2	-
	International Journal of Cloud Applications and Computing	8	1	-
	Other journals	-	-	3
	Other conferences	-	-	1
Sum		363	25	7

Table 2. Summary of the Literature Search Process

Phase 4 - Literature Analysis and Synthesis: In line with our research question, we analyzed the selected literature with the aim of identifying the challenges and best practices that cloud migrations pose for IT-related roles and structures. Additionally, we observed that in order to provide a complete picture of the impact on IT structures, we also need to implicitly outline general changes that the technology induces. Thus, we did not only analyze the literature for challenges and best practices, but also for general changes affecting IT structures.

We observed that categorizing the different concepts by the levels in an organization where their impact is most noticeable can provide an interesting perspective on cloud migrations. This approach allows for a detailed analysis of how cloud migration affects various aspects of an organization, from strategic impact to operational changes. Examining these levels individually allowed us to identify specific challenges and best practices that are most relevant to each level, leading to more targeted recommendations while ensuring that the analysis captures the full spectrum of impacts. We inductively selected the set of levels we would focus on to consist of an individual, a team, and an organizational level. The individual level includes changes, challenges and best practices that affect individuals specifically in their everyday job, such as the tasks they perform or the skills they possess. On the team level, we focused on the overall function of specific teams and the interactions of the people within these teams. Finally, we defined the organizational level to consist of facets affecting all individuals or all teams of a company, as well as strategic matters to a company.

Next, we categorized the focal aspects of each article into broader concepts, resulting in two concepts per level. For every article we then specified its membership of the concepts, thereby synthesizing a concept matrix (Webster & Watson, 2002) which is provided in the appendix. It is important to note that a specific point made in an article might not belong to exactly one level. For example, a challenge might affect the individual level, while the best practice to cope with that challenge might be best classified as an organizational level aspect. In these cases, we aimed to highlight these points separately for each level and concept it appears in, considering it from different viewpoints.

Phase 5 - Research Agenda: We present a research agenda in Chapter 5.

4 Results

We present the findings of our literature review grouped by the level (individual, team and organizational) they correspond to. Table 3 provides an overview of the results. For each identified challenge, it states the best practices that can be utilized to handle the respective challenge. These results are described in more detail in the following sections.

Challenges (C)	Best Practices (BP)		
Individual	**Individual**	**Team**	**Organizational**
C1: Lack of Cloud-specific Knowledge and Skills	**BP1:** Train Employess **BP2:** Introduce Change Agents	-	-
C2: Fear of Change	-	-	**BP3:** Implement Formalized Cloud Strategy
Team			
C3: Shifting Tasks and Responsibilities of IT Department	-	**BP4:** Focus on Providing Value and Services	-
C4: Bypassed IT Department and More Self-Organization	-	**BP5:** Allow Development Teams to Make Autonomous Decisions	**BP3:** Implement Formalized Cloud Strategy
Organizational			
C5: Organization of IT Department as Cost or Profit Center	-	-	**BP6:** Consider Environment of Cloud Vendor
C6: Handling Decision Rights Between IT and Business Units	-	-	**BP7:** Improve Business Skills of IT Staff **BP8:** Foster Collaboration Between IT and Business Units

Table 3. Overview of Challenges and Best Practices

4.1 Challenges and Best Practices on the Individual Level

For the individual level, we found that cloud computing specific knowledge and skills are needed to ensure a successful cloud migration and that a fear of change occurs in professionals, especially in IT roles, which results in them taking a negative stance towards the migration to the cloud.

One of the gatekeeping conditions preventing a successful cloud migration is lack of knowledge on cloud computing. For example, when migrating a company towards using the cloud, merely providing IT decision makers with the necessary technology is not enough to get them to leverage these cloud offerings (Wulf et al., 2019). This can be attributed to several reasons, such as assumed incompatibilities with compliance or simply the lack of knowledge on these newly introduced technologies (Wulf et al., 2019). The tendency of IT professionals to keep using established technologies can be coped with by training employees on cloud computing (Wulf et al., 2019). This training also correlates positively with the staffs' view on the perceived usefulness and perceived ease of use of these technologies (Gangwar et al., 2015). Additionally, training is shown to be important in the context of cloud forensics, a cloud-specific form of digital forensics, which is about finding and analyzing data in the aftermath of cyber-attacks, where Alenezi et al. (2019, p. 10) call it "vital in regard to reaching forensic readiness". Another way to spread cloud computing knowledge throughout a company is by introducing change agent roles throughout the migration process. These change agents have the job of advising decision makers in the company on how they could best benefit from adopting cloud computing for their projects and thereby help spreading cloud computing knowledge throughout the company (Wulf et al., 2019).

The literature also describes a phenomenon of a fear of change affecting the employees of a company implementing or even considering a cloud migration. When this occurs, IT staff can fear a loss of responsibilities or even to become fully obsolete, and in doing so, they become protective (Hahn et al., 2013; Khalil & Winkler, 2023; Vithayathil, 2018). These fears can be addressed on an organizational level, which is where we will come back to them.

4.2 Challenges and Best Practices on the Team Level

On the team level, we identified two major aspects regarding the changes, challenges and best practices affecting IT-related roles and structures. The first one is about a general shift in IT department capabilities and responsibilities towards relational tasks and technology implementation. For the second one, we investigate the development that all teams of a company become more self-organized when migrating to cloud technologies.

The responsibilities and tasks of the IT department shift when migrating to the cloud. Less of the IT department's focus has to be on managing in-house technologies (Khalil & Winkler, 2023), but instead relational capabilities, such as managing cloud service provider relationships, become more important (Garrison et al., 2015; Khalil & Winkler, 2023; Qian & Palvia, 2013; Sarkar & Young, 2011). IT management roles are more concerned with technology implementation (Alkhalil et al., 2017) and take on tasks such as drafting service level agreements with cloud providers (Sarkar & Young, 2011). This shift in responsibilities has the added benefit that the IT of a company can focus more on providing value (Qian & Palvia, 2013) and providing better services to the users in the company (Alkhalil et al., 2017). However, the IT teams are not fully freed of technical tasks and have to still take care of the "configuration, monitoring and integration" of cloud applications (Alkhalil et al., 2017, p. 10), while keeping the security and privacy requirements of the company in mind (Sarkar & Young, 2011). Another challenge IT departments must take on when migrating to the cloud is managing the relationships (Sarkar & Young, 2011) and communication (Wulf et al., 2019) with other users and teams throughout their companies in cloud-specific matters, like which cloud services to use. This aspect becomes especially important when looking at challenges from an organizational level, which is where we will investigate it further.

An aspect affecting all teams of a company, is that cloud migrations lead to more self-organized teams in general (Khalil & Winkler, 2023; Krancher & Luther, 2015; Krancher et al., 2018). With lighter governance, they can get access to services faster (Wulf et al., 2021) and do not have to wait for the IT department when they require a new service (Khalil & Winkler, 2023). However, this benefit comes with the associated risk of the IT department being bypassed (Hahn et al., 2013; Sarkar & Young, 2011), which Hahn et al. (2013) propose, can be addressed with a formalized cloud strategy, an aspect we will further highlight on the organizational level. For the specific case of software development teams, this self-organization and continuous feedback especially accelerate the agility and learning processes in that team (Krancher et al., 2018). The adoption of PaaS enables such teams to make decisions autonomously, e.g., about requirements, solutions design, and distribution of tasks (Krancher et al., 2018). Further, PaaS allows for shorter deployment and delivery cycles, which enable developers to get feedback quicker both from the code itself (e.g., if there is a deployment error) and from end users (Krancher et al., 2018).

4.3 Challenges and Best Practices on the Organizational Level

When it comes to the organizational level, we present aspects regarding the IT strategy and IT governance of a company, like implementing a formalized cloud strategy. We also show how the organizational structure changes in response to cloud migrations.

To deal with the previously mentioned risk of the IT department being bypassed, companies should implement a formalized cloud strategy, where the IT department provides blueprints for cloud usage for the rest of the organization (Wulf et al., 2019). It thereby functions as a “certifier, consultant, and arbitrator” (Sarkar & Young, 2011, p. 5). This formalized cloud strategy might also help to overcome the protective behavior of the IT department mentioned on the individual level (Hahn et al., 2013).

The organizational structure of a company is a factor that plays a role in cloud migrations. Regarding the size of the IT workforce, it can be observed that a cloud migration does necessarily result in a reduction of the number of employees (Qian & Palvia, 2013). It is even documented that new human resources were

attracted in one case (Wulf et al., 2019). However, it is said that future expansions of the company could potentially be handled without increasing the IT headcount (Qian & Palvia, 2013).

As cloud computing can entail significant shifts in responsibilities, the question arises as to whether the IT department should be managed as a cost or profit center. A best practice is to base this decision on the competitive environment of the cloud vendor. When the cloud vendor faces intense competition, a cost-center model is preferable, whereas when the cloud vendor has significant pricing power, a profit-center model is more advantageous (Choudhary & Vithayathil, 2013).

The adoption of cloud computing and specifically SaaS can influence how decision rights on the application level are handled between IT departments and business units. For on-premise applications, factors like application complexity, strategic importance, and the need for specific knowledge strongly influence decision rights allocation towards IT units (Winkler & Brown, 2013). Conversely, for SaaS applications, the emphasis shifts towards business units, especially when applications are more standardized and have less complex integration needs (Winkler & Brown, 2013). To mitigate governance inconsistencies and prevent shadow IT, organizations should consider adjusting their IT governance models for applications with limited scope delivered via SaaS, while IT leaders should enhance their teams' business skills and foster collaboration between IT decision-makers and stakeholders in various business units (Winkler & Brown, 2013).

5 Discussion

The motivation for our structured literature review was to create a comprehensive overview that synthesizes the current understanding of how cloud computing influences IT roles and structures. Our aim was not only to provide scholars with a solid foundation for further exploration of cloud computing's organizational impact, but also to equip practitioners with the necessary insights to navigate challenges and adopt best practices during cloud migrations. In the following, we discuss the implications of our findings and outline avenues for further research.

Our first contribution to the literature is the provision of a comprehensive overview of changes, challenges and best practices induced by cloud computing migrations. Unlike prior research, which tends to focus on isolated aspects of cloud migrations (Alenezi et al., 2019; Choudhary & Vithayathil, 2013; Krancher et al., 2018), our work offers an overarching collection of these elements. We present a structured overview that spans the impact on IT-related roles and structures during cloud migrations, categorizing them into the individual, team, and organizational level.

Secondly, we observe that among the wide range of papers on cloud migration and adoption, only very few specifically focus on the impact of IT-related roles and structures. Oftentimes, articles deal with the influence on IT only secondary. We find this observation surprising as cloud computing is an established technology that has been around for well over a decade and will generate an estimated revenue of 678 billion USD in 2024 (Gartner, 2023). It is obvious that the technology directly influences IT roles, for example adopting IaaS impacts the day-to-day work of system administrators who previously managed the in-house data center, while PaaS changes the way software developers create applications. We are especially surprised by the lack of research in the IS community on such interrelations of people and technology, as we locate the topic right at the heart of the socio-technical continuum (Sarker et al., 2019), which is where IS research should focus on. To close this gap, we provide a research agenda along the individual, team, and organizational level in the following.

On the individual level, the relationship between migrating from on-premise to the cloud and specific IT roles needs to be further investigated, ranging from CIOs, enterprise architects and developers to system administrators. While there are some articles that investigate the technology's impact on certain roles (Hahn et al., 2013; Khalil & Winkler, 2023; Wulf et al., 2019), these studies often remain superficial in their analysis. For example, research remains to show how a multi-cloud strategy compares to a single-cloud strategy regarding employee's skill and training. Handling different cloud providers may increase complexity for both IT staff and managers. Thus, we pose ***RQ1: How does transitioning from on-premise to the cloud utilizing a multi-cloud strategy affect employee's required skills and training in comparison to a single-cloud strategy?***

Likewise, research lacks an understanding of the effect on specific IT roles when a cloud-only approach is compared to a combination of on-premise and cloud solutions. For example, with the disposal of in-house data centers, the physical hardware management is no longer necessary. Understanding whether the affected roles drop out of the organization or have new responsibilities and how they can continue to add value to the business is crucial for organizations to understand. To this end, we formulate ***RQ2: What are the effects of transitioning to a cloud-only infrastructure model compared to a hybrid model of on-premise and cloud solutions on specific IT roles within organizations?***

The mentioned considerations on the individual level do not only address a gap in the academic discourse but would also yield valuable insights for both IT employees and executives, as they could better anticipate the changes cloud computing induces on their day-to-day work.

On the team level, research remains to show which roles are involved in a cloud migration project and what their respective functions are. As cloud migration endeavors do not solely involve technical, but also legal, financial, and security-related aspects for example, they may require more experts in the project team compared to on-premise IT projects. Consequently, we pose **RQ3: Which roles are involved in a cloud migration project and what are their respective functions?**

Additionally, we propose to further investigate how IT structures like the traditional inhouse IT infrastructure team or software development teams are affected by cloud computing. We have demonstrated that the existing literature offers valuable insights into team-level best practices, such as increased self-organization of (Khalil & Winkler, 2023; Krancher & Luther, 2015; Krancher et al., 2018) or the transition of the IT department's focus towards relational capabilities (Garrison et al., 2015; Khalil & Winkler, 2023; Qian & Palvia, 2013; Sarkar & Young, 2011). However, other areas are not sufficiently covered by research. For example, the impact of cloud computing on performance measures of IT teams like the number of tickets closed, server provisioning or features developed remains unexplored. Understanding such relationships is crucial for assessing the value of cloud adoption for an organization. Thus, we state ***RQ4: How does the adoption of cloud computing influence performance measures of IT units?***

Further, we observe how the changes in IT departments could be interpreted as the IT function moving towards the project coordinator profile as proposed by Guillemette and Paré (2012), since managing cloud technologies seems similar to the outsourcing aspect the profile encapsulates. Insights into the differences between IT departments that might still exist after migrating to cloud technologies could be gained by reevaluating these profiles in the context of cloud. Consequently, we formulate ***RQ5: Which shifts in IT profiles does the adoption of cloud computing induce?***

Academia has only shown preliminary insights regarding the impact of cloud adoption and the size of IT teams. To gain more reliable results, triangulating such data is essential. Organizations would benefit from this knowledge as it aids them in planning their future demand for IT professionals. This is especially important considering the current and expected future shortage of IT professionals (Berg, 2019). Organizations need to know whether cloud computing can help close this gap or whether it will even widen it. To this end, we pose ***RQ6: How does the adoption of cloud computing effect the size of IT teams and the demand for IT professionals?***

Regarding the organizational level, multiple articles found that teams throughout companies adopting cloud technologies become less reliant on the IT department in certain scenarios and are more self-organized overall. From this observation arises the question of how these changes interact with the effectiveness of different procedural models for managing projects like agile and waterfall, as one could imagine that the overall lighter governance achievable through cloud technologies enhances the flexibility of the agile model even more. Thus, we formulate ***RQ7: What are cloud migration-induced effects on procedural models for IT project management?***

Finally, one aspect that remains unexplored by IS literature is the interrelation of cloud technology and low-code development platforms (LCDPs), and the resulting implications for employees. LCDPs facilitate the creation and launch of complete software applications, leveraging graphical user interfaces and visual abstractions to minimize or eliminate the need for procedural programming (Waszkowski, 2019). Typically, LCDPs run on the cloud (Di Ruscio et al., 2022). We believe that examining how cloud platforms may facilitate the adoption of low-code approaches is a critical subject for IS research. This inquiry could reveal how such technologies are redefining the roles and responsibilities between IT professionals and business

experts, potentially reshaping traditional organizational structures. Consequently, we propose ***RQ8: How does the integration of cloud computing with low-code development platforms affect the division of roles and responsibilities among IT professionals and business units?***

Table 4 gives an overview of the proposed questions for future research.

Level	Research Questions
Individual	**RQ1:** How does transitioning from on-premise to the cloud utilizing a multi-cloud strategy affect employee's required skills and training in comparison to a single-cloud strategy?
	RQ2: What are the effects of transitioning to a cloud-only infrastructure model compared to a hybrid model of on-premise and cloud solutions on specific IT roles within organizations?
Team	**RQ3:** Which roles are involved in a cloud migration project and what are their respective functions?
	RQ4: How does the adoption of cloud computing influence performance measures of IT units?
	RQ5: Which shifts in IT profiles does the adoption of cloud computing induce?
	RQ6: How does the adoption of cloud computing effect the size of IT teams and the demand for IT professionals?
Organizational	**RQ7:** What are cloud migration-induced effects on procedural models for IT project management?
	RQ8: How does the integration of cloud computing with low-code development platforms affect the division of roles and responsibilities among IT professionals and business units?

Table 4: Overview of Future Research Questions

6 Conclusion

6.1 Limitations

Our research is subject to several limitations. First, we may have missed relevant articles in our literature review, as other outlets or search terms could also have provided meaningful results. Nevertheless, by combining highly ranked journals in the field of IS, cloud-specific journals and renowned IS conferences, our literature search ensures a representative view of the subject at hand.

Second, we assessed the relevance of the initial search hits mainly on the titles, abstracts, and keywords of the articles. To a certain extent, this is a subjective process, and we may have discarded relevant publications. However, as described in Chapter 3, we utilized an iterative approach that led to a broad initial selection of papers which we narrowed down to obtain the final literature selection. This procedure reduced the risk of discarding relevant articles.

Third, constructing the concept matrix depends on the focus of our analysis. Thus, we may have omitted other concepts that could have created valuable insights for our research. Still, by carefully defining our research scope and objectives, we aimed to strike a balance between inclusivity and specificity, ensuring that the selected concepts align closely with the focal aspects of our review. Additionally, structuring our results along the individual, team and organizational level ensured a holistic view of the relationship of cloud computing and IT roles and structures.

6.2 Future Work

For future research, we plan to further apply qualitative research methods to gain an in-depth understanding of cloud-induced effects on IT structures. Thus, we intend to conduct a multiple case study (Yin, 2014) to collect archival data and interview experienced IT professionals, covering a wide range of IT roles like CIOs, system administrators and developers. We aim to identify both the challenges and best practices that have emerged during a cloud migration, uncovering how the cloud has reshaped their day-to-day tasks, responsibilities, and strategic thinking. By engaging with a variety of roles, our research will strive to generalize the findings, creating a broader narrative of the cloud's impact on the IT industry. This approach will further increase our understanding of the technology's practical implications and highlight critical success factors for utilizing cloud computing.

6.3 Conclusion

The effects of cloud computing on IT-related roles and structures are still poorly understood in academia and practice. Practitioners lack guidance for dealing with the socio-technical challenges that arise in such migration projects. This results in a bad alignment of technology and organizational structures. Towards this end, we conducted a structured literature review and synthesized the fragmented body of knowledge on the effects of cloud computing on IT-related roles and structures. We presented challenges that cloud technology adoption poses on organizations and revealed best practices to handle these challenges, and organized the results into the individual, team, and organizational level. Our findings reveal that research specifically dedicated to the cloud's impact on IT roles and structure is sparse given the enormous practical relevance of the technology and its market size. While some challenges are already well explored in academia, such as the need for employees to adapt their skillset, others remain either untouched or superficially inspected, for example the impact of certain approaches like cloud-only or multi-cloud on specific IT roles like system administrators and developers. With our study, we aim to initiate a journey for both researchers and practitioners to gain a more profound understanding of the organizational implications of cloud migration. On the one hand, our results contribute to closing the gap between the current state of research and the practical relevance of cloud computing. On the other hand, our results can support practitioners to achieve a smoother transition to the cloud, laying the foundation for a successful digital transformation.

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Appendix: Concept Matrix of the Literature Review

Article	Individual Level		Team Level		Organizational Level	
	Knowledge and Training	Fear of Change	IT Department Capabilities	Self-Organization	(IT) Strategy and Governance	Structure and Processes
Basket of 11						
(Battleson et al., 2016)						x
(Choudhary & Vithayathil, 2013)						x
(Krancher et al., 2018)				x		
(Vithayathil, 2018)	x	x	x		x	x
(Winkler & Brown, 2013)					x	x
AIS Conferences						
(Abokhodair et al., 2012)	x					x
(Adendorff & Smuts, 2019)	x				x	
(El-Gazzar et al., 2017)		x				x
(Güner & Sneiders, 2014)					x	x
(Hahn et al., 2013)			x			
(Hoberg et al., 2012)			x		x	
(Karunagaran et al., 2016)	x					x
(Krancher & Luther, 2015)	x			x		
(Malladi & Krishnan, 2012)	x	x				x
(Mocker et al., 2016)					x	
(Qian & Palvia, 2013)	x		x		x	x
(Sarkar & Young, 2011)		x	x		x	
(Wulf et al., 2019)	x	x	x		x	
(Wulf et al., 2021)				x	x	x
AIS SIGs						
(Ali et al., 2021)	x				x	
(Cetindamar et al., 2021)	x					
(Yang et al., 2015)					x	
Cloud Specific Journals						
(Al-Azzawi & Kaya, 2021)	x				x	
(Alenezi et al., 2019)	x					
(Alkhalil et al., 2017)	x		x			
FW BW Search						
(Borgman et al., 2013)					x	
(Gangwar et al., 2015)	x				x	
(Garrison et al., 2015)					x	
(Khajeh-Hosseini et al., 2010)						x
(Khalil & Winkler, 2023)	x	x		x		x
(Khan et al., 2016)	x				x	
(Winkler et al., 2011)					x	x
Total	**16**	**6**	**7**	**4**	**18**	**14**