Research Report

Perspectives on Cloud Adoption

IN COMPARISON TO TRADITIONAL IT PARADIGMS, CLOUD COMPUTING ENABLES TO OBTAIN DESIRED COMPUTING RESOURCES ON-DEMAND WITHOUT REQUIRING LARGE, UPFRONT INVESTMENTS AND TO DYNAMICALLY ADAPT AND SCALE THESE RESOURCES TO VARYING BUSINESS REQUIREMENTS. HOWEVER, CLOUD COMPUTING IS NOT A PANACEA. THIS DRIVES THE NEED TO EXAMINE THE SPECIFIC REASONS AND REQUIREMENTS FOR CLOUD ADOPTION IN PRACTICE. HERE, WE FOLLOW AN ANALYTICAL APPROACH TO EXAMINE CLOUD ADOPTION BY CONDUCTING A LITERATURE SURVEY AND AN EMPIRICAL STUDY.

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Introduction

Today's CIOs still consider cloud computing to be among the most promising IT investment priorities. While every organization in the past had to maintain its own infrastructure yielding large upfront investments and underutilized resources, the consolidation of IT resources in large data centers managed by a cloud provider offers major advantages. First, the cost of entry is significantly lowered. Often, a pay-per-use model is applied. Second, IT resources can be seamlessly scaled according to the needs of an organization. This provides major advantages for example for startups, allowing IT landscape scaling depending on the growth of business. Finally, cloud computing allows for new and disruptive types of applications. For example, applications running on smartphones now become able to offload data to the cloud for further processing. Despite the aforementioned advantages, several issues still exist that are currently addressed in research, e.g., security concerns and the migration of on-premise legacy systems. However, research on cloud adoption is lacking an industrial perspective (Jamshidi et al., 2013). Therefore, we performed a joint analysis by conducting a literature survey which is complemented by an empirical study, in which we exploit the knowledge obtained from interviews with IT experts in order to derive the main drivers and obstacles of cloud adoption in industry (Holloway et al., 2017).

Literature View on Cloud Adoption

Existing research that has been conducted in the field of cloud adoption so far can be distinguished into two different research directions: (i) migration frameworks and (ii) influencing factors. While the former provides explicit guidance when cloud adoption is taken into account, the latter research work explores advantages, drawbacks, and obstacles:

- *Migration frameworks* can be distinguished into frameworks that focus on the decision process and those considering the whole lifecycle of cloud adoption resulting in all-embracing migration frameworks. All of them share the definition of different phases. Beginning with some preparation steps, the real adoption is done in some kind of operate phase followed by an adaptation phase (e.g., Conway and Curry, 2012). By investigating the different migration frameworks, we derive three hypotheses (M1–M3) about the adoption process:
  - M1: Not every kind of service is suitable to be moved to the cloud.
  - M2: Enterprises decide on a per-service-basis if they move to the cloud or not.
  - M3: Among the migration types cloudification prevails.

Here, cloudification means to move a service to the cloud. This expression refers to the migration of locally installed applications to web-based equivalents.

- *Influencing factors* are the factors relevant for the decision of cloud adoption. To analyze these factors, we conducted a literature review. To determine the impact of a paper we considered, e.g., the number of citations (at least 35 citations), the significance of the authors, and the impact of the conference or journal. Hence, we identified 18 relevant papers and 9 influencing factors, e.g., relative advantage, complexity, suitability of the application, security concerns, or control of IT resources. Concerning data-related issues, there is a widespread perception that sensitive business data will never be moved to the cloud. Moreover, performance unpredictability is mentioned as one of the ten major cloud obstacles. From the results of our analysis of influencing factors, we derived two additional hypotheses (F1–F2):
  - F1: Applications that impact key competencies will not be migrated into the cloud.
  - F2: Applications that are migrated for a longterm usage prevail.

Empirical Study of Cloud Adoption

For our empirical study, we conducted five interviews with IT experts from different organizations. We chose interview partners on the executive level with authority or insight into cloud operations among organizations that exhibit a lifetime of more than ten years and that use cloud computing for their internal business tasks. The interviews were performed using a questionnaire in an oral and semi-structured way in order to be able to adaptively react to the received answers. In doing so, we closely followed the features of an expert interview. The questionnaire was structured as follows: At the beginning, it contained some gen-

eral questions about the business corporation and the role of the interviewee in the company. This was followed by general questions on cloud computing. The main part of the questionnaire comprised questions about the first cloud project. This part was structured based on the stages in the migration framework proposed by (Conway and Curry, 2012). That model was chosen since it constitutes a conjoint work of leading organizations from the industry, the non-profit sector, and academia, and thus can be considered as the most mature one. However, we had to extend the model because our study also aimed to account for aborted cloud migrations and temporary usage scenarios. Each stage of the project in the questionnaire dealt with the benefits, obstacles, and conditions from both a technical and an organizational perspective. The questionnaire finished with questions on future cloud projects.

The transcripts of the interviews consisted of 10 pages on average and were analyzed using a qualitative content analysis. Basically, the qualitative content analysis constitutes a systematic method in which techniques for content analysis are applied in order to retrieve a system of categories from a given text material. As result, we obtained a system of categories over three levels. Table 1 shows the first-level categories: 14 factors that affect companies in the process of cloud adoption in practice. For the second-level categories, see Holloway et al. (2017).

Revisiting our Hypotheses

As part of our literature research, we compiled some first hypotheses to be reconsidered within the scope of our empirical study. Concerning hypothesis M1, we assumed that not every kind of service is suitable to be moved to the cloud, but some interviewees explicitly stated that all applications are suited in general. Therefore, M1 could not be confirmed. Hypothesis M2 claimed that the decision of a company to move to the cloud is made on a per-service basis. The results of our study are confirming this hypothesis. Regarding the migration types in hypothesis M3, we expected that cloudification prevails. However, our findings are in contrast to that assumption. Replacing legacy systems by cloud offers was the dominant migration type.

First-Level Categories
Business trend
Service immaturity
Preparation
Pilot cloud applications
Requirements
User acceptance
Deployment model
Qualified applications
Organizational issues
Technical issues
Organizational reasons
Technical reasons
General advantages
General disadvantages

Table 1: Factors Affecting Cloud Adoption in Practice

We could not find any evidence supporting that applications affecting key competencies of companies will not be migrated to the cloud (hypothesis F1). On the contrary, one interviewee explicitly stated that he expects his organization to be completely cloud-based by 2020. Finally, hypothesis F2 was confirmed: cloud projects are intended for a permanent usage of cloud services. No company had either initiated nor was planning a temporary use of cloud services.

Conclusion

Today, moving to the cloud seems very promising due to low upfront investments, optimal resource utilization, unlimited scalability, and new types of applications. The results of our study revealed that companies are influenced by multiple, partially conflicting factors in the decision process of cloud adoption of which many have already been attributed to cloud computing by researchers so far. However, some of these factors are considered differently in practice. For example, all interviewees considered the security standards of cloud services to outperform on-premise solutions. In contrast, security is often considered as a major obstacle in literature. Also new factors were introduced within our empirical study. To the best of our knowledge, for example, service immaturity and user acceptance have not been mentioned in research so far.

Enterprises regard cloud computing as still evolving. Cloud services are perceived to be immature compared to on-premise solutions and pilot cloud projects are best to be started with applications that affect only a small user group and demand low investments. Within the results of our study, a single use case was dominant: the permanent usage of public cloud services with a migration strategy that replaces legacy applications with publicly available cloud offers.

Overall, our study revealed that companies consider cloud computing as a business trend where adoption is indispensable in order to successfully compete in the market. For the future, we found that the companies consider more applications for cloud migration. In the next years, the growth of cloud computing will continue since more companies will take their step into the cloud. This will also keep the interest in exploring the factors which affect companies in cloud adoption.

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