Key Factors Impacting Cloud Computing Adoption

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Findings from multiple cloud provider case studies identify 9 key factors and 15 subfactors affecting the adoption of cloud technology. These range from technological issues to broader organizational and environmental issues.

The cloud computing industry is estimated to be worth some US$35 billion. With so much at stake, researchers in both academia and industry are scrambling to identify and resolve potential challenges affecting the successful adoption of cloud services.

Research has highlighted the fact that, to date, most existing studies focus on the technical problems associated with cloud (A. Khajeh-Hosseini, I. Sommerville, and I. Lango Sriram, "Research Challenges for Enterprise Cloud Computing," white paper, 2010, http://arxiv.org/ftp/arxiv/papers/1001/1001.3257.pdf; S. Leimeister, K. Riedl, and H. Krcmar, "The Business Perspectives of Cloud Computing: Actors, Roles and Value Networks," *Proc. 18th Eur. Conf. Information Systems* [ECIS 10], Assoc. for Information Systems, 2010, http://aisel.aisnet.org/ecis2010/56).

Perhaps this can be explained by the lack of an empirical body of knowledge about cloud adoption, as most of the information available is anecdotal evidence from Web articles and position and practitioner papers. With this in mind, we examined the technological, organizational, and environmental factors that impact cloud services adoption.

RESEARCH METHODOLOGY

We performed three case studies of cloud service providers (SPs) and their customers, which are summarized in Table 1. Comparing data from both the supplier and customer sides of the technology, obtained primarily through face-to-face interviews with senior decision makers, we identified several factors impacting cloud services adoption.

We grouped these factors using the framework developed by Louis Tornatzky, Mitchel Fleischer, and Alok Chakrabarty (*The Processes of Technological Innovation*, Lexington Books, 1990), which distinguishes three contexts for innovation adoption:

- *technological*—what technologies are available to an organization and how certain technology factors influence the adoption process;
- *organizational*—the structure and processes of an organization that constrain or facilitate the adoption of innovations; and
- *environmental*—regulations and relationships with governments, present constraints, and opportunities for technological innovations.

Table 2 lists the key factors and subfactors within these contexts that impact cloud services adoption.

TECHNOLOGICAL FACTORS

Our study suggests that four technological characteristics

Table 1. Case studies and interview sources.		
Firm	**Industry**	**Interviewees**
Case study 1: SourceDogg (software as a service)		
SourceDogg (service provider)	Procurement software	Chief executive officer (1 interview) Executive director (2 interviews) Chief technology officer (1 interview)
IBTB* (customer)	Public sector (health)	Purchasing manager (1 interview)
APM* (customer)	Public sector (food and drink)	Procurement officer (1 interview)
Case study 2: AD Networks (infrastructure as a service)		
AD Networks* (service provider)	IT and networking solutions	Chief technology officer (1 interview)
Information Mosaic (customer)	Global securities processing	Product management (2 interviews) IT manager (1 interview)
Case study 3: Rimal (software as a service)		
Rimal* (service provider)	Consultancy	Managing director (2 interviews) Developer (1 interview)
NDC* (customer)	Electronics	IT manager (1 interview)

*Pseudonym used to protect anonymity.

Table 2. Key factors impacting cloud computing services adoption.		
Context	**Factor**	**Subfactors**
Technological	Relative advantage	Reduces capital expenditure: savings on hardware and software costs Increases scalability Faster implementation time; drives down administrative time
	Compatibility	Streamlines internal processes: can readily deploy applications/templates Need for better integration with existing IT systems Need for better bandwidth and connectivity
	Complexity	Difficulty persuading employees to use cloud systems Cloud systems need to be intuitive to user needs
	Trialability	Adopters can carry out pilot studies, trials, and experiments in a risk free environment
Organizational	Increased collaboration	Leverages more internal engagement and collaboration along a company's supply chain
	Increased traceability and auditability	Provision of a traceable and transparent audit trail demonstrates compliance and data integrity
	Convincing IT managers	Managers fear losing control of their IT environment Transition to cloud may result in IT managers' jobs becoming obsolete
Environmental	Security and legal issues	Need for locked down processes on data protection and confidentiality
	Perception of the term *cloud*	The term *cloud* evokes a negative, skeptical reaction

influence the decision to adopt a cloud computing environment: relative advantage, compatibility, complexity, and the ability to trial the platform. Some companies we studied deemed cost savings, increased scalability, and time savings to be relative advantages that cloud technology can provide over traditional IT systems. Moreover, study participants in IBTB and APM—pseudonyms used to protect anonymity—note that they were up and running on their cloud systems in 24 hours—a dramatic improvement over traditional IT system implementations, which can take up to six months. Our case studies also revealed that clients could streamline and improve internal processes as a result of adopting the cloud.

We learned that client experiences integrating cloud systems with existing organizational IT systems, such as Enterprise Resource Planning systems, do pose a challenge and could impact long-term adoption and acceptance of cloud services. Moreover, as organizations rely on connectivity to the network and external datacenters as a key component of cloud adoption,

bandwidth and connectivity are as much of a concern as the actual performance and services SPs offer.

The cloud's complexity is a source of concern for some clients' employees, which can result in resistance to its adoption. Although training is of course one way to mitigate this concern, providers must also work to build systems that are intuitive to use.

Trialability of the cloud system is another important factor impacting its adoption. All of the adopters we studied performed various trials, pilot studies, and experimentations with their respective cloud systems prior to full adoption.

ORGANIZATIONAL FACTORS

Improving collaboration and promoting openness both inside and outside the organization is a key organizational factor impacting customer adoption. All the customers in the study noted that adoption of the cloud has resulted in more collaboration along their supply chain, as well as improved team engagement and communication inside their firms.

The need for increased traceability and auditability is another compelling reason for adopting cloud services. Every information service in an organization can be tracked using cloud traceability capabilities (M. Armbrust et al., "Above the Clouds: A Berkeley View of Cloud Computing," 1990, www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.html; B. Iyer and J.C. Henderson, "Preparing for the Future: Understanding the Seven Capabilities of Cloud Computing," *MIS Qtly Executive*, vol. 9, no. 2, 2010, pp. 117-131). Providers can thus serve their clients by providing the data storage audit trail required for regulatory and legal purposes.

Adopting cloud systems is a shift in organizational norms and culture, particularly for IT managers, a group often stereotyped as being

controlling and having an "if it ain't broke, don't fix it" attitude toward change. This might be merited— studies have shown that the massive transition to cloud could make many IT managers' jobs obsolete. However, those IT managers who adjust their skills and capabilities to suit the cloud landscape will be rewarded with tremendous opportunities.

ENVIRONMENTAL FACTORS IMPACTING ADOPTION

Our analysis revealed that security and legal issues significantly impact cloud adoption. Adopters in the study felt safer about cloud services once they knew where their datacenters are actually housed, as well as the legislative practices of the jurisdiction in which they're located.

Our analysis also revealed significant risk averseness from the public sector, which presents many challenges for widespread cloud adoption. Thus, regular meetings with the provider prior to cloud adoption can help ensure that proper governance procedures are in place and that systems are implemented in a risk-free environment.

Interestingly, several of the study participants noted that the common perception of the term, *the cloud*, was a potential barrier to cloud adoption. One study participant pointed out, "Sometimes you wonder, if the word *cloud* hadn't been around, would we be better off?" Thus, when dealing with their clients, providers might want to avoid specific mention of the cloud and instead refer to "a new service delivery model."

Our case studies on cloud adoption identified 15 subfactors, as shown in Table 2, that can be used to analyze a company's existing or proposed cloud initiative. We also found that many of the issues surrounding cloud adoption are user related and not technical. One key chal-

lenge comes from IT managers and employees who are resistant to cloud adoption based on a fear of losing their job or a lack of understanding about the cloud's impact on their work.

Our case studies can provide a better understanding of how certain factors impact cloud adoption and in turn lead to a more informed managerial decision-making process regarding adoption of cloud systems. Our research design was exploratory, so further work should more closely examine each adoption factor to gain a more integrated perspective on cloud services adoption. C

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