Towards a Change Management Framework for Cloud Transitions: Findings from a Case Study at a German Machine Manufacturer

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Abstract: Cloud computing provides benefits such as cost savings, a high degree of flexibility, as well as advanced security opportunities. However, introducing a cloud environment into an established enterprise requires both technical and structural changes in the organization. Thus, a well-planned change management approach is essential to ensure a successful transition. The goal of this paper is to contribute to change management research by providing a change management framework for cloud transitions. Furthermore, we present measures to implement the framework consisting of a vision statement definition, communities of practice, a learning journey, a change story, and a collaboration tool. Finally, we also provide a roadmap for the sequential implementation of the identified measures. Our results are based on an extensive literature review and a case study approach, including eight expert interviews.

1 INTRODUCTION

Cloud computing has a high potential to transform IT and other industries through more attractive software services (Armbrust et al., 2010). More and more organizations are using cloud services to enable cost savings and to release employees of basic infrastructure management tasks. However, transitioning to cloud computing describes a radical change, which needs to be managed within the company to ensure project success.

The increasing rate of technological advancement and growing global competition call for a continued need for organizational change in the future (Appelbaum et al., 2012). Thus, the active management of change is necessary, as reflected in evolving literature on change management, that experiences influence from different conversational streams, including theoretical and practical scholars, e.g., (Kotter, 1995) and Lewin (Hussain et al., 2018).

However, change management needs to be adapted to different contexts, i.e. cloud transition. Hence, our research paper investigates the following research questions:

RQ1: What components should a change management framework for a cloud transition comprise?

RQ2: How could the change management framework for cloud transition be implemented?

Our contribution consists of the identification of four components for a change management framework for cloud transitions based on a literature review. Furthermore, we present measures to implement these components derived from a case study conducted at a European machine manufacturer. Lastly, we present a roadmap to put the measures in chronological order.

In the following sections, we describe the concepts of change management and cloud transitions, followed by our research approach. Afterward, we present our contributions being a change management framework, measures for implementing the framework, and the roadmap for its implementation. Finally, we present a short conclusion, including limitations and future work.

2 FOUNDATIONS

In this section we first introduce the concept of change management. Afterward we present the concept of cloud transition and its connection to change management. To the best of the authors' knowledge, no related work for change management in the context

of a cloud transition exists.

2.1 Change Management

Organizational change aims at adapting an organization to the dynamically changing environment it operates in. Thus, organizational change can be defined as the observation of shifts in shape, quality, or state of an organization after the introduction of new ways of thinking, acting, and operating (Pardo del Val and Martínez Fuentes, 2003).

To increase the likeliness of successful change, active management is necessary. Thus, change management describes the goal-oriented, comprehensive, and often cross-departmental redesign of structures, processes, business areas, or entire companies (Dichter et al., 1993). Change management processes usually comprise several phases.

According to Lewin (Hussain et al., 2018), a change management process comprises three phases. First, the organization realizes that the status quo no longer meets the requirements of the markets in the unfreezing phase. The moving phase describes the second phase, which identifies change objectives and necessary changes to achieve these objectives. In this phase, the organization leaves behind the status quo and creates space for new structures, processes, business areas, and corporate strategies. Finally, the refreezing phase anchors the new state of the organization (Hussain et al., 2018).

Furthermore, Kotter (Kotter, 1995) provides an eight-stage model for successful change. The process stages comprise the establishment of a sense of urgency, the creation of a guiding coalition, the development of a vision and strategy, the communication of the change vision, the empowerment of actions for change of internal structures and systems, the generation of short term wins, the realization of larger change projects, and the anchoring of new approaches in the corporate culture. However, Kotter's model is criticized to be based only on his own experiences in practice, lacking a scientific basis. Nevertheless, it became a success quickly in practice at the time it was advocated, and it remains a key reference in the field of change management (Appelbaum et al., 2012).

2.2 Cloud Transition

Cloud computing is a research area with increasing amounts of published research in recent years. The National Institute of Standards and Technology (NIST) defines cloud computing 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 and Grance, 2011). Besides, cloud computing can be distinguished in three distinct service models being Infrastructure, Platform, and Software as a Service (IaaS, PaaS, and SaaS), as well as in four different deployment models which are private, community, public, and hybrid cloud (Mell and Grance, 2011).

Thus, management, operation, and ownership of infrastructures, platforms, and application capabilities are repositioned to cloud providers and accessed remotely by customers (Mell and Grance, 2011; Schneider and Sunyaev, 2016). This enables the realization of many advantages, e.g., cost savings and a high degree of flexibility (Schneider and Sunyaev, 2016; Yahya et al., 2019). However, cloud computing also bears challenges which have to be actively addressed, i.e., increased need for security (Yahya et al., 2019) or federation of several cloud services (Hohenstein et al., 2017).

However, a cloud transition is a complex undertaking for an organization, both from an organizational and technical perspective. The introduction of cloud computing changes the role of the IT department and introduces new tasks (Choudhary and Vithayathil, 2013). Generally, tasks shift from low-level infrastructure, platform, and service development and maintenance to more conceptual tasks like identifying value-adding constellations of cloud services and service provider management. Thus, change management processes need to prepare employees for changing circumstances in the course of a cloud transition.

3 RESEARCH APPROACH

This section presents the applied research approach. RQ1 is answered based on a literature review. To answer RQ2, we conducted a case study building on the results of RQ1.

3.1 Literature Review

To identify components of a change management framework for a cloud transition, we conducted an extensive literature review on the two concepts change management and cloud transition. We systematically reviewed the literature including forward and backward search.

3.2 Case Study

To derive an approach for implementing a cloud transition using an action roadmap, we combined the results from RQ1 with a case study approach. A case study approach is suitable due to the explorative nature of the research endeavor. To guide our research, we applied Yin's framework (Yin, 2013) due to its clearly defined structure. We conduct the case study at a European machine manufacturer who is currently preparing a cloud transition.

Data collection consists of eight expert interviews with employees in management positions at the machine manufacturer (see Tab. 1). The semi-structured interview guideline aims at identifying concrete measures to implement the change management framework as well as temporal dependencies between measures. We transcribed all interviews.

Data analysis follows a grounded theory methodology (Eisenhardt, 1989). First, we coded the interviews according to our change management framework presented in section 4. Afterward, we analyzed the codes, deriving concrete recommendations for measures to implement the change management framework as well as a roadmap for the investigated company.

Table 1: Overview of interview partners.

ID	Role	Interview Duration
I1	Global IT Architecture	37:24 min
I2	Head Commercial Services	31:44 min
I3	Head IT China	17:38 min
I4	Head of Global Talent Mgmt.	18:03 min
I5	Global IT (PLM / CAD)	20:52 min
I6	DevOps Innovation	30:44 min
I7	Product Owner IoT	31:37 min
I8	Engineering Lead	23:43 min

4 CHANGE MANAGEMENT FRAMEWORK

Based on the literature review, we created a framework for change management for a cloud transition consisting of the four key components vision, management, communication, and collaboration.

4.1 Vision

According to Kotter (Kotter, 1995; Kotter, 1996), a vision is crucial to driving change within an organization. A clearly defined vision helps employees to understand and implement the change and acts as a guideline that leads projects into the desired direction. Furthermore, it is an essential measure to break the status quo by looking behind the quick goals.

Empirical results undermine the importance of a clear vision for change. First, (Appelbaum et al., 2012) found that several research projects show the importance of a shared understanding of the change project's outcome and the value of a clear vision in the change management process. Also, (Whelan-Berry and Somerville, 2010) confirms that indicating a vision at the beginning of the change process is crucial. A vision typically describes the desired state of the organization after the change. Moreover, a shared vision changes the relationship between employees and an organization by creating a shared identity (Senge, 1990).

Since cloud systems are usually a new concept for companies, it is crucial to define a clear vision to act as a guideline throughout the change when designing a change strategy. Thus, we include the development of a vision statement as the first component of our framework for change management for cloud transitions. Essential components of a vision within the change management process for cloud transition are a clearly defined long term goal that describes the outcome of the change process for the whole organization as well as its implementation.

4.2 Management

Along with Kotter's eight steps of change management (Kotter, 1996), we identified a strong focus towards new team formats in organizational change management literature (Appelbaum et al., 2012). Involving all employees in the change process reduces resistance, and active involvement of employees in change is argued to be a success factor for change (Cameron and Green, 2000). However, for successful change, employees have to be trained accordingly (Keutzer, 2018). Further insights into real-life projects show that the formation of a steering committee can act as a step to break old structures and enable new thinking (Heck et al., 2012).

Creating teams or bolstering individuals who exert influence in the organization to lead change strengthens the implementation of new technologies or structures (Kotter, 1996). This is especially relevant during a change management process for cloud transition (Wegner et al., 2002; Langenberg, 2011; Miyachi, 2018) since it can help affected employees to get to know new technologies. Thus, we identify the formation of a change management team, cultural integration, and an opportunity for all employees to partici-

pate and learn within the setting of a new technology as an essential component of our change management framework. More precisely, we chose communities of practice (CoP). CoP approaches unify crucial communication and collaboration possibilities with new technological possibilities arising from cloud technologies (Wegner et al., 2002).

4.3 Communication

Communication is concerned with activities of information exchange to achieve change in behavior and attitudes (Elving, 2005). It plays a central role in change management (Kotter, 1995; Helpap, 2015; Judson, 1991; Schweiger and Denisi, 1991).

In terms of communication strategies, the two main streams of research are programmatic and participatory communication. Both strategies aim at changing behavior and attitudes. However, programmatic approaches denote top-down communication, i.e., the management informing employees, while participatory strategies focus on dialog and exchange between all levels of an organization. In the context of change, the participatory strategies are more successful (Bordia et al., 2004), and the recipient's sensemaking and participation in the change initiative is an essential factor for successful change (Bartunek et al., 2006). Thus, (Bartunek et al., 2006) recommends addressing the recipient's understanding of the change initiative actively.

Communication plays a vital role in change management models. In Judson's five-step model (Judson, 1991), communication is used for bargaining and persuasion to minimize resistance. Furthermore, (Kotter, 1995) dedicates two steps of his eight-step model to communication. These steps are the establishment of a sense of urgency and the communication of the vision. Both apply a programmatic communication strategy since the management informs the employees top-down. However, there are also tendencies towards a more participatory strategy involving the employees with Q&A sessions or discussions in quarterly meetings.

Summarizing, change communication needs strategies to be successful at different points in the change process. At first, a more programmatic top-down approach is applicable to get the right sense of urgency and move the people out of their comfort zones. In the course of the change process, the change management team should use more participatory approaches to involve the employees, thus fostering the success of the change management initiative. Thus, communication is one of the components of our change management framework.

4.4 Collaboration

The involvement of employees in the change process is central. Collaboration establishes trust, which is one of the most critical factors influencing cooperative behavior and collaboration (Holton, 2001; Hattori and Lapidus, 2004; Jones and George, 1998; Stoller et al., 2010). Collaborative working should be a core competency of learning organizations (Holton, 2001).

Research on CoP shows the importance of collaboration in change initiatives. Collaboration fosters innovative change (Hattori and Lapidus, 2004) and learning (Teague and Anfara, 2012). Besides, collaboration is of increasing importance in cloud transformations, as described by (Hill, 2013): *"In making a decision about what will best support a particular requirement [...] organizational leaders should seek out the tools that foster team communication, collaboration, and information sharing.".* IT project and portfolio management of cloud services include the identification and planning of project activities, minimizing risk, managing the project, resources, and team members, and, more importantly, checking for interdependencies with other cloud or IT projects (Joha and Janssen, 2012). Therefore, collaboration between actors is necessary for a successful cloud transition and represents the last component of the proposed framework for change management.

5 MEASURES

Based on the components of the change management framework, we analyzed eight expert interviews and derived specific change management measures for the machine manufacturer in our case study.

5.1 Vision

The analysis of the interviews shows that a clear vision statement is a desired and important step for change. Setting a clear goal for a desired outcome of the cloud transition process helps the employees to unite their efforts.

Several interview partners mentioned goals they want to achieve with a cloud operating model. First, cloud technology should not be implemented merely for its own sake but to enable new business opportunities and possibilities for future development. Thus, the cloud should enable meeting changing customer expectations due to quicker deployment and more efficient internal use of resources. Also, interviewees considered the necessity to maintain a secure

data management enabled through cloud computing, i.e., *"In many cases, cloud technologies provide higher security standards than storing data on our self-managed servers."* (I2). Finally, along with the machine manufacturer's new one brand strategy and global business allocation, employees value stronger collaboration across business units and countries as I7 expressed: *"The only way this process can work is through using the same tools globally so employees can communicate cross-company, [...]"*.

Concluding, the interviewees value the implementation of a cloud transition project. The new technology should enable the company to realize new possibilities for their business. Internally, the cloud transition aims at data security and improved efficiency for collaboration across the whole organization. Therefore, our proposal for a vision statement for the machine manufacturer's change management for a cloud transition is the following:

"We implement the cloud transition jointly to establish secure and efficient work for our organization and our customers as well as to advance digital business models while keeping an open mind to the possibilities of what comes next."

5.2 Management

We identified several requirements for the management and implementation of the change process, including that *"the change has to be led by the team"* (I7). Furthermore, forming small teams can be beneficial for projects (I1, I4, I7) and *"projects should not contain too many top management people"* (I1). Additionally, employees *"have to learn how to deal with the cloud"* (I1). Therefore, we propose a management structure based on CoP as well as a learning journey for employees.

CoP provide a team approach focusing on involvement, small teams, and a learning objective for the management of change for the company. (Wegner et al., 2002) defines CoP as: *"Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis"*. The relationships between team members are based on mutual engagement due to shared norms and cooperation. Members develop a shared knowledge pool *"as a common professional language, familiar routines, sensibilities, artifacts, tools, and stories"* (Kietzmann et al., 2013).

Thus, regarding the cloud transition at the machine manufacturer, we developed a CoP approach illustrated in Fig. 1. First, to address the need for data security at the machine manufacturer (I5), a security

CoP is created. Also, a global organizational structure requires safe cross-border data exchange possibilities (I7). Second, significant changes in the architecture due to the cloud transition require the reevaluation of current IT structures. A small group of people, i.e., an architecture CoP, should investigate this because fast decisions are necessary. Third, to analyze cloud operations on an ongoing basis, a cloud operations CoP is formed. Lastly, the DevOps CoP focuses on process improvements in order to enable faster (I1, I6, I7, I8) and more agile work (I6, I7).
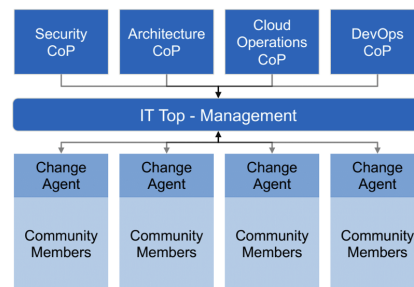

Figure 1: Management structure including communities of practice.

In our proposed structure, the IT top management connects the CoP. The IT top management ensures that the outcomes within a CoP are shared across communities to enable knowledge sharing between communities.

The leaders of CoP have a central role as they are representing the community and represent the change as change leaders. They represent the community externally. Furthermore, the CoP should meet regularly.

Furthermore, a cloud transition confronts employees with new technologies and concepts, resulting in the need to develop a skillset. Knowledge and capabilities regarding cloud computing are different across the organization (I7), making it necessary to address each employee individually to avoid leaving anyone behind (I4). Hence, we recommend a learning journey that enables the participation of all employees in four learning stages:

- **Cloud Striver:** Employees participate in web-based trainings and events to develop basic knowledge.

- **Cloud Participant:** Employees actively submit cloud use case ideas and understand cloud capabilities for their work.

- **Cloud Adventurer:** Employees are active members of a collaboration tool for change management, as described below.

- **Cloud Professional:** Employees can train others and are change agents for the community.

The developed learning journey helps employees to understand new processes and build-up knowledge as they move through the stages. In the CoP, employees are encouraged to learn and share their knowledge. The produced results will improve the processes of the organization and the daily work of all members.

5.3 Communication

Through the analysis of our interviews we established that communication is a central component throughout the change process for cloud transition (I4). As a communication tool, story telling is used.

Our analysis shows that communication is a central component throughout the change process for cloud transition (I4). As a communication strategy, we propose story telling. Story telling is useful in change processes because it enables a deeper, more personal engagement with employees since employees align stories with their experiences and their understanding of the organization (Gill, 2011). Furthermore, story telling helps employees to understand management decisions. Thus, change stories are a popular tool in consulting agencies (Keenan et al., 2012; Basford and Schaninger, 2016), and also find increasing attention in research.

We structure change stories into three aspects. First, the management uses past success stories involving the employees to get their attention. Afterward, the story creates a sense of urgency. Finally, the story management provides a solution as well as the thought process, which leads to the solution.

5.4 Collaboration

Collaboration is central in a change management process, especially in organizations that are divided and practice silo thinking (Stoller et al., 2010). Silo thinking also happens in the case study partner's IT division. To foster collaboration in the case study setting, we propose a communication tool rolled out across the organization to enable frequent exchange for change management related and general questions. This gets also clear through the following interview insight: *"In the future there will be one unified [company name] which is also part of this change process. There are no more silos like in the past, rather everything is connected. The only way this process can work is through using the same tools globally so employees can communicate cross-company, which was not always the case in the past."* (I7)

In the course of the interviews, we identified several requirements for a communication tool. First, the tool should enable an exchange with colleagues from different locations and functions to enable collaboration. Also, it should be possible to ask questions about the change management and to have them answered. Smaller groups without management participation make sure that employees are comfortable to ask questions. Question-asking with threads enables easy follow-ups on questions. Additionally, the tool should enable participation in events and meetings at different locations, meaning that broadcasting and call functions are available. It should be possible to share documents in the tool. Lastly, different groups should be created for different types of communication, e.g., groups for different divisions, CoP, or 1:1 chatting.

6 ROADMAP

The presented roadmap is based on the proposed change management framework for cloud transitions and measures derived through the interviews. The measures are put in sequential order and establish steps in the change management process. The roadmap consists of five steps as illustrated in Fig. 2. In the following, the five steps are detailed:

Envision. This step aims at creating a clear picture of the change management process by formulating a vision statement for the cloud transition. The step is also concerned with establishing a change story.

Communicate. Communication is central to change management and thus is prioritized. A kickoff event initiates the change management process. During the kickoff, the management uses a change story to communicate the changes. The change story provides the employees with a feeling of involvement and a sense of what will happen in the change process. Furthermore, the employees are assured that everyone can participate. Also, the management should select a tool for the change communication.

Empower. This step aims at setting up CoP. The IT leadership decides on the structure, i.e., the structure presented in Fig. 1, and initial participants of the CoP. However, the employees later also have the option to leave or enter CoP. Furthermore, the communication tool is implemented for all IT employees, and the CoP structures are mirrored in the tool.

Train. The kickoff for the CoP takes place, where the management introduces the learning journey to the employees. Aftward, the learning journeys for the employees start depending on their knowledge level.

Iterate and Evaluate. The employees move through the learning journey using individual continuous

Figure 2: Roadmap for implementing the change management framework for a cloud transition in the case study setting.

learning schedules. The top management is involved to keep in touch with the employees' beliefs, problems, and concerns regarding the changes, e.g., during informal meetings. Furthermore, to develop a sense of the employees' current status within the learning journey, it is recommended to organize a hackathon event where employees and CoP can test their knowledge. However, these recommendations for implementing the described measures need to be adapted to organizational context and culture.

7 CONCLUSION

In this research paper, we provide a change management framework for could transitions, identify measures to implement the change management framework in a case study setting, and provide a roadmap to implement these measures.

Although the results and concrete measures emerged from the specific context of one company, we believe the findings can be generalized within the bounds of a similar setting. Especially the derived change management framework for cloud transitions provides a starting point for designing other change management processes in different organizations.

This work provides a step towards understanding how change management for cloud transition can be implemented in an organization. However, this work holds limitations, which can open up exciting opportunities for future research. Most of all, the study is limited to one organization. Thus, future work should investigate the applicability of the developed change management framework for cloud transitions in further organizations. Furthermore, the data analyzed in this paper was collected over a short period. An investigation over a more extended time could provide new insights based on longitudinal data.

This work provides implications to theory and practice. On a theoretical level the primary contribution is the investigation of a developing field of study and the derived change management framework for cloud transition as well as the identification of mea-

sures to implement the framework. Additionally, conclusions for practice can be drawn from the results of this paper. Companies interested in starting a cloud transition initiative can use our findings as guidance for implementing their own change management during a cloud transition.

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