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Learnings from a Cloud Migration Project at a South African Retailer

ABSTRACT

All industries are aware of the potential benefits of cloud computing, however, the migration to cloud has not been widely adopted by South African retailers. The purpose of this paper is to explore the motivations behind organisations deciding to migrate to cloud and the factors that may impact a successful cloud migration project. The paper discusses a case study that analysed the key drivers and the impact of cloud migration within a retail environment. The empirical findings suggest that skills and competencies largely impact every aspect of cloud migration, from decision making to execution and support. Furthermore, that migrating to cloud will differ based on organisational need and the type of cloud service being adopted. In addition, the findings outlines that best practise may advance as more organisations migrate to cloud environments.

Keywords

Cloud migration, skills and competencies, cloud benefits, migration rationale, success criteria,

INTRODUCTION

According to Benlian, Kettinger and Sunyaev (2016:1), cloud computing is disruptive and can support innovative services and business models. Until recently, the migration of Information Technology (IT) applications and data to the cloud has been largely unexplored by organisations in South Africa, however, the creation of local cloud data centres by Microsoft and recently, AWS, has changed the landscape. According to Writer (2018), different industries are looking at investing in cloud with retail being the second largest following IT software and services companies. Daniel (2020) concurs stating that the end of 2019 and early 2020 have witnessed heightened interest and activity that may change the ways that companies operate.

Migrating to cloud-based services provides substantial benefits to organisations including improved user satisfaction, opportunities for organisational advancement, development of new skills, and reduction in redundant work (Ahmadi et al. 2015). Cloud computing has the ability to accommodate the rapid progress of economies and technological obstacles because it enables an organisation to focus on their core business whilst a service provider manages their IT infrastructure (Garrison, Wakefield and Kim, 2015).

Whilst it may be less complicated to deploy applications that offer such benefits, organisation that decides to migrate to cloud must consider potential constraints that may impede a successful implementation. Such obstacles can be differentiated into technical and non-technical aspects. Alharthi et al. (2017), assert a range of challenges including infrastructure, culture and operational constraints that may hinder a successful cloud migration. Much focus in literature has been on technical factors such as security with not much consideration directed to organisational resources.

The transition from legacy systems to cloud computing requires capable employees with the required competencies, knowledge, experience, skills and the willingness to learn. Because cloud is still fairly novel in South Africa, it can be expected that very few potential adopters possess the skill to seamlessly build and deploy cloud applications. Furthermore, the migration to cloud could present a steep learning curve for organisation in terms of differences in the technical structure and potential benefits presented.

This paper will explore the gap in literature regarding the adoption of cloud with the main focus being the impact of skills and competencies on successful cloud migration. The objectives are to identify drivers that motivate cloud migration and factors that impact successful implementation as well as the challenges experienced as a result of a skills deficits. The paper will

introduce the cloud migration concepts via a review of the literature. Subsequently, the paper will explore empirical findings from semi-structured interviews conducted with employees in a retail organisation that conducted a cloud migration project.

OVERVIEW OF CLOUD COMPUTING

Cloud computing is known to be one of many IT innovations that forces organisations to rethink the way in which they procure, manage and deploy IT services. Momoh et al. (2014) calls it a new wave in IT and Mell and Grance, (2011:3) defines it 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”. Cloud provide services like infrastructure, applications and storage virtually based on three service models namely, platform as a service (PaaS), software as a service (SaaS) and infrastructure as a service (IaaS) (Mell & Grace, 2011).

Infrastructure as a Service (IaaS) offers the outsourcing of computer infrastructure such as hardware, storage, servers and data centre space over the internet. The IaaS model offers a scaling up and down functionality as per demand, allowing organisations to pay for use and is more appropriate for large organisations as it requires resources with great expertise and is costly (Wilson (2017). Platform as a Service (PaaS) offers a functionality for the development and deployment of applications in the cloud to avoid the complexity of building and maintaining own infrastructure. It allows the maintenance of the application development life cycle from design to deployment and provides a platform where applications can be accessed remotely. Software as a service (SaaS) provides functionality to use applications on a cloud infrastructure (Tawfique & Vejseli (2018). This model does not require installation of applications on the user's computer thus making it the service provider's responsibility to manage maintain and upgrade processes.

Mell and Grance (2011) mentions four delivery models for hosting cloud services namely public, private, hybrid and community cloud. Public cloud services are provided by a service provider though the internet and sold on a pay as you use basis (Khan, Nicho & Takruri, 2016). Private cloud resources are exclusive to an organisation that may be serving multiple consumers (Ahmed, Salhh and Hazem, 2017). The Private cloud may be hosted on premise or off premise, managed by the organisation or a third party. The Hybrid cloud delivery model provisions cloud resources using a structure of two or more models. The delivery models remain “unique units but are bound together to enable data and application portability” (Khan et al., 2016:26). Community cloud services numerous organisations that collaborate in the building of infrastructure and the development of service policies (Kaushik & Kumar, 2013). This cloud deployment model may be provisioned by a service provider or a single organisation within the community.

Cloud computing is an emerging information technology trend that is changing the way organisations conduct their business across all sectors. Chen, Chuang, and Nakatani (2016) affirm that cloud computing simplifies the management and application of computing resources via new techniques and can enhance the competitive advantage via entry to advanced IT environments. Thus Opera-Martins, Sahandi and Tian (2016) identify cloud computing as an essential strategic resource that allows organisations to stay competitive and meet business needs. This is substantiated by HBR (2017) calling organisations to embrace cloud computing to allow for greater business agility, data capabilities, and better customer and user experiences.

According to West (2014), cloud migration is typically based on the stakeholder's perception of risks versus the potential cost savings and efficiencies that can be realised. The benefits include, “agility, scalability, availability, cost-efficiency, elasticity, extensibility, the main drivers of cloud adoption are cost-efficiency and flexibility” (Gupta, Saxena & Saini, 2016:1). The decision to migrate is driven by broad motivations such as possibility of realising significant cost savings, to achieve improved organisational performance and agility to enable quick response to the ever changing environment. The main driver for the adoption of cloud is the financial benefit that reduces costs for current applications. Cloud computing has changed IT development, deployment, use, maintenance and cost (Gangwar & Hema, 2015).

Organisations can effectively leverage the benefits of cloud computing when they consider all factors that may impact migration. More so, organisations that are not taking advantage of the benefits are at a greater risk of losing competitiveness Lewerke (2017). Pettey (2019) refers to the shift to new IT architectures such cloud computing as a break- through in digital business, including next-generation IT solutions.

Although cloud computing provides major benefits to early adopters, there are barriers such as the lack of skills and competencies (Bannerman, 2010; Khan 2017). As cloud computing continues to evolve, its complexity is also evolving requiring updated skills in architecture, deployment, development and operations. Other barriers include security concerns, lock-in, control, legal, service, cost, governance, industry integration, and customisation (Opara-Martins, et al., 2016). Barriers such as the cost of migration, integration, interoperability and customisation needs are attributed to a lack of skills in the effective implementation and management of a cloud solution. Before organisations migrate to a cloud environment, they need

to carefully plan and propose a well-defined strategy requiring knowledge of cloud solutions that enhance decision making to prevent losses throughout the cloud migration process. Expertise such as solution architects, engineers, developers and systems administrators are required to realise the full benefits provided by cloud technology investments.

The study applied the Technology Organisational Environmental (TOE) theoretical framework that reviews both internal and external requirements applicable to the adoption and implementation of new technology. According to Wilson (2017) technology readiness, relative advantage, compatibility and complexity must be explored in the research related to technology. The organisational context focuses on the characteristics of an organisation such as size, degree of complexity in managerial structures, human resources and staff linkages (Iahad & Saedi, 2013). The environmental context comprises of industry structure, competitors, government regulations and policies.

RESEARCH DESIGN AND METHODOLOGY

A case study was applied for the research design because the study applied qualitative research to obtain an in-depth description of a phenomena within an organisation (Babbie & Mouton 2001). The study explored to gain insight into the skills and competencies required to drive successful cloud migration as this was largely unexplored in the literature.

Data was sourced from a retail organisation that implemented a cloud migration project through semi-structured interviews with IT managers and IT staff involved in the project. The purposive sampling method was applied because a small sample was obtained for the case from knowledgeable experts (Lewis, et al. 2009; Esterhuysen, et al., 2016). Because the purposive sampling method is subjective in nature, the sample is not representative of the population. According to Alkassim, Etikan and Musa (2016:2) purposive sampling is a “non-random technique that does not need underlying theories or a set number of participants”. The participants were selected by the researcher as a result of what needed to be known, their willingness to provide information by virtue of their experience with the cloud migration project.

To analyse and interpret the qualitative data a narrative data analysis method was applied using three steps. Firstly codes were developed by comparing and contrasting the responses from the interviewees to identify similarities and differences. Secondly themes, patterns and relationships were identified to gain understanding and insights and lastly, data was summarised (Yang & Tate, 2012). For the purpose of this study selective coding was performed using ATLAS.ti; codes were framed, guided by the TOE framework through connecting categories on the responses from the interviewees. The focus of the interviews was particularly on two themes.

The first theme focused on understanding the rationale that drove the organisation to migrate to cloud which also focused on the benefits of migrating to cloud and whether the expected benefits and defined goals were achieved. The second theme focused on skills and competency considerations for migrating to cloud.

FINDINGS

The organisation where the cloud migration project took place is referred to as Company X. The participants interviewed were the IT manager accountable for the cloud strategy (Participant A), the head of Business intelligence (Participant B) and (Participant C) was a super user that formed part of the implementation team and the operations after conclusion of the project.

Concept 1: Migration rationale

All participants agreed that cost was one of the main motivations for moving to cloud. Participant A suggested

“The analysis discovered that on premise approaches to infrastructure hosting is more expensive as administering a data centre is not the core business of a retail organisation”.

The cost of administering and operating an on premise data centre requires ensuring proper cooling of the infrastructure at all times. This therefore requires an organisation to be mindful of power supplies. Huge diesel generators would be needed for the functioning of an on premise data centre should there be a power cut. This will furthermore make the cost that an organisation would have to carry very high. Participant A suggested

“A more competitive price could be obtained when getting infrastructure from a bigger data centre that an organisation could simply buy the kind of required capacity from”.

Flexibility provided by a cloud environment was identified as another driver to cloud migration for Company X. Participant B suggested that the cloud environment has provided Company X the flexibility to procure equipment much faster by avoiding the procurement processes that needs to be followed with an on premise data centre that require delays in approvals and shipping time.

“Cloud avoids such processes and one can purchase an additional machine with a click of a button”.

Participant A affirmed this suggestion of flexibility as a driver by mentioning that

“A hyperscale environment that is available in the cloud only pays for that capacity for a very short period of time”.

This was evident in the Business intelligence space of Company X whereby a server had been scaled up for one of the cloud partners to problem solve the stability of their application and that could be charged to the third party. The only requirement was internal processes to manage the experience associated with that work. There was no need to be concerned about going through the hurdles to agree to scale up a machine and the duration thereof.

“The timing to which the server is spin up in this case office hours and not over weekends is a great advantage as there could not be any meaningful way to approach those kind of problems in the past as Company X is guided by a more Capex model”

The analysis suggests that agility is another driver for cloud migration. The process between commissioning and decommission large loads within the on premise data centre tends to be time consuming. This is often due to the due diligence that an organisation like Company X would have to undertake when deciding to decommission. The need to be specific in determining how much of those large expenditures would cost and what the payback period would be.

“Leverage the agility available in a hyperscale environment is another driver”

The study revealed that expertise is as another driver to migrating to cloud. A retailer’s core business is to sell goods to customers and its IT expertise is solely to support the business. Participant A suggested

“IT infrastructure like data centers is not a retail specialty or primary skill as opposed to a partner that provides cloud services like AWS, Microsoft Azure and so on”.

These cloud providers are experts in providing infrastructure, and allow for organisations like Company X to eliminating the need to build data centres. A retail organisation would never be a match in offering these services that are provided by a hyperscaler.

In the analysis provisioning was also identified as another driver to migrate to cloud. Provisioning is the ability to start up and shut down machines and the cloud allows provisioning much faster with no lead time required. Participant C suggested that the only challenge with this was

“Dependency on people to do it for you and if there is no proper team in place it can become cumbersome”.

Expected Benefits

All participants agree that the ability to be more flexible and to increase systems when running out of space were beneficial. Furthermore, the ability to add on new components is much simpler in a cloud environment as well as the cost saving were also highlighted as further for cloud migration. The agility of the cloud environment provides opportunities for innovation and was cited as a focus that could intensify as the cloud migration journey matures.

Although the initial focus of the project was on operational efficiency, the potential for future innovations could not be disputed. And participants agreed the migration poses better opportunities and flexibility for future innovations such as enhanced data science, artificial intelligence and machine learning capability. However, participants agreed that such innovations will require capacity and capabilities from the team and that a designated team that focuses on innovation would be beneficial.

Defined goals

Participant A mentioned that

“Getting rid of the entire existing data centre will ensure that the expected benefits are completely realised”

By moving the entire infrastructure from an on premise data centre to a cloud environment will eliminate the sunk cost of managing an on premise data centre. It is believed that the cloud migration is a realistic objective and benefits will be fully realised once the task is completed.

To define goals the decision makers need to determine the requirement of cloud for a specific organisation such as the application layer being used by the organisation as well as review of potential IaaS, SaaS or PaaS requirements. In the context

of Company X, IaaS layer (physical hardware) is being used. The operating system and the applications on top of the infrastructure was installed by the organisation. According to Participant B

“The main focus was to move the enterprise data warehouse platform to the cloud, which means recommissioning”.

For Company X the cloud environment enabled the creation of a parallel landscape of the production environment to test and verify prior to migration to the main environment. This capability was not possible with the premise infrastructure due to limitations in space.

Participant C mentions that even though the project presented some cost overruns, due to cloud immaturity and the lack of correct controls to manage the cloud overruns, the cloud migration project delivered on expectations. The chattiness of the applications being migrated to cloud had to be understood to determine which phase to implement first. The core applications were the last to be migrated as there were learnings from the process that could be applied to formulate a best practice.

Participant C suggested that no clear goals were set for the executing staff and goals were only directed at the senior level and/or decision making level. Having clear goals at the execution level could have helped in eliminating some of the hurdles in the project implementation which impacted delivery timelines.

Measurement of success will be determined by measuring the reduction in cost over a period of time as well as overall process improvements.

Concept 2: A focus on skills and competency considerations

Level of complexity

According to participant A the level of complexity is relatively simple as the only requirement is to understand the interaction of the technology. However, because the focus of many cloud partners in SA is on infrastructure, it does not help a retail organisation much in migrating their landscape to cloud. For Company X, the cloud migration strategy was to go to SaaS first, PaaS, then IaaS. The reality though was that the majority of Company X's landscape is IaaS. However, one needs to understand the infrastructure exists to support applications thus making it difficult to look at the landscape at an infrastructural level. Understanding the application level makes it easy to understand how applications are integrated and the migration strategy would then detail groups of servers that make up an application.

“Explaining to cloud partners that the migration strategy has to be application based took a while as a result”.

The complexity is in the matrix of aspects to be reviewed and weighted prior to the selection of a cloud provider. These evaluations include costs, networks, resourcing, skills required from the partner, ways of working and different approaches in the cloud such as processes for backups and restoring of data. Furthermore, considerations regarding logs, formulation of the disaster recovery process, the user experience and anticipated loss of control need to take place. For a big enterprise with several large systems, the migration to cloud is complex as a paradigm shift is required from multiple users. As remarked by Participant A:

“This is often difficult because change is not easy, especially when it is an unknown”.

Decisions on whether to approach the project as a migration or reimplementing added further complexity. Participant B suggests that the initial complexity was around data migration as it involved a working group to get that initial piece to the cloud. The complex tasks of delivery, operation and capacity planning of a server and storage infrastructure are often ran by a cloud partner that specialises in infrastructure management.

“It was easy to launch infrastructure but getting the big set of data that was sitting locally to the cloud was more complex”.

Lack of cloud expertise

A cloud migration strategy focused on IaaS requires skills in infrastructure architecture and the competency to deploy, measure and manage these services is not core business area within a retail environment. As such, a cloud partner is usually assigned to provide the majority of migration skills and competencies and these skills are in very high demand within the South Africa market. The skills required for SaaS are similar to on premise hosting because the management of an application layer remains the same and therefore the skills sets to manage the SaaS delivery model can be located internally.

With assistance from cloud partners to provide the necessary skills, a hybrid of skills set between contractors and internal staff should be established. There needs to be a detailed review of the skill sets that reside internally and a holistic understanding of the requirements within the new environment. When working with a cloud partner, internal training and cloud skills development should be a priority to ensure effective integration.

A formal process needs to be undertaken in terms of the recruitment of specific skills required for a cloud environment as well as the skills development of internal resources. For example, knowledge of the backend will allow internal resources to understand the system better.

There was a large dependency on the cloud provider to provide the required skills for the migration as these skills sets were lacking in Company X, and furthermore within the South Africa market. Moreover, Participant C expressed that a major concern was that the cloud partners did not possess enough knowledgeable resources for such the project. This further highlights the skills disparities within the SA market when large cloud migration projects are embarked upon. There needs to be a careful review of the available skills prior to such project and from this a thorough service level agreement with the cloud partner. The onus will therefore be on the service provider to provide the necessary skills and expertise and subsequently, a transfer of skills to super users within the organisation.

CONCLUSION AND LIMITATIONS

The main objective of this study was to explore the factors that may have an impact on a successful implementation of a cloud migration project by in the retail sector in South Africa. A qualitative approach was undertaken using semi structured interviews from three individuals in a retail organisation that has embarked on a cloud migration journey.

The TOE framework is recommended to assist in the process and a shift in mind-set will be required to analyse the potential starting from the initial decision making. The ability to translate requirements and develop new unique solutions to streamline operations post implementation requires specialised skills in order to generate value from the cloud. The integration of cloud within large organisations will impact the entire decision making processes. The onset should be a careful assessment of the problem that an organisation is aiming to solve in order to adopt a specific cloud strategy. This should be preceded by a review of the specific workloads that can take advantage of cloud features to design solutions with a focus on specific requirements. Organisations need to be well informed about the different delivery models in order to determine the most suitable model for their migration.

The study found that a cloud literate leadership team is crucial to the success of a cloud migration journey. Due to the benefits promised by cloud and in order for organisations to be able to leverage the full potential of cloud, the leadership team needs to be aware of the contextual resource influences of cloud implementation specific to their organisation. This will assist decision making regarding the appropriate service model that an organisation can adopt. The study further established that there is a difference in the cost structure between cloud and on premise hosting which also required a shift in outlook. The cloud migration project highlighted the lack of specialised skills in South Africa with regards to IaaS cloud migration that is application based.

Findings from the study highlight the importance of identifying the required skills for cloud migration within an organisation and to fill the skills deficit where required via a partnership model. This can only be achieved with the right cloud partner that has a substantial knowledge base and the ability to upskilling internal staff. This highlights the importance of service level agreements that address management and integration of the migration.

For guidance on where organisations need to start with a cloud migration strategy, best practice guidelines need to be established. Such guidelines will be developed and refined once more organisations embark on a cloud migration journey.

Although skills and competencies is a category of the organisation component in the TOE framework, results have highlighted that this applies to all the elements of the TOE framework. The study further established that there is a skills deficit in South Africa pertaining to the migration and management of a cloud environment.

LIMITATIONS

The major limitation is of this study is as a result of the small sample and case being based on one organisation. Further studies by other retail may be conducted to validate and strengthen the findings. Also the narrative review approach often relies on the researcher's personal preference and may be vulnerable to subjectivity (Yang and Tate, 2012). Even though the organisation adopted a mix of the service model, the main focus of this study was on the IaaS model. This therefore becomes another limitation as there may not be similarities to how skills and competencies may impacting the success of cloud migration in other models such as PaaS and SaaS. This study therefore proposes further research on the implementation of PaaS and SaaS on the availability of skills and competencies.

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