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The Development of Government Information Infrastructure: The case of Government Cloud Computing in Oman

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Abstract

This paper investigates the roles of institutional isomorphic mechanism in Information Infrastructure (II) implementation. It explores a type of cloud computing namely; Infrastructure as a Service in the context of its national government implementation in Oman. The research answers the following research question; how institutional isomorphic mechanisms impact the Cloud Computing Implementation? The findings revealed that institutional isomorphic mechanisms played a major role in the implementation of government Cloud Computing project in Oman and in particular the Coercive and mimetic mechanisms. Practical and theoretical implications of the findings are then discussed.

Keywords: Information Infrastructure, Cloud Computing, Implementation, Institutional Theory, Isomorphic Mechanisms

1.0 Introduction

Research in Information Systems (IS) has traditionally focused on system development and IT governance in organizational contexts as well as studying IS effect on individuals, groups, market and organizations (Sidorova et al. 2008). However, research showed the significant challenges of implementing large-scale complex systems and exposed the existing weak theoretical understanding of these type of large complex systems or information infrastructure (Tilson et al. 2010b). Indeed, the recent wave of digitization and digital convergence invites the call for re-examining our assumptions and strengthening our theoretical understanding.

Cloud Computing (CC) presents one of the new infrastructure technology that disrupts our understanding of systems implementation and infrastructure complexity (Bhat 2013; Choudhary and Vithayathil 2013). It provides not only an alternative hosting of information technology (IT) services but also a standard uniform services for the

entire organisation. The market rhetoric highlights that CC offers a solution for many organisations to obtain IT services faster and more cost-effectively, with shorter implementation time. According to Gartner, these services are growing in number, and organisations are adopting the new trend by implementing cloud-based services (Gartner 2014). The reported successful stories of adopting such a standard information infrastructure contrasts sharply with the accumulated knowledge in IS implementation and IS infrastructure implementation (Star and Ruhleder 1994; Hanseth and Moneteiro, 1997; Hanseth al 1996; Hanseth & Lyytinen, 2006). Moreover, research on government implementation highlights that implementing large information infrastructure is always complicated (Iannacci 2010; Currie and Guah 2007; Avgerou 2000). Since infrastructure implementations in governments are growing dramatically due to the many initiatives to provide better services by using the latest technologies available, it is important to examine how modern IS infrastructure such as cloud computing is being implemented. This examination could offer a fresh perspective on the implementation of standard IS infrastructure. It could also help government agencies to achieve e-government and avoid different implementation complexities.

This study examines the implementation of cloud computing services in the government context of Sultanate Oman. The specific type of cloud computing examined is Infrastructure as a Service (IaaS). The study adopts an institutional perspective considering the important role that institutional context and forces play in systems adoption and implementation (Avgerou 2000; Currie and Guah 2007). This perspective has been recently promoted for IS infrastructure research as it provides a macro perspective regarding the institutional arrangement and context that impact the standards adoption which has been largely overlooked in IS infrastructure research (Iannacci 2010). It also responds to calls for IS researchers to engage with institutional theory as it is conceptually rich and more conceptually suits the examination of complex social phenomenon (Currie 2009)

Institutional isomorphism presents a cornerstone in institutional theory that focuses on the stability of institutions. Adopting this perspective could provide a complementary lens to IS research that focuses on the role of institutions which has been overlooked in

this body of research. This research adopts the lens of institutional isomorphism to understand how they impact the implementation of cloud computing and in particular Information Infrastructure as a service (IaaS). In doing so, it aims to answer the research question: how institutional isomorphic mechanisms impact the implementation of Cloud Computing?

The findings unravel different institutional mechanisms that play a significant role in the implementation of government cloud computing. These institutional mechanisms or forces gloss over local differences and hence play a key role in the successful implementation of the standard large IS infrastructure of cloud computing. The findings also highlight the scope of the institutional proactive intervention in the implementation of cloud computing and show that institutional sanctions, policies and pressure play an important role in the implementation in this context.

The remainder of the paper is as follows. The second section presents a brief literature review of CC and IS infrastructure implementation in government. The third section presents the theoretical foundation of the research. The fourth chapter presents the research method while the fifth section describes the case study. The sixth section presents an analysis of the case study and the seventh section provides further discussion and presents the research's conclusion and contribution.

2.0 Literature Review

This section presents a brief literature review of CC, Information Systems implementation in Government, and IS Infrastructure research in government.

2.1 Cloud Computing

The National Institute of Standards and Technologies defines cloud computing as “a model for enabling 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” (NIST 2009). There are three types of services offered through CC. These types are Software as a Service (SaaS), Platform as a

Service (PaaS) and Infrastructure as a Service (IaaS) (Armbrust 2010 ; Creeger 2009; Durkee 2010). Software as a Service (SaaS) refers to business systems that are delivered as a service using the Internet (Armbrust 2010). Platform as a Service (PaaS) means that the users have a cloud environment in which they can develop their environment and use software that they have developed (Armbrust 2010). Infrastructure as a Service (IaaS) is the most basic model of CC services, where the client simply leases the infrastructure that is needed for the application or business continuity requirements (Armbrust 2010). Moreover, cloud computing could be categorised according to its ownership to three main types: public, private and hybrid. Certain types of cloud emerge according to the interest of particular groups, for example, community cloud or government cloud.

Studies of CC focused on the technical aspects particularly in the area of grid computing and virtualisation. Studies also described the type of services, offerings and the business benefits of the cloud (Buyya et al. 2010; Creeger 2009; Youseff et al. 2008). Studies of the CC can be classified as definitional, or factor-based studies. Within each category, there are different authors who have examined particular phenomena and with a practical focus, contributing to the overall concept.

With the popularity of the CC in the market, Security and data privacy issues become a concern for many organizations as the data or infrastructure are being shared with other organization. Therefore, studies have also investigated the issues of security (Chang and Ramachandran 2016), regulation (Schneider and Sunyaev 2014) , and policies(Armbrust 2010) of cloud computing. Furthermore, studies have the cloud computing adoption from a technical perspective (Güner and Sneiders 2014; Mahmood et al. 2014; Oliveira et al. 2014; Sabi et al. 2016). Few studies have investigated the business values of CC and viewing it from various perspectives. For example, from the vendor's perspective, some studies identified the key players in the cloud business and future cloud strategies (Bhat 2013; Hoberg et al. 2012). Others studies describe the business values from the client's perspective, organisations as well as individuals (Hoberg et al. 2012; Leimeister et al. 2010; Marston et al. 2011). The role of government as a policy maker and regulator is another perspective

(Marston et al. 2011). Specific areas of business have also been studied, such as healthcare (Giniat 2011; Sultan 2014) and CRM implementation (Petkovic 2010).

All of the above studies focused on describing the cloud rather than providing in-depth analysis of how it might affect the business environment or the users. Although the studies above help to find different factors that contribute to the success of CC related implementation, it misses the concern on how and why this technology evolve or become successful in a different setting. This is why it is important to look at CC from the interpretive perspective. Interpretive research related to CC is minimal in volume and depth. For example, Melin et al. (2014) investigated how IT fashions influence the legitimacy of IT decision makers in implementing cloud solutions. They used in-depth longitudinal case studies of two universities from two countries, one in Sweden and the other in Australia, seen through the lens of the Theory of Institutional Legitimacy. They concluded that IT fashions could benefit an organisation as well as harm it. Furthermore, they may improve or degrade the legitimacy of policy makers and bring about shifts in their viewpoints on such technologies.

2.2 Information Infrastructure

Information Infrastructure has originated from the concept of Infrastructure. Infrastructure defined in the Oxford dictionary as “The basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise: *the social and economic infrastructure of a country*”(OxfordDictionary). Information Infrastructure research in information systems has been conducted especially from the 1990s with the advent and ubiquitous use of the Internet (Ciborra and Hanseth 1998; Hanseth and Monteiro 1997; Hanseth et al. 1996). However, it continues to present a thin strand of research in IS. IS field has focused, in general, on IT governance, system development, and in studying IS effects on individuals, groups, organizations, market and limited research on Information Infrastructure (II) have been introduced when compared with overall IS research (Sidorova et al. 2008). For example, one of the studies that reviewed articles published in ISR and MISQ during the past 20 years reveals that around 2% of articles have focused on infrastructural issues (Tilson et al. 2010b). Tilson et al. (2010a) argue that the dearth of well-published examples could be due to the huge obstacles in

studying large-scale complex phenomena which do not fit with many IS researchers' techniques. They also highlighted the existence of a weak theoretical understanding of Information Infrastructure as a new form of IT (Tilson et al. 2010a).

Several authors have defined Information Infrastructure. Tilson et al. (2010b) for example, defined Information Infrastructure as a group of technologies and human elements, networks, systems and process that contribute to the functioning of an information system. Moreover, Hanseth and Lyytinen (2010) defined Information Infrastructure as: "a shared, open (and unbounded), heterogeneous and evolving socio-technical system (which we call installed base) consisting of a set of IT capabilities and their user, operations and design communities".

For the purpose of this study, the Information Infrastructure definition developed by Hanseth and Lyytinen (2010) is adopted. This definition highlights both the structural properties and the emergent properties of Information Infrastructure that distinguish it from their constituent elements.

Earlier studies of Information Infrastructure tend to focus on how to conceptualise Information Infrastructure (Monteiro et al. 2014). These studies conceptualised different topics in Information Infrastructure such as design (Pipek and Wulf 2009; Star and Ruhleder 1996) and standards (Hanseth et al. 2006; Hanseth and Monteiro 1997). Some studies attempted to conceptualise Information Infrastructure based on contrasts between local and global contexts (Ribes and Finholt 2009; Ure et al. 2009) and between system design and implementation (Braa et al. 2007). Other studies in Information Infrastructure introduced a new way of developing new language and plan for understanding Information Infrastructure (Sahay et al. 2009; Ure et al. 2009). Moreover, the elements of standards have been explored by many authors as they highlighted the area of standard making (Hanseth et al. 2006; Lyytinen and King 2006), control (Ciborra et al. 2000; Nielsen and Aanestad 2006), evolution (Braa et al. 2007; Henningsson and Henriksen 2011) and the tensions between control and evolution (Hanseth et al. 1996).

Building or developing an information infrastructure has many challenges to mention but a few: inertia, time, costs and complexity of implementation. Research into the process of implementing information infrastructure had identified many issues that should be considered when contemplating on introducing information infrastructure. For example, tension between standardisation and flexibilities (Hanseth et al. 2006), tension between top-down and bottom up governance (Constantinides and Barrett 2014), local and global standardization (Silsand and Ellingsen 2014; Star and Ruhleder 1996), paradox of control (Nielsen and Aanestad 2006), paradox of change (Braa et al. 2007), bootstrapping issues (Hanseth and Aanestad 2003), legitimation (Constantinides and Barrett 2014), and interpretation.

These studies highlight that Information Infrastructure address multiple locales, phases, and timescale. Information Infrastructure research has traditionally focused on examining the micro-practices of designing, implementing and using IS infrastructure with little attention to institutional practices for its adoption and implementation Pipek and Wulf (2009). It has also been criticised for its theoretical and methodological weakness and the domination of short-term and single site examination of technology implementation Pollock and Williams (2010) Monteiro et al. (2014).

3.0 Theoretical Foundation

This study adopts concepts of isomorphic mechanisms from institutional theory as a theoretical lens. Many studies have investigated Information Infrastructure implementation challenges as mentioned earlier, however; most of these studies addressed it from the technical angle of Information Infrastructure development such as data standard and standardisation procedures, and less attention is given to the institutional perspective (Iannacci 2010). Studying Information Infrastructure from an institutional perspective is important, as there is limited systematic consideration of the influence of institutional perspective from broader context on the form and dynamics of Information Infrastructure—even though such an assessment would have immediate implications for Information Infrastructure policies. Monteiro et al. (2014)

highlight that studying Information Infrastructure from institutional theory perspective “can be a major enhancement to examine what scope exists for proactive Information Infrastructure interventions, policy, and governance—and how these may vary under different Information Infrastructure forms and settings” (Monteiro et al. 2014). Moreover, studies that are using institutional theory in IS field have generated criticism from IS community as they are conceptually rich but empirically impoverished (Hasselbladh and Kallinikos 2000). Hence, studies which empirically use institutional theory will be a valuable contribution to the IS literature.

This research argues that it is important to shift the focus from social problems to more in-depth effects of environmental pressures to determine the formal structure, functions and related aspect of organisations (Meyer, 1979; Tolbert and Zucker, 1994; Teo et al., 2003; Scott, 2008:37). Institutional theory has gathered various aspects of the organisations including the economic, political and social pressures context (Carroll and Delacroix, 1982; Teo et al., 2003). Returning to the effect of environmental pressure on the organisation, institutional theory utilises the various aspects of the organisations by examining three types of mechanisms which are coercive, normative and mimetic mechanisms (DiMaggio and Powell, 1983; Tolbert, 1985). These three mechanisms have been identified by many researchers, such as DiMaggio and Powell (1983), Tolbert and Zucker (1994) and Teo et al. (2003), as the isomorphic mechanisms which are usually driven by either interconnected relations or structural equivalences. Table 1 describes these three isomorphic mechanisms.

Table 1: Institutional isomorphic mechanisms.

Institutional Mechanisms	Description	Examples
Coercive	Result of both formal and informal pressure posed by one organisation on the other organisation upon which they are dependent and by cultural expectations in the society within which organisations function(DiMaggio and Powell 1983)	Centralised policies, political power, and rules and regulation
Normative	the normal social action that considers particular types of processes or behaviours as legitimate(Scott 2001)	Professional, experience, training and education
Mimetic	occur when new organisation technologies are poorly understood and when goals are not clear, and their environment create uncertainty; the organisation then tend to model themselves on other organisations(DiMaggio and Powell 1983)	Mimetic culture, taken-for-granted, best practices

In the field of Information Systems, the institutional theory has been applied throughout different industries including the government sector. Different area of government has been studied using institutional theory; some studies addressed this theory from national level (Grimshaw and Miozzo 2006; King et al. 1994); whereas others used it to study a single organisation (Davidson and Chismar 2007; Gosain 2004).

Few studies have used institutional theory to study Information Infrastructure (Brown and Thompson 2011; Hanseth and Monteiro 1998; Iannacci 2010). For example, Iannacci (2010) describes the role that institutional facts play in the development of Information Infrastructures in public sector projects. He argues that the previous approaches focused more on the technical side of the installed base at the expense of the institutional installed base.

4.0 Research Method

This research adopts a qualitative interpretive approach which allows in-depth exploration of social and cultural phenomena (Myers 2010). Myers (2013) argues that the qualitative research approach allows scholars to examine the social and cultural phenomena. Moreover, the interpretive approach assumes that people create and interpret their own independent and inter-independent meanings as they interact with the world around them (Orlikowski and Baroudi 1991). It advocates that it is necessary for the researchers to understand differences between humans in their role as social actors (Saunders et al. 2007).

When looking for this research question, the case study approach is the best-fit to answer the research questions. This research is about the isomorphic mechanism that influences the Information Infrastructure implementation in government. Benbasat et al. (1987) emphasised that case study approach consider a well-established method to study IS data and analysis of data. Also, Cassell and Symon (2004) explain that a case strategy research is a detailed exploration of the data collected over a different period within their context. This type of approach is well suited to the research questions that require a detailed understanding of processes because of their rich information

context. The level of analysis of this research is on the national level as the government CC project is being implemented by the whole government. Moreover, different government entities are utilising or are in the process of utilising the government cloud. This type of case study is considered as an embedded (*Multiple units of analysis*) single case (Yin 2014). Moreover, the case study involves an embedded agency which is a user of government cloud. In the embedded unit, various organisational practices are identified against the isomorphic mechanisms.

The research reported here is part of a wider project to examine the implementation of government cloud in Sultanate of Oman. Data collection includes 30 face-to-face interviews with senior managers, managers, technical staff and vendors of Information Technology Authority of Oman (ITA) and the Ministry of Health (MoH). Interviews were conducted in the period between 29/07/2015 and 27/12/2015. All interviews were recorded and transcribed verbatim. Interviews lasted between 40 minutes and two hours with an average of one hour. Interviewees were chosen from management and technical levels on the basis of their involvement in G-cloud. Documents were also reviewed including government reports, vendors' reports and presentation slides, websites in addition to technical manuals and reports. All transcriptions and documents have been carefully read and were subject to open coding. The data were not forced into categories but allowed the data to be integrated by making notes in new categories. For example, coercive and mimetic mechanisms were much prominent in the data than normative mechanisms reflecting that they had a stronger influence in the implementation.

5.0 Case Description

The case study explores the implementation of the national government CC project in Oman (Oman G-Cloud). Sultanate of Oman is a country located in the Arabian Peninsula bordered by United Arab Emirates, Saudi Arabia, and Yemen. Oman is part of the Gulf Cooperation Council (GCC) which also includes the following countries; Saudi Arabia, UAE, Qatar, Bahrain, and Kuwait. The GCC objective is to enhance, integration, coordination and interconnection between the members in all areas to achieve unity (GCC 2015). The United Nations Development Programme in

Human Development Index considered GCC countries in 2015 as “very highly ranked” in human development, and Oman is ranked 52nd in this index(UNDP 2015) compared to developing countries. Moreover, the United Nation’s E-government Survey in 2014 ranked Oman 48th in the E-government development index increasing 18 ranks from the 2010 survey. GCC countries, including Oman, are highly ranked in development indexes and currently placed right behind developed countries and well above other developing countries. This unique status of GCC allows them to be studied independently. Also, they share similar cultural, economic, social and political characters which can be different from other developing countries.

Oman G-Cloud is one of the e-government initiatives where the implementation started in 2014. The initiative is intended to provide services to the government agencies in Oman and to set up a shared infrastructure including servers, network, storages, applications where all government entities’ IT infrastructure requirements are met by offering it through one agency. Having G-Cloud in place, government agencies can focus on their core business, reducing the IT budget, increasing their agility and providing the public e-Services at higher efficiency (ITA 2015). ITA has proposed to all government agencies a government CC services to achieve its e-government objectives and integration. ITA decided to implement the private cloud model. The private cloud is a model where the cloud infrastructure is operated exclusively for an organisation. This model can be managed by the organisation or a third party, and it can be within the organisation premises or outside (Mell and Grance 2011). With this model, the ITA has decided to build G-Cloud using Open Source (OpenStack). Using Open source was a strategic decision to avoid the lock-in challenges of the off-the-shelf package along with many other typical benefits of open source. ITA realises the open source has disadvantages such upgrades and lack skilled staff. However, ITA finds the advantage of adopting the open source technology outnumbers the disadvantages of off-shelf technology. Therefore, on December 19, 2013, ITA signed an agreement with Nortal, an international software development company for the supply, design, delivery, implementation and operation of the G-Cloud for three years. During the time when the data collection was conducted for this research, there were several projects which were hosted through the

G-Cloud. One of these projects is the Ministry of Health(MoH) e-portal (MoH e-portal) which is the focus of this paper.

Table 2: Case study description details

Agency/Project	National Government Cloud Computing	Ministry of Health/ e-Health Portal
Level	National	Embedded case
Main Objectives	An Infrastructure Platform for all government agencies	e-Health portal for Patients, business, government agencies, and Internal employees.
The Vendor	Nortal (Fully Involved)	ICT Health (Fully Involved)
Project Start Date	December 2013	May 2014
Project Completion Date	December 2016 Three-year contract Implementation and Maintenance	Officially launched December 2015 on the main stage
Project Type	Establishment a national G-Cloud	New portal
Date Joined the G-Cloud	---	May 2014 with Mini Cloud July 2015 with the G-Cloud

6.0 Data Analysis

This section shows the different organisational practices that led to the implementation of cloud computing in MoH.

6.1 Coercive mechanism

Organisational practices of the coercive mechanism have taken the dominant role in the implementation stage of the G-cloud. Although the ITA staff highlighted during the interviews that ITA is not forcing anyone to join the G-Cloud, the practices that ITA have conducted during the implementation indicate that agencies had institutional pressures over them. These practices are categorised as political power, centralised policies, financial resources, rules and regulations, compliance and standardisations.

One of the most noticeable coercive practices is the political power over the agencies to use G-cloud as IaaS. ITA gives priorities to projects that are considered important nationally and do consider projects from selective agencies as necessary projects for the country. One of the senior managers in ITA explains: *“we are giving priorities to the e-transformation projects, many of the e-transformation projects are under*

development or on planning phase, so it makes it easy for the organisations and for ITA to build their application on the G-cloud-enabled environment from the start". Therefore, there was political pressure practised by these agencies to join the G-cloud. Also, ITA is mandated by the Council of Ministries office to achieve e-government which provided more political power on ITA over agencies, and MoH is one of them. MoH is one of the agencies who had to comply with these policies. The ITA senior executives had a good relation with the MoH senior managers, which helped the implementation of G-Cloud. One of the IT management team in MoH states that *"The decision was made by a senior manager in Ministry of Health and a senior manager in ITA to join the G-Cloud and the G-cloud team in ITA, and the member of the evaluation team in e-tender have evaluated which company who will do the implementation of e-health portal along with hosting it in the G-Cloud"*. This power is a reason that a good number of IT staff were not involved in decision making. Another senior IT staff in the MoH says, *"Honestly, I am not involved in why they have decided to go with G-Cloud, I am only concerned with the part after they have decided"*.

When it comes to the financial practices in the G-cloud, all the staff who has been interviewed in MoH agreed the zero charge policy was an incentive to join the cloud. ITA funded the MoH e-portal projects, which mean that finance played an important practice in G-cloud implementation. One of the project members added that: *"joining the G-cloud was mainly to save cost on the hardware. It was the time we were finalising the tender, and then the ITA was offering this solution, and it was offered for free"*.

Another factor that is having a major influence in the G-cloud implementation is the security standards. ITA allows government agencies the freedom of doing whatever they want within the scope of the agreement. However, the ITA vendor's architect explains that scope of the agreement in how to enforce security policies and other requirements before opening the service as he said that the G-cloud is a *"security sensitive project"*. Moreover, the Information Security Division (ISD) played a major role in the G-cloud implementation by assuring the ITA vendor and the government entities are following the security guidelines strictly. A senior manager of Information

Security Division is a member of the G-cloud steering committee, and he makes sure that the security standards are met based on best international practices from the top level. These standards have been taken mainly from the cloud security alliance (CSA) which is a component of National Institute of Standards and Technology (NIST) and some standards which have been drafted by the ISD team. A senior director in the ISD explains: *“We have mediated these standards for the cloud, we work as an ISO for the cloud. We have mandated the government cloud must meet these standards, and we have been auditing them against these standards plus our standard”*. Although, these standards are mandated by the ISD to be applied in G-cloud implementation, and for agencies that are getting services from the G-Cloud, there are no clear documented guidelines for them to follow.

The issue of imposing security standard has been highlighted many times by the MoH staff. These standards have been elaborated differently, depending on the different group of people and how well they understand and in which group level they are from. For example, the management sees imposing standards and controls are important as it will enhance their application and make it secure from potential attacks, and the technical users consider these controls and standards are delaying their project to go live, and it becomes more difficult for users and technical staff.

While ITA imposed these standards, some IT staff resisted some of these standards and had negotiated to make sure that their project can be completed and becomes user-friendly. For example, MoH portal team had issues with security standards which affect many modules to go online. Therefore, the MoH pushed the G-cloud team to ignore and bypass these security blocks so they can go live and try to solve the issue later. One of the managers in the MoH explains, *“ITA wanted to impose their standard in our system especially the security standards. For example, they had many concerns, and we asked them to give us many exceptions. Also, at the time we first started the portal we had created different subsites for various directorate and hospital, for us for the portal to upload the information almost every action we took nearly every click returned an error from ITA, because they had to analyse every traffic to make sure it is not an attack, so they had to make an exception on their system to make it pass”*.

6.2 Normative mechanism

Several normative practices have also facilitated the implementation of cloud computing in MoH. These practices are related to the professionalism of the agencies team; general knowledge about the CC, culture acceptance, the experience of staff, and training. The role of professionals was evident in the success of implementation to the G-cloud. MoH professionals had much more knowledge on how the CC operates. The vendor's senior manager along with ITA team solved many issues related to implementations. It was a learning experience for both the ITA G-Cloud team along with the MoH team. One of the managers in MoH states, *"I know cloud can provide you with high availability and can have an endless amount of space"*. Another senior manager in the MoH also adds that *"ITA had several seminars and they have invited us. We understand it, and we encourage it"*. However, IT staff who were not involved in the decision making to join the G-cloud did not have enough knowledge of the benefits of it. For example, the security manager in MoH says that *"I honestly don't know the details about its functionalities. They did make a presentation about the G-Cloud, I did not attend"*. The limited knowledge contributed to the implementation challenges. However, the vendor project manager who was heavily involved in the implementation states in one of the cases by how the knowledge is necessary by declaring, *"it was a learning curve, it was more of the staging environment, and we fix it, they would not replicate these rules into production, so we told them whenever you list something on the staging or production, you have to synchronize both servers"*. Although there were different views on the G-cloud, all the e-health team agrees that G-Cloud is given better implementation flexibility for them.

When it comes to the training in using the G-cloud, all agreed that training is necessary for general knowledge, however, the professionals who know how the G-cloud functions understand that there is no need for a professional training on the cloud but only training on how to set up the interface which is considered as the main objective of G-cloud. A senior manager in MoH explains that *"ITA provided us with a workshop on how to implement and how to configure the system and how to host the*

system. Since we are the only organisation and they are helping us as much as we can, and we feel we are lucky”.

6.3 Mimetic mechanism

Mimetic practices played a major part in the implementation of the e-health. Participants were convinced that the implementation of this standard II, however, might not suit their needs, cannot be escaped as they perceived it as presenting an international standard that other countries and organisations adopt. They believed that since others implemented it, then they had to implement it as well. This view has surfaced in most interviews. For example, one of the managers of the e-health portal describes the G-cloud as *“a new trend in hosting government network”*. The e-health portal management also adds that *“If you look at other countries experience you will find that they have one portal for the whole government and G-Cloud would help in this one portal”* and the network manager adds *“I believe the whole world is going to the cloud”*. Therefore, the relevant best practice was present when adopting this project.

Another mimetic practice is creating MoH to be a role model for other agencies who have to interest to join the G-cloud. The DG of IT states, *“Also the ITA want to health portal to be a good showcase for them, and they are trying hard to give us the best service for us. Also, their security standards a very high and they have the advantage over others”*.

7.0 Discussion and Conclusion

This research started by questioning how institutional isomorphic mechanisms influence Information Infrastructure implementation. It examines the case of national government CC in Oman and in particular the implementation case of Ministry of Health e-Health portal. The research findings showed the existence of isomorphic mechanisms that lead to the implementation of CC standards to the e-health portal. This is consistent with other research findings which also showed the existence of isomorphic mechanism in the implementation of government information systems(Currie 2012; Gozman and Currie 2014; King et al. 1994; Liang et al. 2007).

The case study showed that mimetic forces were a driving force for the implementation of cloud computing in Oman. This finding differs from Currie (2012) work where institutional isomorphic forces become conflicted with efforts to impose organisational change. This was evidence when IT professionals in MoH negotiated the standards, which were enforced by the G-cloud team over the e-health portal. However, the study revealed that the resistance has not resulted in implementation failures as the National Health program in Currie (2012) study. The ITA agrees with the modifications of some standards to ensure that the e-portal is up and running for its users. The study also in line with the work of Gozman and Currie (2014) that shows the extent on how systems enable the alteration of previously embedded practices. With the introduction of the government CC, the ITA were able to impose these standards. The study shows that imposing standards from the top government agency (ITA) to local agency (MoH) in Information Infrastructure project is possible as it reveals in government CC case in Oman.

The research shows that MoH encouraged by the market rhetoric of CC as a way to solve the complexities and save cost when implementing large Information Infrastructure in a government organisation. It shows that this government initiative seems to be very positive toward this kind of implementation. This indicates that market rhetoric and mimetic forces could drive organisations and involved actors to believe of the essentiality of implementing such a standard and reduce the contesting of it. These findings contrast what previous II research emphasised regarding the negotiation, contesting and resistance of standards implementations (Hanseth and Lyytinen 2010; Sahay et al. 2009). Future II research is invited to examine further the role of market rhetoric and mimetic forces in implementing cloud computing and other large standard infrastructure. Information Infrastructure literature highlighted the technical and sociotechnical complexities when dealing with large, complicated infrastructure. While these studies have explained the role of Information Infrastructure as a guideline for intervention, it is important to explore how Information Infrastructure system such as IaaS can be implemented through government interventions. The study shows that the national government used the G-cloud as a method to impose its standards on MoH portal.

Therefore, looking at an implementation case study that involves a cloud implementation can help in finding out whether this technology is a different case on what Information Infrastructure have highlighted in previously. Evidence of the problems and failures of centralised control in public sector infrastructure development from top-down are clear in the literature (Adler-Milstein et al. 2008; Currie and Guah 2007). The case study shows that the G-cloud implementation that comes with standards from a national government can be achieved.

The study also contributes the institutional role of Information Infrastructure studies which has not been sufficiently studied. When looking at the role of institutions in Information Infrastructure implementation, it is noticeable from the Information Infrastructure literature that there is a dearth of knowledge in this area of research. The previously limited research on Information Infrastructure and Institutional Theory have not highlighted this gap of the new approach of the centre telling you to implement national standards (Brown and Thompson 2011; Iannacci 2010). The study shows how the organisational practices lead to institutional isomorphism within government agencies.

Additionally, the study also shows how that CC as a new form of Information Infrastructure and as a disruptive technology are changing the way how implementation is being done.

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