



Public organizations flying in the cloud: A case study of cloud computing value creation in Moldova central public administration

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Abstract

As information technology (IT) becomes an integral part of society, public sector organizations have witnessed an increasing shift in how they deliver services to citizens. One area of IT that has contributed to this transformation in service delivery has been in the domain of cloud computing. Extant research has focused on the factors related to the adoption of cloud computing within public sector organizations, however, little is known about how cloud computing creates value in public sector administration. Addressing this, we conduct a case study research on the Moldova central public administration to investigate how cloud computing enhances value in public service delivery. Accordingly, we identify seven ways cloud computing enhances value creation in public administration. Among those values, faster service delivery, transparency and accountability are values rarely highlighted in the previous academic research. Based on our results, we propose solutions that public administration should take into consideration when utilizing cloud computing as a service delivery model.

Keywords: *Cloud Computing; IT value; IT strategy; Government Infrastructure; efficiency; agility; Shared Government platform; Cloud Architecture; IT innovation; services in the public administration; IT policy*

1. Introduction

Value creation through IT represents a core and unsettled issue in IS research. This importance has increased over the last decades given that IT is merely not an integral part of organizational life, it has rendered conventional mode of organizing and value creation unsustainable (Agarwal and Lucas, 2005). While numerous empirical studies have focused on assessing IT value from the perspective of private sector organizations with emphasis on IT-Business Value related to economic factors such as cost-benefits analysis, competitiveness, productivity, profitability (Brynjolfsson and Hitt, 1996; Wegen and Hoog, 1996; Bharadwaj, Bharadwaj & Konsynski, 1999; Anderson, Banker & Ravindran, 2006), there is a dearth of empirical research focusing on how IT creates value in public sector organizations. This lack of attention is quite surprising given that public sector organizations will be the leading actors in the utilization of cloud computing services (Wyld, 2010). Understanding the value cloud computing brings to public sector administration is thus important because it helps policy makers to fully exploit the value potentials of cloud computing (CC). According to the National Institute of Standards and Technology (NIST) official definition, "CC is 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, p.2)". CC changes the conventional modes of organizing, where IT resources and applications are acquired

as individual products and used locally on a local infrastructure to a ***Cloud computing model*** where the user acquires only the remote access to the desired resources via the Internet. So, instead of paying the full price for hardware and software, the beneficiaries of CC are paying only for the service they use (pay as you go). According to International Data Corporation (IDC) the cloud services market is now entering an "innovation stage" that will boost new cloud solutions that will contribute to a massive shift toward CC, estimating a growth of IT cloud industry to \$127 billion by 2018 (Gens, 2014).

Despite being a relatively new form of emerging technology, the use and rapid adoption of CC in the public sector has been remarkable (Wyld, 2010). This is quite surprising given that public sector organizations are often considered to be last movers when it comes to new technology adoption (Harvard Business Review Analytic Services, 2014). While prior research on CC in the public sector has discussed adoption and barriers to CC (Wyld, 2010; Rahimli, 2013; Busch, Smith, Gill, Harris, Fakieh & Blount, 2014; Zhao, Gaw, Bender & Levy, 2014), there exist scanty research on empirical accounts of how CC creates value in public sector administration. Against this backdrop, this thesis will be guided by the following research question: *How does cloud computing create value in the public sector administration?*

From a practical perspective, this research seeks to provide guidelines on how CC enhances an efficient and innovative public sector administration. Such guidelines are important to guide policy makers within the public administration as they make decisions on IT considerations. Theoretically, this research seeks to contribute to IT value research by highlighting other non nominal considerations or factors important for IT-value Research. Answering such a question also falls in line with recent calls within the IS research community on the need to understand how IT adds value in organizational life (Kohli and Grover, 2008). In addition, this research, partly comes at a time when there is a growing recognition of today's digitized society (Pang et al., 2014; Garrison, Wakefield & Kim, 2015, p. 390). For example, more and more people are in possession of divers sort of technologies such as (smartphones, tablets, intelligent glasses, smart watches), they communicate, interact and do business with the help of IT. We believe that public sector, which is traditionally considered inert, must adjust to the needs of its citizens and deliver real-time and qualitative services. To make this happened, the public sector needs to increase its administration's efficiency by harnessing the power of digital technologies. Thus, the public sector has an opportunity to tap the tremendous potential of cloud computing by increasing efficiency and reacting faster to the administrative needs in order to better serve the general public. We believe that analysis of the ultimate technological know-how in a traditional, and bureaucratic environment like public sector, makes an interesting perspective IS research in general and particularly in IT-Value research.

2. Literature review

In this chapter, we present a review of previous relevant scientific studies in the area of the research problem. In order to understand the value of cloud computing on the performance of public organizations, it is important to understand what both value and cloud computing is, thus we begin with defining the term of IT value, then defining cloud technology by highlighting the essential characteristics and models. Next, we take a closer look on how information technologies are being used in the public sector, focusing on CC adoption. Since the extant research addressing the value of cloud computing on overall public sector performance is limited, this section focuses on defining performance factors in close relation to public sector business processes. The aim of this chapter is to gain a deeper understanding of the topic by creating a frame of reference for fulfilling the study's purpose and answering the research question.

2.1 Value of IT

Information and communication technologies are an omnipresent force that are shaping the way people live, communicate, interact and work. While each of us is sensing the value of IT on a daily basis, from micro and macro level perspective –research examining the value of IT remains diversified and complex. So far, IS research has been focused on assessing IT value from a private sector organizational perspective, generally addressing economic factors as cost benefits, competitiveness, productivity, profitability (Brynjolfsson and Hitt, 1996; Wegen and Hoog, 1996; Bharadwaj et al., 1999; Anderson et al., 2006). Such studies have often focused on the business value of IT, expressed in cost-benefit analysis. However, such a view of IT value does take into account other aspects of value that can't be explained in monetary terms. While researchers put forward various complexities in quantifying the value of IT in an organization such as a lack of theoretical bases for investigating IT value in the public sector (Pang et al., 2014) political environments and bureaucratic nature of organization (Bretschneider, 1990) our objective in this study is to investigate various ways IT create value in public organizations. While the business sector uses various ways of measuring performance, such as sales revenues, productivity, etc., public sector - on the other hand deals with non-economic values, such as transparency, accountability, and democracy (Pang et al., 2014). In this sense, only few papers have investigated the impact of IT on non-economic value such as accountability (Seltsikas and O'Keefe, 2010), transparency and trust (Kim and Lee, 2012). Such a situational context indicates that public and private sector organizations offer completely different context when addressing the value of IT.

Public managers can create value by increasing the quality of services, reducing costs and by ensuring the integrity with which public sector organization operate (Moore, 1995). In this paper, we will treat the value of IT in the public sector of Moldova from the efficiency of the public services, increasing collaboration through the government agencies, accountability, etc. of the system.

2.2 IT in Public Sector

Modern information technologies have made governments across the globe realize the potential value of using IT tools to leapfrog from the preconceived traditional, inert, bureaucratic organization to an efficiency oriented body that delivers on-time and in-time public services for its citizens. By harnessing the power of ICT, public sector seeks to improve public service delivery and increase internal efficiency and productivity. Governments are becoming proactive in this domain by investing massively in IT in order to improve public services, optimize internal processes and revitalize democracy (Bhisikar, 2011). However, the changing nature of technologies implies constant infrastructure updates that the public sector cannot usually afford (Singh and Chandel, 2014). Therefore, more governments around the world are shifting to cloud technology, leveraging economies of scale and reducing spending on technology infrastructure. A research based on data from 200,000 users at government organizations in the United States and Canada revealed that an average public sector organization uses 721 cloud services, which is 10-20 times higher than what IT expects (Skyhigh, 2014). Wyld (2010) predicts that the government will be the leading sector in the development of cloud computing across the wider economy. Before moving on to how Cloud Computing is actually creating value for public sector, let's have a closer look at the major characteristics of this technology.

2.3 Cloud Computing

Cloud Computing is considered a true turning point in the history of computing (Wyld 2010). This is due to a totally different delivery model of IT resources. If in traditional model, IT appliances are provided as independent products which are sold from a vendor to a user, being used exclusively on a local infrastructure, then the CC paradigm enables the provision of IT resources as services (not as products) available remotely via the Internet (Cellary & Strykowski, 2009). Therefore, the CC model disrupts the entire computing industry by shifting the acquisition from a product to a remote access to it. By doing so, the beneficiaries of CC (individuals, users, enterprises, public organizations) are charged on utility basis or “pay as you go” – similar to utility services such as electricity or gas (Low, Chen & Wu, 2011). This approach highlights one of the main characteristics of Cloud Computing, which are dynamic resource accessibility and massive scalability (Low et al., 2011; Singh, et al., 2014). Cloud computing has three service models (see Appendix Table 1) and four deployment models (see Appendix Table 2).

For individuals, cloud computing means accessing web-based email, social media platforms, peer-to-peer file sharing, photo sharing, etc. For organizations, moving to the cloud has a more economic value due to cost savings that result from hardware and software non-acquisition. And finally and most important for our research - for governments, adopting cloud is especially attractive given both changing demands for IT and challenging economic conditions (Wyld 2010). Additionally, benefits such as elastic scalability, flexibility and high availability of

resources, making cloud computing highly attractive among private and public sector organizations (Zhang, Cheng & Boutaba, 2010).

2.4 “Cloudy” Public Sector

Let’s have a closer look on how Cloud Computing creates value in the public sector. The United States, European Union, Japan, South Korea and Australia are just a few examples of CC pioneers in the public sector-domain. Internationally, governments decide to adopt shared technologies to improve public sector efficiency (Low et al., 2011), ensure responsive delivery of services while offering higher service quality and enable green IT (Bhisikar, 2011). Wyld (2010) argues that before moving to a cloud environment, government executives need to consider the potential savings, increased collaborative capabilities and operational advantages with the security, reliability, and privacy concerns. However, adopting cloud computing in the public sector is not so easy and as smooth as in the private sector where only the CEO decision is required. Governments – besides facing a multi-level decision on this issue and timely policy planning, have to face more challenges in adopting G-cloud (government cloud), such as: regulation or the legal framework for CC that aims to ensure the availability, accessibility, and data privacy at a national level (Busch et al., 2014); cyber security of public data hosted in the cloud due to highly sensitive data that can harm the country and citizen’s security (Busch et al., 2014). All this specific public sector characteristics makes an interesting blend between technologies and governance act, therefore we would like check how IT is impacting the public sector per se. More Governments around the world are embracing cloud technology (Wyld, 2010); for example, U.S. federal government adopted cloud to in late 2009 to cut costs, improve efficiency, green environmental policy; the European Union has created the “Euro Cloud”; Japan built “Kasumigaseki Cloud” to facilitate information resources sharing and integration among government agencies. However, scientific research lack in investigating the value and impact of this technology. This paper aims to fill that gap.

2.5 Efficiency improvement and value creation

Value creation in relation to the public administration cloud usage can be measured in different ways. Efficiency and effectiveness of the services are one of the main ways of achieving greater value in public administration (Pang et al., 2014). Thus, improving the quality and the quantity of the public services will increase the capability of the service delivery in public administration and create value to the whole nation. However, previous researchers have not been explicitly clear on the defining of the efficiency as regards public administration value creation. However, within this thesis, we have adopted the following definition of the efficiency to identify the public administration value creation in relation to the efficiency improvements. “Continual Service Improvement - A measure of whether the right amount of resources have been used to deliver a Process, Service or Activity” (Knowledgetransfer, 2015).

According to the adopted definition, an efficient process is capable of achieving its goal with the minimum amount of money, time and resources (Knowledgetransfer, 2015). Based on the discussions in previous research, the efficiency improvement in public administration can be

mainly divided into two areas as follows. Efficiency in operational activities due to efficient use of resources and efficiency of services due to the increase of service responsiveness. Value creation in operational activities is extensively discussed by the previous researchers (Chou, 2015; Marston, Bandyopadhyay, Zhang & Ghalsasi, 2011) but the impact of service efficiency in public administration value creation is rarely addressed by most of the previous researchers. Nevertheless, adopted the definition of the efficiency states the importance of the continual service improvement in order to create value in public administration. Therefore, we would focus more on value creation in related to the service efficiency in this study.

2.5.1. Value creation in the operational activities

Efficient use of resources is related to better utilization of the available human and physical resources in order to get the maximum benefits out of it. In a cloud infrastructure, most of the computer hardware is handled by the cloud providers. Therefore, cloud users do not need to invest a large amount of money on purchasing and maintenance of such equipment and they can pay for the usage of the cloud infrastructure (*pay as you go*). Thus, cloud computing leads to decrease the hardware cost and the infrastructure maintenance cost significantly (Miller, 2009). For instance, (Wyld, 2010) argues that general service administration of the federal government expected to drop the infrastructure cost by 90 % and significant energy savings after shift into the CC, while offering improved services to the general public. Moreover, fewer computer hardwares save computing power and promote green IT in public administration (Chou, 2015).

Server virtualization in CC decreases required number of physical servers significantly. Clients are accessing the cloud resources through the middle tier. When there is a bottleneck in a server, clients have the possibility to access to other virtual servers in the middle tier those are dedicated to carry out the same task (IIIT, 2010). Such an efficient technology helped to increase server utilization by 60-70 % in federal government IT usage (Kundra, 2011, p. 7; Dimitrov & Osman, 2014). Moreover, virtualization technology is capable of creating clone servers in order to minimize the actual server needs of an organization (Pocatilu, Alecu & Vetrici, 2010). In addition to that, cloud servers also have the capability of automatically balance the workload at peak and non peak times (Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica & Zaharia, 2009; Miller, 2009). As such, there is no need to buy equipments to handle load balancing needs. Such a built in capability helps to minimize the server downtime and provide an efficient service to the cloud users.

Cloud computing simplifies the application development and management of such applications due to the high availability of required softwares on the cloud. Thus, cloud users no need to bother about software maintenance cost, license cost and upgrading cost since these tasks handled by the cloud providers (Dimitrov & Osman, 2014). This kind of environment is ideal for inventing and deploying new innovations in the public services. Normally, public administrators simultaneously execute several application development projects in order to facilitate convenient services to the general public. Therefore, this is an ideal opportunity to effectively serve the general public and create value in the public administration of Moldova.

Chandrasekaran & Kapoor (2011, p. 3) pointed out that order processing is time consuming due to the hierarchical operational procedures in the public sector. But the cloud architecture has built in capability to overcome such barriers by dynamically allocating required resources when needed. Nevertheless, in legacy IT systems, it takes long time and incurs more cost to handle such needs due to the difficulty of scaling the IT infrastructure (IIIT, 2010). Therefore, we would explore how public administration in Moldova addressed this issue in their new cloud infrastructure.

2.5.2. Value creation in the service activities

Kundra (2011, p. 5) states that, duplicative systems lead to fragmented demand for the IT infrastructure resources and complex IT system environment. Nevertheless, Chandrasekaran & Kapoor (2011, p. 3) argue that CC set up a common platform for the services in the public administration. A unique digitized platform based on cloud computing has the possibility of increasing the collaboration among different agencies and different non government organizations. That will enhance the co-production capability due to the sharing of information and expertise among them (Pang, Lee & DeLone, 2014). Duplicative systems always generate redundant data to the users and the quality of the information produced by such systems is questionable. Sometimes that type of information can confuse the users' mind and mislead them. In addition to that, several system logins and different instructions waste users valuable time, while creating higher maintenance overhead to the public administration. These IT system qualities related drawbacks will badly affect the public engagement with the government IT services and perceive unpleasant user experiences on the user's mind. As such, it is essential to have a unified IT system to produce quality and reliable information to their users. Such a unique digitized platform is capable of eliminating fragmented demand for the IT infrastructure resources by accessing common applications stored in a single data center. Thus, cloud computing makes easier to manage the vast amount of services in the public administration of Moldova. Users can expect reliable, secure and more convenient service from such a unique IT system. Therefore, we would investigate how cloud computing helped to eliminate duplicate systems and create value in the Moldova public administration.

Kundra (2011) argues that automated management and on demand self service in cloud services leads to decrease the IT personal involvement in routine tasks and delivering services faster than never before. In a conventional IT system environment, the IT officers were available for fixing the bugs immediately. But it is questionable whether the cloud providers react immediately to solve their clients' system failures. Furthermore, Wang et al. (2011, p. 4) presents some examples related to substantial financial and customer losses due to service outages in cloud computing. According to Chandrasekaran & Kapoor (2011), automated management and on demand self-service will help public workers to focus more on core areas and create value in the public administration. Nevertheless, it is hard to leverage the value in public administration without improving the service quality of the cloud providers. Therefore, we would like to investigate this service quality related problem due to the fact that the public administration in

Moldova facilitates a wider array of services to the whole nation (Government Decision No. 710, 2011).

According to Kundra (2011), federal cloud architecture has the ability to rapidly scale up and meet unpredictable demands. This scalability feature can be used to avoid disruptions and service outages, while creating value to the general public. For instance, public administration needs to handle higher workloads when the tax filing is taking place in a certain period of the year. Therefore, governments need to be agile and more flexible in order to meet challenges innovatively (Pang et al., 2014). Thus, cloud computing is an excellent option to the public administration for fulfilling short term, immediate and unpredictable service needs when required.

Cloud architecture can dynamically allocate the required resources anytime and cloud databases are capable of handling big volume of government's application data even in the peak load for maintaining the quality of the services (IIIT, 2010). Therefore, government agencies have the possibility of scaling up the scope of their projects without bothering dynamic resource needs (Singh & Chandel, 2014). Automatic load balancing capability of cloud computing can meet the prioritized needs of the public administration. Thus, cloud infrastructure is capable of handling rapidly expanding customer base and their diversified service needs easily.

2.6 Cloud related technological advancement and the value creation

Cloud infrastructure helps to link cloud users with leading-edge technologies as well as devices such as tablet computers and smartphones (Kundra, 2011). That will create rich user experiences and change the way of public engagement with the services of the public administration. In a traditional public administration, communication happened mainly through the paperwork and telephone conversations. But after implementing the cloud system, public engagement with the government services is mainly through new digital communication channels. This will simplify the administrator's duties and promote transparency and equality of the government services to the public. Moreover, it will save significant time and the money of the general public. Therefore, we can argue that, mobile technologies and interactive user interfaces in a CC environment has the possibility of increasing the public engagement with government services (Pang et al., 2014). In such a way, the general public can easily access the comprehensive government information repositories and get the maximum benefits out of it. In addition to that, cloud computing's excellent ability of integrating with big data intelligent analytics, helps public administration to derive valuable knowledge and information to the whole nation including private sector (Pang et al., 2014). Thus, the cloud computing helps to tap into private sector innovation and provide efficient and convenient services to the general public (Kundra, 2011).

3. Theoretical framing and research methodology

In this chapter, we are going to discuss about how we frame our research based on the selected theoretical framework and the methodological choices. In addition to that, we briefly discuss about the interview process and plan for the data analysis in the next chapter.

3.1 Theoretical framing

After the careful consideration of IS theories and models, we have found that most of them related to the IT adoption and utilization of IT capabilities. Moreover, these models were unable to explore IT value creation within the public organizations. Nevertheless, DeLone & McLean information systems success model (D & M model) is capable of providing a holistic view of IS success within a firm. This model is based on the definitions of the IS success and the related measures (Bernroider, 2008, p. 258). Original D & M model were introduced in 1992 and there are six constructs in that model (Bernroider, 2008, p. 258). Petter & McLean (2009, p. 160) states that in 2003, some major modifications were introduced and service quality was added into the D&M model (see Figure 1). However, D & M model constructs are highly dependent each other. We have identified factors related to *system quality*, *information quality*, *service quality*, *intention to use*, *use and user satisfaction* in the literature review. According to the updated M & D model, *system quality*, *information quality and service quality* affect the *intention to use*, *use and user satisfaction* (see Figure 1). Moreover, *intention to use*, *use and user satisfaction* affects the *net benefits* of an information system and vice versa (see Figure 1). Therefore, we believe that the elements in the updated M & D model will guide us to explore how cloud computing creates different benefits or the values in the public administration of Moldova.

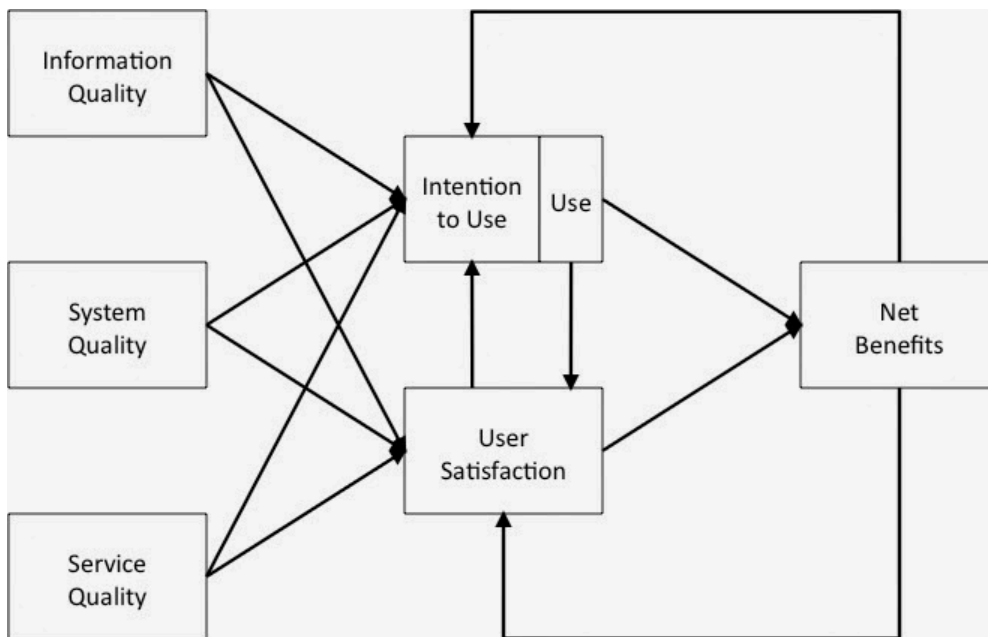


Figure 1: Updated information success Model (DeLone and McLean, 2003)

3.2 Research methodology

Qualitative research approach in the form of a case study is chosen to create a deeper understanding on how cloud computing impacts the value creation in the public administration of Moldova. Case study is one of the most common methods used in IS research (Denzin & Lincoln, 1994). Case study method helps researchers to explore the holistic perspective of a real world event (Yin, 2007). Qualitative interviews are one of the ways to conduct a qualitative research (Bryman & Bell, 2011, p. 201). Semistructured interview questions are not strictly defined for each interview and suitable for getting varied information depending on the situation (Saunders, Lewis & Thornhill, 2009, p. 320). In this research, we have conducted semi structured interviews in order to get comprehensive and required information while staying within the boundaries of the relevant topics.

3.2.1 Data collection and analysis

Questions in the interview guide (see Appendix, Interview guide) are based on what we have discussed in the literature review section. There, we addressed some important factors that affect the public administration value creation in related to our formulated research question. For instance, the success of the automated management and on demand self service will heavily depend on how fast the cloud providers react to the system failures. This factor raises issues related to the quality of a cloud system. Moreover, it is related to the service quality of the theoretical framework in this study. In order to address this issue, we included the question 23 in the interview guide.

Case study method interview questions are often formulated based on the "how" or "why" questions (Yin, 2007). These types of questions help to create deeper understanding about the context in a case study research. For instance, we have asked a question about how interviewees feel about the quality of the information produced in the cloud system (Appendix, Interview guide, question 15). This information quality related open ended question stimulates respondents to explain and describe the situation (Saunders et al., 2009, p. 337).

We have conducted face-to-face Skype interviews with five respondents in this study (table 3). All of them were well familiarize with the new cloud system and represented different levels of the organizational hierarchy. Respondents were fluent in English, so all the interviews were recorded and transcribed in English language to communicate effectively for both researchers in this study. Thus, we were capable of eliminating the bias due to the language barriers and ensure the credibility and honesty in the interview process (Bryman and Bell, 2011, p. 396). Relaxing environment and the body language are important in qualitative research (Saunders et al., 2009, p. 489). Therefore, we decided to conduct interviews in a relaxing atmosphere after the office hours. Which helped us to get deeper insights from the respondents without interrupting their normal duties. However, we had difficulty of arranging Skype interviews with high rank respondents in the Moldova public administration due to their tight work schedules. Some of the high rank respondents were abroad for attending an IT summit. Therefore, we had to wait for weeks to arrange relaxing interviews with them. The body language of the respondents is important since it helps to collect reliable information for the analysing purposes (Bryman and

Bell, 2011, p. 489). We could observe respondents' body language and subtle gestures, although we could not conduct face to face interviews with the respondents. Duration of every interview were more than one hour due to the number of questions we asked in the interviews. We did not stress respondents to answer all the questions in the interview guide and allowed respondents to skip the questions that can be harmful to their confidentiality (Bryman and Bell, 2011, p. 136). Nevertheless, we mentioned the employment position of the respondents in this study since it neither affected to their career nor the privacy (Bryman and Bell, 2011, p. 128).

After the empirical data was recorded, we transcribed the empirical data and coded the data based on the constructs of the M & D model and structured the data analysis section accordingly. Thus, M & D model simplified the data collection and interpretation of the collected data in this study. Nevertheless, we had to exclude some interesting facts in the transcribed data due to our data coding under the themes of the M & D model.

Interviewee	Experience /years	Main activity	Organization	Interview duration	Interview type
A. Chief Technology & Innovation	20	Manage all technology aspects of the Government, including Technical Frameworks, M-Cloud, M-Points and many other	e-Government Center of Moldova	90 min	face -to-face (Skype)
B. Information Security Manager	19	Ensure the security of the governmental technological platform as well as design a functional governmental framework in terms of information security	e-Government Center of Moldova	85 min	face -to-face (Skype)
C. Monitoring and Evaluation Coordinator	16	Monitor the implementation of technological projects managed by EGC	e-Government Center of Moldova	60 min	face -to-face (Skype)
D. IT manager	6	Manage information technology and computer systems	Center for Special Telecommunications	90 min	face -to-face (Skype)
E. Civil servant	13	Manage the external assistance database and information system	State Chancellery of Government of Moldova	70 min	face -to-face (Skype)

Table 3: Summary of the interviewees

4. Data analysis & results

In this chapter, we are going to introduce our case study and analyse the collected data by selecting relevant quotes from the empirical data and embedded them under the following themes: system quality, information quality, service quality and user experience. We decided to merge *use, intention to use and user satisfaction* factors in the updated M & D model (see Figure 1) into user experience for a simplified analysis process. We believe that user experience covers those three factors making easier to explore the public sector organizations. Later analysis of the

empirical data under these four themes, aim of this study is to identify key factors that affect the value creation in public administration.

4.1 Case description

We chose to do our research about public administration in Moldova because it represents a relevant case study to assess IT value in the public sector. In our opinion, there are some factors that make this case study suitable for our research question. First of all, being a small country allows a faster capitalization and uptake of modern technologies, therefore a faster value creation both for public administration and for country overall performance. Secondly, having not so many IS legacies owned by the public sector and building new systems based on latest technology allow us to assess the impact of technologies build from scratch. This fact is important because IS legacy or old-dated systems usually act as a burden blocking the adoption of modern technologies. And finally, having a good ICT infrastructure with fiber-optic network, which covers most of the country (about 85%) and enjoying a fast Internet connection makes the Republic of Moldova a perfect match for our research.

The Republic of Moldova has emerged in the past few years as one of the top 10 countries in Europe and top 20 countries at a global level with the highest Internet speed (Netindex, 2015). Moreover, Moldova has one of the cheapest Internet in terms of price per megabit, where almost 70% of the population have a computer at home (National Annual Survey, 2014). Therefore the government committed to reform the public service delivery by harnessing the power of digital technologies, setting a general strategic objective that by 2020 the government will become more transparent, and responsive, and perform better due to intelligent investments in IT and their massive use in the public sector (Government Decision No. 710, 2011). To drive this transformational reform, Government of Moldova created the e-Government Centre (that acts as Chief Information Officer for the Government) and approved the Strategic Program for Governance Technological Modernization via Government Decision No. 710, dated September 20, 2011.

This Strategic Program identifies a range of problems that the Governance Transformation Agenda needs to address: poor quality in public service delivery, corruption, bureaucracy, inefficiency of public institutions, data centers that are vulnerable to security, high operating costs and reduced quality, and limited use of innovative models of service (Government Decision No. 710, 2011). In this context, Cloud Computing was identified as the backbone to achieve these outcomes. As a result, in February 2013, the eGovernment Center (eGC) together with the State Enterprise Center for Special Telecommunications (CTS), has established an operational Shared Government Technology Platform called **MCloud** (MoldovaCloud). The cloud platform represents a joint governmental information infrastructure operating on the basis of cloud computing technology that provides innovative services to ministries and government agencies.

The Government also approved the MCloud First Policy – a document that obliges ministries and other central administrative authorities subordinated to the Government to migrate there IS

into MCloud (Government Decision No.128, 2014). This document also states that public authorities are not allowed to create their own infrastructure without the State Chancellery coordination.

Moldovan Cloud provides all three cloud computing service models (IaaS, PaaS, SaaS) to government entities (see Appendix Table 4). Moldova is the first country in the eastern European region to implement cloud computing in public administration and for this solution, the Executive of the Republic of Moldova was awarded with the international prize "**Best Cloud Project in Central & Eastern Europe**" (E-Government Center, 2012).

Regarding Mcloud adoption, 26 public institutions (see Appendix table 5) have migrated their digital content to the platform as of March 31, 2015, therefore because of this uptake the Government decided to extend the platform capacities by releasing a procurement bid for Mcloud Phase II.

4.2 Themes

4.2.1 Theme 1: System quality

This theme relates to the overall performance and the quality of an information system. System quality creates different user experiences and the factors that relate the system quality may affect the value creation in the public administration.

Efficient use of resources is related to better utilization of the available human and physical resources in order to get the maximum benefits out of it. Server virtualization in cloud computing decreases required number of physical servers significantly. Moreover, cloud servers have the capability of automatically balance the workload and dynamically allocate the required resources in peak and non peak times. Interviewee D has extensive technological expertise and he stated this is how he described the resource utilization.

*We could save more than 60 % of the cost in both capital and recurrent expenditures on computing resources, because workload can be allocated flexibly and dynamically to the available computer systems, and less equipment needs to be owned by the government.
(Interviewee D)*

Order processing is time consuming due to the hierarchical operational procedures in the public sector. But Interviewee C pointed out that "*now we are experiencing significant time saving through streamlined procurements and new system implementations*". That is mainly due to the automated services and efficient built in tools in the cloud infrastructure.

In comparison to the legacy IT systems in the Moldova public administration, there was no need to invest a larger amount of money on purchasing and maintenance of softwares and hardwares, since they can pay for the usage of the cloud infrastructure (*pay as you go*). Following quote support the above argument and shows that public administration could reduce more than four times of their hardware expenses while focus more on the core business areas.

Every ministry invests huge funds for the servers, but they use at a limited capacity. For example, only for one governmental agency the server purchasing concept submitted in 2011 for examination and approval to the public procurement agency was operating with an estimated cost 4-fold higher than the entire cloud infrastructure implemented in 28 public institutions until now. But M-cloud provides these services at low investment, now our ministries investing in digitising services and not in hardwares. (Interviewee C)

Due to the automatic load balancing capability of cloud computing, there is no need to buy separate equipments to handle load balancing needs in critical situations. Fewer computer hardwares, automatic load balancing and less paperwork help to save recurrent expenditures like computing power and possibly, promote green IT in public services. Interviewee A agreed with the above argument and stated that *“we could save up to 30% of our electricity cost after implementing the first phase of the cloud solution in 2013”*. This initiative acts as a role model for the citizens and other organizations to work towards environmental sustainability in Moldova.

Cloud computing simplifies the application development and save the software maintenance cost, license cost and the upgrading cost due to the high availability of the required tools to develop applications on the cloud. Interviewee A agreed with the above argument and mentioned that, *“our software development platform as a service (SaaS) is providing tools, test environments and mechanisms to develop secure and highly available cloud based applications”*. This type of platform simplifies the software development and deployment of such applications on the cloud. But interviewee D pointed out that the Moldovan government’s software development activities based on the cloud platform is in the preliminary stage. Nevertheless, interviewee A stated that in the MCloud Phase 2, public authorities expecting to further expand the (SaaS). Expansion of the SaaS is ideal for inventing secure applications and deploying those new innovations in the public services. This is how interviewees shared their views about the application development activities.

At the moment, most of the software development projects handled by the outside companies, and those companies are responsible for deploying the applications on the cloud. For example, the governmental document management system (SIGEDIA) is currently piloted only in 9 Central public authorities. (Interviewee B)

In the MCloud phase 2, we are expecting to provide a learning platform to facilitate and enable users’ learning and capacity building on the development of the cloud based applications and integration with MCloud services. (Interviewee A)

Automated management and on demand self service lead to decrease the IT personal involvement in routine tasks and delivering faster services. Interviewee A, agreed with the above statement and said *“that helps government agencies to focus on their core operational purposes and services”*. Obviously, automated management and on demand self service has an impact on cost savings related to the human resources in the public services. In addition to that,

focusing on core areas helps to improve the overall service and operational efficiency in the public administration. Thus, public authorities have the possibility to develop and deploy their own services faster than never before. The following quote shows how Interviewee A described about automated management and on demand self service in the public administration.

Infrastructure is owned and operated by government service providers and offers to customers on-demand. Government agencies are able to self-provision this infrastructure, using a Web-based graphical user interface that serves as an IT operations management console for the overall environment. (Interviewee A)

It is questionable whether the cloud providers/IT staff react immediately to solve the service outages. Therefore, we asked from interviewee D how they solve the system failures and provide robust services to the users. He explained that, “*we are adopted to a private deployment model, so the data centres located within the premises. Our well trained in house IT staff is capable of reacting immediately to solve the issues in the cloud infrastructure*”. Due to the nature of the cloud infrastructure in the Moldova public administration, IT staff can better approach the system failures rather than cloud service providers. Therefore, the cloud users can expect high availability of the services in the Moldova public administration. Moreover, interviewee C mentioned that “*intensive training about the usage of self-service tools is a need for using the IaaS*”. Thus, Moldovan government officials realized the importance of proper training for their IT personals in order to deliver reliable services to the whole nation.

4.2.2 Theme 2: Information quality

This theme relates to the quality of the information produced, stored and deliver to its users. Information quality also creates different user experiences and the factors that relate to the information quality may affect the value creation in the public administration.

Duplicative systems always generate redundant data to the users and badly affect the quality of the information produced. Interviewee A stated that “*cloud infrastructure is more centralized compared with the decentralized IT systems we had before. So it is a unique platform that provides convenient and efficient services to our users*”. Thus, Moldovan public authorities were able to unify and improve the quality of the services provided by the different agencies. Interviewee E also added that “*e-services portal is the gateway to all electronic services offered by the Moldovan government*”. Such a common portal for all the digital services offered by the government agencies can provide consistent information to the users. Moreover, Interviewee B said that “*citizens provide their personal data to government only once, and agencies can reuse these data for the delivery of different services*”. So, we can claim that cloud infrastructure minimizes the possibility of producing inaccurate and redundant information to the users. The above facts reveals that completeness and timeliness of the information is always high in a unique platform. Consequently, the e-services portal saves the valuable time of the citizens and the organizations those who request the e services from the public administration. Additionally, it reduces the maintenance overhead to the public administration.

A unique digitized platform based on cloud computing has the possibility of increasing the collaboration and value creation among different agencies and other non government organizations. Interviewee D agreed that CC enhanced the collaboration among different agencies and said *“the cloud platform helps to exchange the information and data among government agencies through the MConnect service, and it increased the connectedness and communication”*. This provision enhances the co-production capability in the public administration. Moreover, Interviewee A added that *“increased collaboration among agencies helped us to overcome departmental silos and communicate through a shared technology platform helped us to offer high quality services”*. Mobile technologies and interactive user interfaces in a cloud environment increases the public engagement with government services. According to interviewee C *“the e-Government centre aimed to make the government data open for citizens and improving governance and service delivery”*. Such an effective approach helps citizens to easily access the comprehensive government information repositories and get the maximum benefits out of it. Interviewee E shared the views of the interviewee C and also added *“citizens and businesses can easily access through a single government portal information and electronic services provided by the central public authorities”*. We asked from Interviewee C whether the public administration collaborate with outside organizations and she stated that

Interest in open data arising. For example, an NGO in Moldova is working on a project called budget stories. This project releases budget information in the form of infographics to create stories. Another example, some students are combining different maps with geographic data, those maps help the government to visualize some national problems. (Interviewee C)

The above facts reveal that the Moldova government already experiencing the benefits of collaborating with outside organizations. Integration with non governmental organizations, universities and business communities will inflow the outside creativity and innovation to the public administration. Moreover, increased collaboration helps to provide a less bureaucratic, flexible and efficient public services to the citizens in the Moldova.

Information protection is a major concern when citizens, business communities and other non governmental organizations provide their personal data to the public administration. But the interviewee D mentioned that *“we are obliged to protect data, cloud infrastructure enables us to maintain the highest levels of security over public, private, commercial secret, and state secret data”*. Interviewee B also shared the views of the Interviewee D and added *“MSign and MPass service tools allow users to securely log into the cloud service portal based on different authentication mechanisms and the MLog tool audits their behaviours carefully”*. Due to the centralized data storage, backup procedures and security mechanisms in the Moldovan private cloud model, users can expect the highest level of protection over their sensitive data. Information security may critically affect the accountability and the transparency of the actions in the public administration. To address this issue, Moldovan government has prepared a cloud security architecture. It specifically mentions the requirements from the service providers,

authorities and beneficiaries in terms of the security perspective. Interviewee A also added that “we engage with a third party company to audit if the cloud security architecture rules are followed by the responsible people”. Moreover, authorities step forward to raise the awareness about security issues among the cloud users. Interviewee C pointed out that “in the MCloud Phase 2, we are going to provide learning and capacity building to our users about security of cloud applications and infrastructure”. Cloud infrastructure itself can not ensure 100% security of the sensitive data. Therefore, it is important that the authorities take necessary actions and the responsibilities to protect sensitive information and build the trust on the public administration.

4.2.3 Theme 3: Service quality

This theme relates to the overall quality of the services provided and delivered by the cloud computing infrastructure to the public administration that ultimately enables a seamless service delivery to the general public. We will analyse if and how CC impact the service quality in the public administration in Moldova.

Cloud computing is known as a tool for ensuring responsive delivery of services while offering a high service quality.

It brings much more dynamics into services development because you don't have to spend a lot of money and effort in conducting procurement of hardware, you just move ahead with development of software which ultimately is the basic ingredient for a new, modern and qualitative service. (Interviewee C)

Due to the nature of the cloud infrastructure, application and service deployment can be easily performed in different environments.

We definitely may say that the application development and services development because of Cloud is much more streamlined or convenient. Public agencies, ministries can rapidly deploy their services from test environment to production environment. (Interviewee B)

Therefore, Moldovan Government can increase the delivery time of public services with the help of cloud technology. Moreover, cloud infrastructure also has the capability of automatically balance the workload in peak and non peak times.

Applications and services can be managed more efficiently because of Cloud self-service principle. Taking as an example tax services in Moldova: citizens and business entities have to pay taxes until 31 of March thus during the last week of March these systems are used intensively. In this particular situation, due to MCloud and its elastic allocation of resources, the government ensures the business continuity of this critical process for entire country. (Interviewee A)

Therefore, we can conclude that public administration in Moldova harnesses the power of cloud technologies in handling higher workload while preserving a high service quality.

Furthermore, besides boosting the public institution's ability to develop and deliver faster service, Moldovan Cloud offers itself a mix of cross-sector services that aim to streamline even more the quality of the public services.

In order to provide government-to-public, government-to-business and government-to-government service, MCloud offers a broad collection of software components to government agencies, such as authentication and access control (MPass), government electronic payment gateway (MPay), government digital signature service (MSign) and many more. (Interviewee D)

Because MCloud incorporated specific tools and instruments it allowed public administration to perform better at the service provision level.

The Government of the Republic of Moldova has invested in Cloud Computing to support government reform agenda with specific focus on improving public service delivery, government efficiency and performance. We can assess the result of this effort by looking at the public services assimilation after implementing this technology. For example: the uptake for the Criminal Record application in an online interface (a service provided by the Ministry of Interior) has reached 98%. (Interviewee A)

Therefore, cloud computing can create added value in terms of service quality for public entities, boosting their ability to digitize services, as well as for end users (in case of public sector are represented by citizens, business entities and the whole nation) – who are the final consumers of these services. Having a clear vision and a centralized technological solution is the key ingredient for success. *“The government's ongoing goal is to modernize and digitize all services that can be delivered online by 2020 and make them accessible through a single government platform” (Interviewee E).*

4.2.4 Theme 4: User experience

System quality, information quality and the service quality affect the users' attitudes towards an information system. Moreover, these factors have a major impact in creating different user experiences. These different user experiences affect the users' engagement with an information system and may have an impact on the value creation in public administration.

Users' willingness or unwillingness toward an information system can tell a lot of information about the value of that system; whether the system malfunction or users are reluctant due to some other reasons.

There is no too much of resistance from those who understand the benefits of CC and most of public agencies who did not have their own infrastructure – they adopted CC

without any kind of reluctance. On the other side, those public agencies that traditionally had their own infrastructures - they were reluctant to adopt CC because they thought they will lose control over everything. (Interviewee A)

On the same issue, another respondent declared that *“The resistance is coming from the people working in the government institutions due to their lack of understanding the benefits which MCloud brings and their perception that this is just another reform initiative that won’t work”*. To address this critical issue, interviewee C declared: *“The only thing we had to conduct at that moment was trainings, public events, knowledge sharing events in order to change their mindsets and to solve the capacity problem”*. Respondent A concluded that *“Most of those who were reluctant in the first place changed their mind after seeing how CC generated economies for other public entities”*.

Measuring customer satisfaction is one of the best ways to benchmark and improve the customer’s experience. Interviewee B declared: *“A regular customer satisfaction is collected in order to have a more detailed understanding of the consumer’s perception of the MCloud services and include the feedback in the development of the MCloud Platform (Phase 2)”*. On the same topic respondent C revealed that

“MCloud customers have indicated a high level of satisfaction with the service this can also be sensed by the latest data regarding the MCloud service uptake, where over 80% of Central Public Authorities use at least of one MCloud service and more than 57 % of them use two or more services”.

This information highlights the positive tendency of cloud computing adoption in the public sector of Moldova that creates continuous value for internal users (government users).

While the business sector focuses more on economic values such as sales revenues, productivity, etc., public sector - on the other hand deals more with non-economic values, and accountability is one of them.

“Due to MCloud delivery model, specifically having MPass and MLog components, allows looking through the system data and identifying who did what, when, in what context and for what reason. Of course, this makes cloud users more accountable and more careful about their actions in the information systems. If public servants perform something out of the policy or their responsibility – this could be easily detected”.
(Interviewee A)

The above answer emphasizes the added value brought by cloud technology to the government accountability.

Another non-economic value highlighted by all of our respondents several times during the interview was related to anti-corruption.

“That is a great opportunity to fight corruption, because whenever procurement happens, it’s all the time associated with same interests – at least that’s a common

practice in Moldova and because of the shared governmental technological platform the procurement frequency diminished". (Interviewee A)

On the same subject respondent B added *"Of course, those persons (public officials) who tried to control, procurement processes are not that fond of CC because that's somehow limiting their freedom to such extend in procurement"*. From the above information it becomes obvious that Cloud Computing besides bringing value in terms of public sector efficiency it also protect the integrity of the public sector per se by eliminating official's personal interest and fighting corruption. Therefore, by harnessing modern technologies, Moldova public administration can increase transparency and trust in public institutions.

5. Discussion

The purpose of this study was to explore the impact of cloud computing on public administration value creation by answering the following research question. *How does cloud computing create value in the public sector administration?*. In the previous chapter, we analysed the empirical data under the themes of the M & D model. Our analysis focused on how cloud computing creates value from the perspective of the civil servants. However, this had an indirect effect to the entire citizens in the Moldova. Consequently, this research has identified following values in the public administration of the Moldova, that brings value to the entire nation as well. Some of those values discussed by the previous researchers, but the other values have been paid less attention in previous research. In this chapter, we are going to discuss the identified values in related to the previous research and answer the stated research question in this study. Furthermore, we would like to present our conclusions, limitations and suggestions for future research in the latter part of this chapter.

5.1 Values

We have identified cost benefits, time saving, increased collaboration and knowledge co-production, green IT, information protection, faster and seamless service delivery and accountability & transparency as main influencing factors behind the value creation in public administration.

5.1.1 Cost benefits

Most of the previous research has shown that cost benefit is the main motivating factor behind the adaptation of the cloud computing. Previous researchers mentioned that cost savings from hardware, software and the infrastructure as the most significant cost benefit factors (Chou, 2015; Miller, 2009; Wyld, 2010). Both interviewees A and D also pointed out that the Moldovan government could save more than 60 % of the cost in both capital and recurrent expenditures on computing resources. Due to the high availability of hardware and software in the cloud infrastructure, the Moldovan government not needed to initially invest huge capital for

purchasing own softwares and hardwares, while further maintaining of such facilities in separate agencies. Therefore, being a relatively small country with austere budget, the Moldovan government heavily benefiting from the Mcloud. Although the cost savings from hardware is extensively discussed in previous academic research, little attention has been directed towards the cost benefit based on the better resource utilization in related to server virtualization and automatic load balancing capability. Interviewee C pointed out that, after implementing the cloud solution, every ministry invested in digitising services rather than investing huge funds in servers, which is four times higher than the cost for the entire cloud solution. Thus, better resource utilization helped them to pay for fewer number of servers available in their private cloud. The above findings support the previous research and also extended the research scope of the value creation in cloud computing.

Although the cost saving in the usage of the application softwares heavily discussed by the previous research, a little attention paid on cost savings of the application development on the cloud. Therefore, we tried to identify whether there is a significant cost benefit of developing applications on the user friendly cloud environment. However, Interviewee D mentioned that most of the software development projects handled by the outside companies, so we did not have enough evidence to clearly identify the benefits of it.

Dimitrov & Osman (2014) argue that automated management and on demand self service in cloud services leads to significantly decrease the IT personal involvement and have a major impact on cost savings. Nevertheless, extensive previous research has shown that main cost savings due to the hardware, software and other computing resources (Chou, 2015; Miller, 2009). Moreover, in this research, both interviewees A and D point out that infrastructure is owned and operated by Moldovan government service providers and the well trained in house IT staff handle the issues in the cloud infrastructure. As such, cost savings based on less staff involvement is not a significant factor in this study. Thus, the findings comply with the earlier research despite the contradictory findings of the Dimitrov & Osman (2014) research.

5.1.2 Time saving

Previous research has shown that order processing is time consuming due to the hierarchical operational procedures in the public sector (Chandrasekaran & Kapoor, 2011, p. 3). But researchers paid little attention on how cloud computing affects the time saving of the public administration. However, the interviewee C points out that the Moldovan public administration experiencing significant time saving through streamlined procurement, system implementation and on-demand service provision. Procurements become faster due to the dynamic allocation of the required resources when needed. Additionally, this research identified that the service creation and system implementation is much faster due to the user friendly build in tools in the cloud architecture. These findings support the previous research and extended the research scope of the cloud related time saving in the public administration. In addition to that, citizens are experiencing their time saving through the service digitalisation. But it is not a major focus area in this study.

5.1.3 Increased collaboration and knowledge co-production

Previous research points out that cloud computing enhances the co-production capability due to the sharing of information and expertise among different parties (Kohli & Grover, 2008; Pang et al., 2014). Interviewee D also points out that cloud facilitates the exchange of information and data among government agencies through the MConnect service, which enhanced connectedness and communication between agencies. Nevertheless, it is important to extend the collaboration with other organizations since one single public organization doesn't possess all the required resources and not capable of tackling challenging public issues (Pang et al., 2014). To support that argument, interviewee C mentioned that the awareness and interest in open data are rising. For example, an NGO in Moldova is working on a project called Budget Stories. Interviewee C also mentioned that some students are combining different maps with geographic data, creating maps which will even help the government visualise some national problems. These findings strengthen the previous research related to the collaboration and value creation in cloud computing.

5.1.4 Green IT

Chou (2015) indicates that cloud computing can create value of green IT and this environmental protection can ultimately create a social value. Another researcher specifies that shifting into the cloud computing brings significant energy savings (Wyld, 2010). We wanted to check if the cloud computing solution adopted by public administration in Moldova embrace the idea encapsulated in green computing. The results of our analysis revealed that the cloud platform in Moldova contributes to green IT and environment savings even if this was not identified as an outcome. Respondent A declared that just after the first year of implementation, the Government saved up to 30% of electricity cost. Public official also declared that energy consumption is shaped by the actual workload that cloud performs, meaning that cloud platform can automatically consolidate a certain workload in a couple of servers while unused servers are put in standby mode - consuming no energy. In this context, public sector in Moldova benefits from the power of green computing, saving energy and saving money for the same processes, thus being more accountable with the public money and promoting environmental sustainability.

5.1.5 Information protection

Previous research brings up the idea that the adoption of cloud computing in the public sector is more challenged compared to private sector. Before moving to the cloud, the public sector must consider regulation of data privacy and data security of public data (Busch et al., 2014). Indeed, our respondents have confirmed that these issues are very sensible and it impacts the security of the entire country. Respondent A refers security as the most popular concern related to cloud platform, however, he points out that security level in cloud environment is 3 times higher compared to the information systems and data that are kept out of the cloud. Interviewee B also added that the issue of information security and protection is fully covered by a legal document, namely Cloud Security Architecture that acts as a legal framework for this sensitive area. Regarding to information protection, it is important to mention that public sector deals

with much more variety of data compared to the private sector. Interviewee D highlights the public sector data diversity mentioning public, private, commercial secret, state secret data. Our empirical study revealed that a centralized data storage, backup procedures and security mechanisms that act together in a cloud environment, ensure a high level of data protection in the Moldova public sector.

5.1.6 Faster and seamless service delivery

Previous research indicates that cloud computing decrease the IT personal involvement in routine tasks and increases the speed of service delivery (Kundra, 2011). Our empirical study has endorsed this affirmation, confirming that cloud computing brings much more dynamics into the public sector service development. Respondent D mentioned that public institutions have all necessary IT tools to concentrate on public service digitization rather than on loosing their time for acquisition or in-house production. Interviewee B also added that service development because of Cloud is much more streamlined and public agencies can rapidly and easily deploy their services from test environment to production environment. Therefore, we can affirm that due the adoption of cloud technology, Moldovan Government has boosted the delivery time of public services, offering in time and on time services for its citizens.

Previous research also refers to the ability of cloud architecture to allocate dynamically required resources, while being capable of handling big volume of government's application data even in the peak load for maintaining the quality of the services (IIIT, 2010; Singh & Chandel, 2014). We believe that this particular aspect is very important for public sector where service provision must be ensured 24/7, and where no server errors are allowed. To this extent, our case study revealed that due to cloud elastic resource allocation, government ensures the business continuity of public services, especially when the systems are used intensively like in the last period of tax payment (*interviewee A*). Therefore, citizens can access public services without being frustrated by Web servers error messages (Ex. error 404, 500, 502, or 504), while public sector can continue its activity preserving a high service quality.

5.1.7 Accountability and transparency

Numerous research papers focus on the economic values of IT, while just a few investigate the non-economic values. Our literature analysis revealed that just a scanty empirical studies connected values like transparency, trust and accountability with IT systems in the public sector (Seltsikas and O'Keefe, 2010; Kim and Lee, 2012). The empirical research performed in the public administration of Moldova demonstrated a very tight connection between technologies, in our case Cloud Computing technologies and the increasing accountability and transparency of the Government. Respondent D pointed out that after MCloud implementation, civil servants and public officials became more accountable and careful about their activity because every step and every wrong or illegal action could be detected by flexible logging and auditing mechanism. Therefore, besides bringing cost savings to austere country budget, Cloud Computing increases public sector accountability and transparency. Worth mentioning, that these non-economic values are especially appealing in the public sector because they represent critical and crucial values for a healthy and democratic governance act. Moreover, our empirical research has

identified another important value that we have not considered during the literature review, but due to the fact that it was highly emphasized by all respondents, we want to highlight it in this section. Our respondents reiterated that Cloud Computing helps to fight corruption in the public sector, this fact was argued by two examples: first having a centralized technological platform decreased the number of isolated procurement for hardware and software that were associated with some personal interests; And secondly, because civil servant or citizens “can not bribe a server” - ensured a cleaner and more transparent the service delivery. Therefore, by harnessing cloud computing the public sector in Moldova eliminate the scourge of corruption thus ensuring the integrity of governance act.

5.2 Conclusions

Our objective was to explore how does cloud computing create value in the public sector administration. Answering this question, we have identified seven ways of IT value creation related to cloud computing in the public sector. Namely: cost benefits, time saving, increased collaboration & knowledge co-production, green IT, information protection, faster & seamless service delivery and accountability & transparency represent the major factors behind the value creation in public administration.

Among those values, some of those values are highlighted in the previous research, but little attention has been directed towards the some of the cost benefits and time saving in the public administration. However, this research addressed those gaps by identifying the values of better resource utilization, faster service creation and streamlined procurements. In addition to that, previous academic research paid little attention on critically examining the effect of faster service delivery and transparency & accountability on public administration value creation. In this context, our empirical study highlights the importance of cloud computing value creation of critical public sector issues like service delivery, transparency & accountability. Those values can bring the private innovation into the public administration. Moreover, our case study identified the corruption issues, overlooked by the previous researchers. But we believe that this matter has major impact on the whole business processes in the public administration, including service delivery, cost benefits, time saving, data protection, etc. Therefore, believe that discovering this value extended theoretical contribution of value creation in public administration.

Practically, we highlighted following suggestions to improve the value creation in the public administration of Moldova. There are some agencies willing to integrate with the Moldova central public administration cloud system in the future. Those agencies first need to understand their expected values after considering agency specific goals and individual needs. For instance, one agency may appreciate value creation through the agility of the services, while others may stress that the cost savings helps them to create high value in their respective agencies. Thus, it will help cloud providers to optimize their services according to different agencies' value needs. This will help better integrate agencies in the central public administration of the Moldova. Consequently, increased collaboration among agencies will enhance the co-production capability in the central public administration of the Moldova. Therefore, it is important to consider agency priorities before integrate into the cloud system.

At the moment, the central public administration of the Moldova is using a private cloud deployment model. But, as the number of agencies grows with the cloud system, agencies will have different preferences for their cloud services. For instance, some agencies may prefer Software as a Service (SaaS) rather than platform as a service (PaaS) depending on their unique needs. As such, IT staff must rethink about expanding their cloud infrastructure in order to maximize the value creation in different agencies. In that sense, IT staff may consider a hybrid deployment model by combining several infrastructures together. That allows maximum agility of the services in the central public administration of Moldova by keeping data centres in the private cloud infrastructure, while experiencing the benefits of the public cloud. Consequently, agencies will experience service efficiency improvements and create value in the public administration. Moreover, having a hybrid deployment will allow public administration to better integrate with external partners, in promoting open innovation in the public administration.

Cloud computing has an excellent ability to integrate with big data intelligent analytics, that helps to derive valuable knowledge and information to the whole nation. At the moment, the government has a vast data collection of citizens, business community, etc. But the conversion of such data to the meaningful knowledge base is in the primary stage. Only the outside parties such as universities utilize this data for intelligent analytics. So, we recommend them to focus more on knowledge creation in the MCloud phase 2.

Generally, IT staff in the public administration needs to be aware of cloud technological changes and future literature related to value creation in cloud computing. That will help them to rethink about their current cloud strategies and apply only the relevant modifications based on the success stories from other firms. Moreover, such an efficient strategy will help them to gain the required skills in order to sustain their current innovation forever.

5.3 Limitations and Future research

The findings of this study cannot generalize to another context without paying attention to the peculiarity of our case. Our intention is not to generalize the results, but similar type of public administration set up in a different country can get inspirations from the practical contributions of this study. In this study, we did not consider all the factors that affect the value created in the public administration. For instance, we did not consider indirect factors like financial performance improvements related to value creation in the public administration. In a future research, someone can consider those unidentified factors in this study and extend the knowledge in value creation in the public administration. We could not identify the benefits of the in-house application development in a cloud environment, but a future research can identify this gap. Service digitalisation effect of time and cost savings to the citizens and cloud computing effect on efficient government decision making were not focused areas in this study. Therefore, in a future research, it is interesting to see how those factors affect the value creation in public administration. Moreover, future research can focus on the effect of the non economic factors such as accountability and transparency in the public administration value creation, that is rarely discussed by the previous researchers.

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7. Appendix

Service model	Description
Software as a Service (SaaS)	Allows access to provider's applications on the dedicated cloud infrastructure by various client devices (Mell and Grance, 2011). However, clients are restricted to control the cloud infrastructure except some application configuration settings.
Platform as a Service (PaaS)	Consumers have the possibility to deploy and control their own created or acquired applications on the cloud infrastructure, but not allowed to control the cloud infrastructure (Mell and Grance, 2011).
Infrastructure as a Service (IaaS)	Consumers can deploy arbitrary software on the cloud infrastructure, having control over operating systems, storage, deployed applications, and limited control of select networking components (e.g., host firewalls), but no control over cloud infrastructure (Wyld 2010).

Table 1: Service models in cloud computing.

Type	Description
Public	IT resources are available to the general public and can be managed by any type of organization or the combination of them (Mell and Grance, 2011).
Private	Systems and services are delivered and managed within a single organization.
Community	IT resources are used and controlled by a group of entities or organizations that have a common mission or interest.
Hybrid	A combination of two or more cloud infrastructures that are linked by standardized technology allowing data and application portability (Cloud Security Alliance, 2009).

Table 2: Deployment models in cloud computing.

Service model	Description
IaaS	Offers government agencies on-demand access to virtual data centers using a Web-based graphical user interface that serves as an IT operations management console for the overall environment
PaaS	Offers a broad collection of software components (including application platform and database services) that are delivered by the cloud provider to be integrated into Central Public Authorities' information systems in order to provide government-to-public, government-to-business and government-to-government service. One of the most demanded components is M Pass (government authentication and access control service), M Sign (government digital signature service), and MPay (government electronic payment gateway)
SaaS	Offers consumers the right to use the cloud provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email).

Table 4: Service range provided by MCloud

Public institution
1. State Chancellery
2. Ministry of Agriculture and Food Industry
3. Ministry of Justice
4. Ministry of Education
5. Ministry of Defense
6. Ministry of Foreign Affairs and European Integration
7. Ministry of Labor, Family and Social Protection
8. Ministry of Interiors
9. Ministry of Environment
10. Agency for Land Relations and Cadaster
11. State Enterprise "Cadastru"
12. Ministry of Health
13. Agency for Regional Development and Constructions

14. National Company for Health Insurance
15. National Chamber for Social Insurance
16. State Tax Service (State Enterprise “FiscServInform”), under Ministry of Finance
17. State Labor Inspection
18. State Agency of Material Reserves
19. National Standardization Institute
20. National Integrity Commission
21. Public Procurement Agency
22. MOLDAC (National Accreditation Center)
23. Civil Status Service
24. Civil Protection and Emergency Situations Service
25. Neurosurgery and Neurology Institute
26. Moldova State University of Medicine and Pharmacy “N. Testemitanu”

Table 5: List of public institutions using MCloud

Interview guide

1. Please tell us a little bit about yourself and your position in the organization? How long have you been working here? What are you responsible for?
2. Tell us why the Government decided to implement Cloud Computing in its administration?
3. What were the challenges faced in this process?
4. What are the key factors in adopting cloud computing in public administration?
5. What type of cloud service model are you using currently?
6. What type of cloud deployment model are you using currently?
7. What type of IT infrastructure you had before cloud computing?
8. What's Cloud pricing strategy have you adopted?
9. How many agencies are using cloud infrastructure at this moment?

10. What applications do you move in the Cloud? Do you have a set of rules to decide the types of applications that should be moved to the Cloud?
11. How do you feel about application development for the new projects after implementing the cloud system?
12. Is there a productivity increase in application development and management in cloud system?
13. In which ways the cloud infrastructure is capable of fulfilling short-term/immediate service needs? (e.g. Startup of new projects, tax filings in a particular time period) over the old architecture?
14. How easy is for cloud users to deploy and manage applications on their own?
15. How do you feel about the quality of the information produced in the new digitized cloud system?
16. How the cloud system is capable of handling rapidly expanding clients' and their diversified needs?
17. The Government usually holds enormous sensitive/confidential data, how do you ensure personal data protection in the cloud infrastructure?
18. Is cloud computing affects the government transparency and accountability? If yes, in what way?
19. How about energy consumption changes of the cloud system over old infrastructure?
20. Is there a significant decrease in the infrastructure and software maintenance cost (due to decrease of server maintenance cost, software maintenance cost, license cost and upgrading cost)?
21. How about computer hardware resource utilization improvements (e.g virtualization of servers, lesser hardware) in the cloud system?
22. Are you experiencing the elimination of duplicate systems and benefits of a unique IT system after implementing the cloud infrastructure?
23. Does on-demand self service in cloud architecture (less IT personal involvement in routine tasks) helped to deliver services faster in comparison to the old system? How about time taken to respond for solving IT failures by the cloud providers/IT personals over old system?
24. Is cloud computing increases collaboration between agencies?
25. How do you feel about new technologies and services of the cloud system?
26. How do you see this infrastructure in next 3 years?