

INNOVATIVE PUBLIC GOVERNANCE THROUGH CLOUD COMPUTING: INFORMATION PRIVACY, BUSINESS MODELS AND PERFORMANCE MEASUREMENT CHALLENGES

Aggeliki Tsohou, Brunel University, Email Address

Habin Lee, Brunel University, habin.lee@brunel.ac.uk

Zahir Irani, Brunel University, zahir.irani@brunel.ac.uk

Abstract

Purpose: Innovative technologies, such as federation of services and cloud computing, can greatly contribute to the provision of e-government services, through scalable and flexible systems. Furthermore, they can facilitate cost reduction and overcoming public information segmentation. Nonetheless, employing those technologies and the associated organizational and technical changes may face significant challenges. The purpose of this paper is to identify and analyse such challenges and discuss proposed (?) solutions.

Design/methodology/approach: We followed a multi-disciplinary perspective (social, behavioural, business and technical) and conducted a conceptual analysis for the three challenges. Focus groups interviews in two countries were also realized for evaluating the performance models that resulted from the conceptual analysis.

Research limitations: The discussed challenges and solutions are based on the experience gained by designing one platform, however across four countries.

Practical implications: The identification of challenges for innovative design of e-government services through a central portal in Europe and using service federation is expected to inform practitioners in different roles about significant changes across multiple levels that are implied and accelerate the challenges' resolution.

Originality/value: This is the first study that discusses from multiple perspectives and in practice the challenges to realise public governance through innovative technologies as emerges from an actual portal at European level.

Keywords: Service federation, Cloud computing, e-Government, Information privacy, KPIs, Business models

1 INTRODUCTION

The ultimate goal of the e-Government is to provide public administrations with the ability to offer an increased portfolio of public services to citizens, businesses or other public agencies in an efficient and cost effective manner. Governments the last decade have been unfolding the benefits of using information and communication technologies for providing electronic public services to citizens, the government itself, public officers, politicians, businesses, etc. (Rowley, 2011). Increased efficiency, information and services' quality improvement, enhanced access to information, increased transparency and accountability, smoother and easier interactions between citizens and public agencies, enhanced democracy, empowered citizens and public officers, openness, are only a few of the realised benefits of e-government for the different stakeholders (Atkinson and Castro, 2008; Prybutok et al., 2008; Rowley, 2011). Nonetheless, in many regions of Europe, citizens and businesses are faced with the difficulty or impossibility of finding information and services provided by local public authorities on the Internet. Many times the information currently available is often segmented and isolated in a non-user friendly manner. Traditional e-Government systems are commonly cumbersome and may cause duplications of the infrastructure in large-scale architectures. On the other hand users' needs may evolve rather rapidly and thus public services demand flexibility and scalability over time. Frequent upgrades must be performed in order to meet this challenge, but traditional infrastructures (relational databases) are not easily scalable.

Innovative technologies, such as federation of services and cloud computing, can contribute to resolving this problem; cloud distribution offers highly scalable databases for applications, ubiquitous network access, location independent resources, and rapid elasticity. Embracing this aim the EU funded project OASIS (<http://www.oasis-eu.org>) facilitates access to information, public services and economic promotion by grouping online services in a unified portal following a user-centered logic. Services within the portal will be made fully interoperable federating services in a unique environment and will enable public administrations to make better use of customer and businesses information and to adapt public services (e-services) so they more often meet the needs of people and businesses. The objective is to have services that are more accessible, more user-friendly, more efficiently run by public authorities and less expensive for the taxpayer. The initiative will be launched with OASIS platform hosting thirteen e-government services that will be deployed in four countries and five pilot sites. Currently each e-government service is provided only in one pilot site; through OASIS platform each e-government service will be provided in two or three countries.

Although public authorities can strongly benefit from the vision of OASIS and using federation of services to foster flexibility and scalability, it should be noticed that such organizational and technical change is not straightforward. Several challenges inhibit the realization of such innovative e-government provision, including information privacy concerns, reengineering of business processes and introduction of new business models and difficulty in measuring the performance of a dynamic systems as OASIS platform. The purpose of this paper is to identify and analyse those challenges as they emerge and present the identified solutions for OASIS platform based on conceptual analysis and focus groups interviews, including privacy requirements, proposed business models and KPIs for public services on cloud computing.

The rest of the paper is organized as follows; after this introduction, three sections present the three categories of challenges, information privacy, business models and performance measurement respectively. For each challenge each section presents the related background, the challenges that were met and the solutions that were designed. Finally, we present the conclusions of the paper.

2 INFORMATION PRIVACY PERSPECTIVE

2.1 European and National Obligations for Personal Data Protection

Given that OASIS platform envisions becoming a central portal for e-government services for multiple countries, information privacy becomes by default a central point of interest. First, the perceived end-user perception on information security and privacy is a major prohibit for adopting cloud computing (ENISA, 2009). Second, given that public agencies process personal and/or sensitive personal data, the implementation of a central platform for e-government services raises concerns for legal compliance with the personal data protection legislation. A two-phase analysis was followed to ensure that personal data protection is ensured. Second, the e-government services were analysed in comparison to the European Union Directive and the national legislation for personal data protection of the involved countries. Second, recommendations were given to ensure legal compliance having in mind the cross-border transfer of data.

For the purposes of the OASIS project the selected public services will be deployed within four countries and five pilot sites. The national legislation of each one of the four countries was analysed focusing on the following aspects: definition of personal data, regulatory framework for privacy protection, existence of supervisory authority for data protection, and if there are provisions for the obligation to install proper security countermeasures for data protection. The services deployed in OASIS were examined especially considering if they are going to be deployed in several countries and what legislative requirements exist to them, the type of data processed from the applications and any additional security and privacy requirements that might be required. The analysis was also driven by the special context of each e-government service and the data that are being processed; for example one of the selected e-government services processes children's medical data and hence the

recommendations of the Working Party under Article 29 of Directive 95/46/EC (Opinion 2/2009) were taken into consideration. Table 1 presents the legal documents that were taken into consideration:

Country	Supervisory Body	Legal Document
France	CNIL (National Commission for Informatics and Privacy)	National Law for compliance to the EU Directive 96/46/EC: The digital and privacy law (“loi informatique et liberté”)
		N°2004-1343 December 9, 2004
		N°2005-1516 December 8, 2005
Italy	Supervisory Authority for Personal Data Protection (Garante per la Protezione dei Dati Personali or Garante)	National Law for compliance to the EU Directive 96/46/EC: Data Protection Code, 2003
		Legislative Decree No. 70 of 9 April 2003
		Legislative Decree No. 259 of 1 August 2003
Bulgaria	Commission for Personal Data Protection	National Law for compliance to the EU Directive 96/46/EC: Personal Data Protection Act (PDPA), 2002
		Constitution of the Republic of Bulgaria (13 July 1991)
		Electronic Communications Act (2011)
Turkey	Telecommunications Council	National Law for compliance to the EU Directive 96/46/EC: Draft Law on the Protection of Personal Data (not in force)
		Turkish Constitution
		Regulation on Personal Data Processing and Protection at Telecommunication Sector
		Civic Code

Table 1: Sources of requirements for compliance to personal data protection legislation

2.2 Challenges

One of the main challenges for the implementation of OASIS platform today is the lack of harmonised guidelines for the protection of personal data when cloud computing technologies are involved. The EU Directive in force for the protection of personal data is not appropriate for cloud computing environments, mainly due to the dynamic localisation of data. The European Commission on January 25th 2012 has proposed a comprehensive reform of the Directive 95/46/EC to strengthen online privacy rights and boost Europe's digital economy (Europa, 2012a). The main reasons driving this initiative are that a) the technological progress and globalisation have profoundly changed the way personal data is collected, accessed and used, and b) the 27 Member States have implemented the Directive differently, resulting in divergences in enforcement. The rapid technological developments and globalisation have brought new challenges for data protection. With social networking sites, cloud computing, location-based services and smart cards, people leave digital traces with every move they make. In this “brave new data world” there is a necessity for a robust set of rules.

2.3 Empirical Findings

Within this rather unstable legislative framework for the data protection, we have identified preliminary privacy requirements per e-government service, which will be running in the cloud environment, based on the diversity of the Member States transpositions of the Directive and the Turkish legislation in force. As a result, Table 2 summarises the recommendations that derive from the analysis of each e-government service and the four national legislative contexts.

Service	Existence of Processing of Personal data	Privacy requirements			
		Italy	France	Bulgaria	Turkey
<i>A filling system for electronic documents (Archiland)</i>	-	N/A	None	N/A	N/A
<i>A user-centric web portal of basic services (Capdemat)</i>	√ Personal data and special categories of personal data	Specify data controller, notify or ask permission from authority (based on national legislation), conduct risk analysis, implement security controls, pay particular attention to the guidelines for children's personal data and the special case of schools	Specify data controller, notify or ask permission from authority (based on national legislation), conduct risk analysis, implement security controls, pay particular attention to the guidelines for children's personal data and the special case of schools	Specify data controller, notify or ask permission from authority (based on national legislation), conduct risk analysis, implement security controls, pay particular attention to the guidelines for children's personal data and the special case of schools	N/A
<i>A crowd-mapping application for public domain management (Ushahidi)</i>	-	None	None	None	N/A
<i>A software suit for internal management of local public authorities (OpenMairie)</i>	√	N/A	Specify data controller, notify authority, conduct risk analysis, implement security controls	N/A	N/A
<i>Monitoring the progress in projects funded by a development agency</i>	√	N/A	N/A	N/A	Establish a credentials management system and implement security measures (without legal obligation)
<i>Investment promotion and business retention</i>	√	N/A	Specify data controller, notify authority, conduct risk analysis, implement security controls	N/A	Establish a credentials management system and implement security measures (without legal obligation)
<i>Data collection</i>	-	N/A	N/A	N/A	Establish a credentials management system and implement security measures (without legal obligation)
<i>Cluster development and management</i>	√	N/A	N/A	N/A	Establish a credentials management system and implement security measures

					(without legal obligation)
<i>City Planning</i>	-	None	None	N/A	N/A
<i>Mapping of territorial economic activities</i>	-	None	N/A	N/A	N/A
<i>Platform that provides static and dynamic public data (OpenData)</i>	-	N/A	None	N/A	N/A
<i>E-Gov Platform</i>	√	Specify data controller, notify authority, conduct risk analysis, implement security controls	N/A	N/A	N/A
<i>Alternative Tourism Network – based on Content Management System (Joomla)</i>	-	N/A	N/A	None	N/A

Table 2: Privacy Requirements for OASIS e-Government Service

3 BUSINESS PERSPECTIVE

In order to examine the business challenges and opportunities of federated public services one has to study the business environments of the involved stakeholders, which mainly include the public authority, the private IT services provider and the OASIS platform. For that purpose we use as a vehicle the concept of business model.

3.1 Background

3.1.1 Business model concept

Breaking down the term business model into the ‘business’ and ‘model’ components helps us create an understanding of the concept:

- Business: a particular organization engaged in the trade of goods, services, or both to consumers or generally the activity of buying and selling goods and services.
- Model: a representation of an object usually on a smaller scale or a simplified representation/description of a complex entity.

Variant definitions exist in the literature, which emphasize either the revenue/product aspects, the business actors and network aspects or the marketing specific aspects (Osterwalder and Pigneur, 2002).

Amit and Zott (2001) argue that a business model depicts the content (goods/services, resources/capabilities), structure (parties involved; linkages; sequencing; exchange mechanisms), and governance of transactions (flow control) designed as to create value through the exploitation of business opportunities. Margetta (2002) states that a business model tells a story explaining who the customers are, what do the customers value and how the business can make money providing that value. At the same time a business model should explain the underlying economic logic of how the business delivers value to the customers at an appropriate cost and how the business is profiting from the specified activities. A simpler definition of business model as a method by which an enterprise builds and uses its resources is given by Afuah and Tucci (2001). Timmers (1999) defined a business model as the architecture for product, service and information flows, including a description of the various business actors and their roles, the sources of revenues, and the potential benefits for the various business actors. Similarly, Weill and Vitale (2001) define a business model as a description of the roles and relationships among a firm’s consumers, customers, allies, and suppliers that identifies the major flows of product, information, and money, and the major benefits to participants. According to Elliot (2002), a business model specifies the relationships between different participants in a commercial venture, the benefits and costs to each and the flows of revenue. The purpose of a business model is to address the relationship between profits, revenues and costs. Petrovic et al. (2001) perceives business models as the logic of a business system for creating value. Hawkins (2001) describes a business model as the commercial relationship between a business enterprise and the products and/or services it provides in the market. He explains that it is a way of structuring various cost and revenue streams such that a business becomes viable, usually in the sense of being able to sustain itself on the basis of income it generates. Rappa (2001) defines it as the method of doing business by which a company can sustain itself; i.e. generate revenue. Shafer et al. (2005) conduct an exhaustive review of business models definitions and define business models as a representation of a firm's underlying core logic and strategic choices for creating and capturing value within a value network. Keen and Qureshi (2006) argue that the logic of value-generation is the core of a business model and regard two themes in the conceptualization of business models: (1) focus on value, and (2) the basic logic of the business. They assert that business models are a vehicle for addressing how to balance value between the customer and the provider. Osterwalder et al. (2005) define business models as a conceptual tool that describes the value that a company offers to one or several segments

of customers and of the architecture of the firm and its network of partners for creating marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams.

Osterwalder (2004) summarizes the objectives of a business model into the following:

1. To contribute in capturing, visualizing and better understanding of the business logic of an enterprise
2. To improve measuring, observing and comparing the business logic of a company
3. To improve the alignment of strategy, business organization and technology
4. To help foster innovation and increase readiness for the future through business model portfolios and simulation
5. To assist on patenting e-business processes or even entire aspects of the business.

3.1.2 Business Model Components

Deriving from the diversity of definitions, a controversy also appears on the building blocks that comprise a business model. Hedman and Kalling (2003) suggest that a generic business model includes the following causally related components: (1) customers, (2) competitors (3) offering, (4) activities and organisation, (5) resources, (6) supply of factor and production inputs, and (7) Longitudinal characteristics such as constraints on actors, cognitive and social limitations. Mahadevan (2000) indicates that a business model consists of a configuration of three streams: (1) the value stream, which identifies the value proposition for the business partners and the buyers, (2) the revenue stream, which is a plan for assuring revenue generation for the business, and (3) the logistical stream, which addresses various issues related to the design of the supply chain for the business. Shafer et al. (2005) suggest that a business model consists of the following groups of components:

1. Strategic choices: customer target, value proposition, capabilities/competencies, revenue/pricing, competitors, offering, branding, mission, etc.
2. Create value: resources/assets, processes/activities.
3. Value network: suppliers, customer information and relationship, information flows, product/service flows.
4. Capture value: cost, financial aspects, profit.

Recent literature seems to converge on the components that construct a business model. Chesbrough and Rosenbloom (2002) state that a business model is composed of 1) value proposition (i.e., the value created for users by the offering based on the technology), 2) market segment (i.e., the users to whom the technology is useful and for what purpose), 3) value chain structure (within the firm required to create and distribute the offering), 4) cost structure and profit potential (of producing the offering, given the value proposition and value chain structure chosen), 5) value network positioning (i.e. the position of the firm within the value network linking suppliers and customers including identification of those with whom the firm will potentially complement or compete), 6) competitive strategy (by which the innovating firm will gain and hold advantage over rivals). Osterwalder (2004) and Osterwalder and Pigneur (2004), suggest a widely cited ontology for developing business models that organises the business model elements into the following four pillars further explained in Table 3:

Pillar	Building Block	Description
Product	Value Proposition	A Value Proposition is an overall view of a company's bundle of products and services that are of value to the customer.
Customer Interface	Target Customer	The Target Customer is a segment of customers a company wants to offer value to.
	Distribution Channel	A Distribution Channel is a means of getting in touch with the customer.
	Relationship	The Relationship describes the kind of link a company establishes

		between itself and the customer.
Infrastructure Management	Value Configuration	The Value Configuration describes the arrangement of activities and resources that are necessary to create value for the customer.
	Capability	A capability is the ability to execute a repeatable pattern of actions that is necessary in order to create value for the customer.
	Partnership	A Partnership is a voluntarily initiated cooperative agreement between two or more companies in order to create value for the customer.
Financial Aspects	Cost Structure	The Cost Structure is the representation in money of all the means employed in the business model.
	Revenue Model	The Revenue Model describes the way a company makes money through a variety of revenue flows.

Table 3: The 4 Pillars and 9 Building Blocks of Business Models (Osterwalder, 2004)

3.2 Challenges in Reflecting the Business Context

The components of a business model are dependent to the nature and context of the business carried out. It is argued that e-commerce and e-business business models are inappropriate for the e-government context because they often focus on maximizing revenue and profit and outweighing competitors, whereas the primary interests of governments are in gaining more efficiency, enhancing the existing public services and developing new ones and empowering citizens (Janssen and Kuk, 2007; Lee and Hong, 2002). Furthermore public networks are quite different from individual organizational hierarchies; service provisioning in the context of e-government typically requires collaboration among a range of actors across different agencies. Finally, government agencies are inherent monopolies, while enterprises function in a competitive and free context. Although the concept of business models has been widely used it is relatively unexplored in the context of e-government (Janssen and Kuk, 2007; Janssen et al., 2008). Very little is known in the e-government field about the components of a business model, the intermediate variables and processes that translate an e-government business model into new service offerings (Janssen and Kuk, 2007). Janssen and Kuk (2007) identify six key components of a business model in public service networks:

1. Organizations in the public service network: The organizations that need to collaborate for the provision of the e-government services.
2. Service offerings: The services that are provided by the processing of data and e-government.
3. Network coordination: The managerial and organizational structures that are necessary for the coordination and facing of problems.
4. Business processes: The business processes that define the information and activities flows involved in the e-government services provision.
5. Shared resources: The role of all resources, including IT resources and human resources for supporting the business processes underlying the e-government services.
6. Network capabilities: The use of ICT for better reuse of existing knowledge and expertise through building interfaces among management, operation and the design and development of infrastructures.

Janssen et al. (2008) describe eight e-government Web-based business models:

1. Content Provider: provision of static and dynamic content including information on products, and services focusing upon the core-business. This content is coming from a single organization and can be customized to match customers' needs.
2. Direct-to-Customer: direct service provisions to customers and businesses focusing upon the traditional functions, services, and products of the organization.

3. Value-net-integrators: coordination of the collection, processing, and distribution of information from several organizations, such a one-stop shop to a certain customer segment. This model coordinates the services provision of other organizations and does not provide any services directly.
4. Full-service provider: collaboration among a number of organizations to provide a one-stop shop. The customers do not directly deal with individual organizations and the identities of the organizations are often hidden and play no major role.
5. Infrastructure service provider: provision of infrastructure services to support the creation of Web sites. Often the infrastructure provider is founded when many organizations discover that they are developing a similar set of functionalities and decide to concentrate the development and service provisioning in one organization.
6. Market: This model brings together supply and demand using market mechanisms. The governmental organization intermediates between many providing and requesting organizations.
7. Collaboration: facilitation of electronic participation and discussion among citizens, business, and public administration for activities including policy-making projects and decision-making.
8. Virtual communities: This model concerns the creation of a community, which is centred on a certain topic or a group of recurring customers.

In order to overcome those difficulties, Al-Debei and Avison (2010) developed a unified framework for the business model concept, taking into account the related literature on the various contexts in which the business model concept applies, including e-commerce, e-business and e-government. Al-Debei and Avison (2010) recognise four elements of business models, as depicted in Table 4.

Dimension	Elements
Value Proposition An overall view of a company's bundle of products and services that are of value to the customer	Product and/or service
	Intended value element
	Target segment
Value Architecture Technological Architecture and Organizational Infrastructure	Core resources
	Core competence
	Value configuration
Value Network Business and Customer Actors Web	Actors
	Role
	Relationship
	Flow communication
	Channel
	Governance
	Network mode
Value Finance Financial Setups and Returns	Costing
	Pricing methods
	Revenue structure

Table 4: The Business Model Elements (Al-Debei and Avison, 2010)

3.3 Empirical Findings

The state of the art analysis demonstrates that although the business model concept is mature for the e-commerce and e-business context, it should be differentiated for the e-government context. For the purposes of building the OASIS business case, we adopted the business process structure of Al-Debei and Avison (2010) (further referred to as e-business perspective) but also the framework of Janssen and Kuk (2007) (further referred to as e-government perspective). The reason is that we aimed at

focusing on both the efficiency value proposition of the governmental agencies models, but also in demonstrating deficiencies of current public electronic services' configuration and how OASIS can provide opportunities to public agencies to become competitive and profitable using cloud computing as a vehicle. Hence, we analysed the five pilot sites' current and future business models using both frameworks.

The analysis of the five pilot sites with the e-business perspective led us to conclude that there is no clear structure for managing the Value Finance component in all cases. Specifically, in all pilot sites we found no linkage between the revenues and costs of providing the e-services. Although public administration does not focus on making profit, from a management perspective it is needed to create a sustainable connection between revenues and costs. Additionally, in most pilot sites, the exploitation of the resources for the provision of the e-services does not create a core competence for the public administration. Finally we noticed that the pilot public agencies tend to hold a contract with a service provider per e-service; hence there is a chance that the capacities of the private providers are not fully taken advantage. Moreover, this practice inevitably increases the administrative burden for creating and monitoring multiple contracts.

The analysis of the five pilot sites with the e-government perspective helped us identify an unnecessary fragmentation of resources within the pilot agencies; although most e-government services require the same business processes and human and IT resources (at least to some extent), the current practice leads to segmentation and probably repetitions that lead to delays, inability to advance knowledge and skills, inefficient use of resources, etc. An example of such repetitions is demonstrated at Figure 1. Across the four countries we noticed that the different public agencies tend to repeat the same processes and occupation of resources in order to provide an e-government service; hence there would be as many instances of the business model (IT resources, personnel, administrative work) as the agencies that provide the e-government service. This is accompanied by slow and bureaucratic procedures to establish a new e-service and fragmentation of resources. Finally, although the needs of the local public authorities resemble, a lack of coordination prevents the creation of economies of scale that could benefit the governments. This means that the provider actually multiplies the revenues for providing the exact same service to various public agencies.

The same analysis of the envisioned OASIS business model reveals how some of these issues can be addressed. OASIS platform deals with the segmentation and isolation of information by grouping online services in a unified portal using the advancement of federating services technologies. Federating services enable the public administration to make better use of IT resources making the services more efficient and less expensive by creating economies of scale and removing duplications of organisational structures and IT infrastructures. OASIS gives the opportunity to public agencies to make a better use of public assets (especially information) and create competitive advantage from making smart processing of it that could be exploited by other agencies. Figure 2 presents OASIS business model from an e-government perspective demonstrating the reduction of repetitions compared to the existing business models (Figure 1). OASIS presents an opportunity to resolve or improve the above problems by creating a central access point that can operate as a marketplace for e-government services. The main concept underlying this business model is that the service functioning and the data can be regarded as separate elements. The public agencies are responsible for the secure processing of public data, but the private service providers can propose novel ways that these data can be processed in the benefit of citizens, businesses and local authorities. OASIS presents a business model in which the public agencies can share with the private service providers the investment costs for a new service offering, but also can create and share revenue by them. Finally, OASIS can become the coordinator of such e-service agreements and aggregate public requests to achieve better price offerings by the private sector.

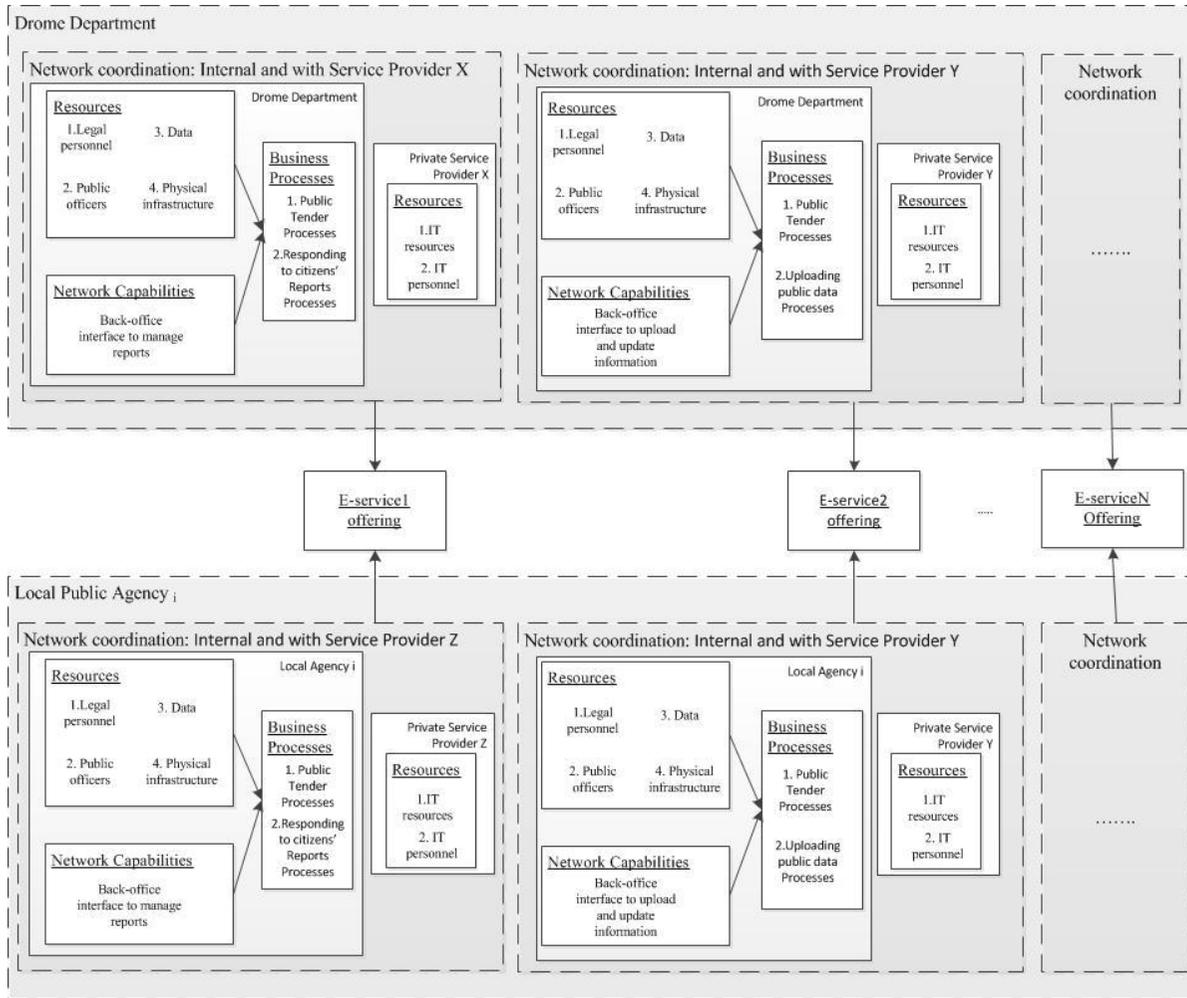


Figure 1: Business model of a Pilot Public Agency from an e-Government perspective

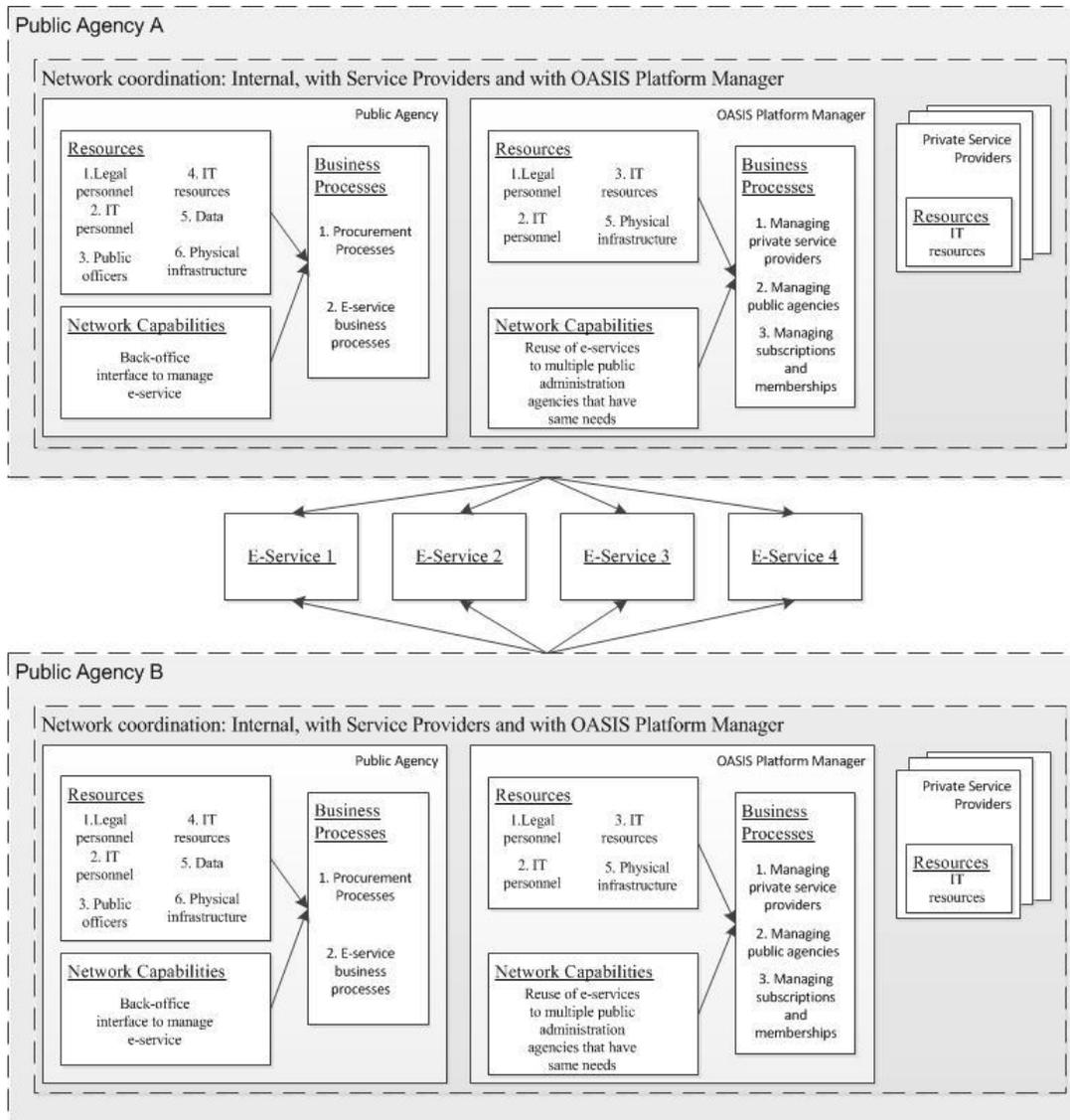


Figure 2: OASIS Business Model From an e-Government perspective

4 PERFORMANCE MEASUREMENT PERSPECTIVE

Availability of electronic public services ('supply-side') has been the primary focus of e-government studies and policymaking, but over the past years, citizen usage of e-government services ('demand-side') has also become a priority issue (Irani et al., 2005; United Nations E-Government Survey, 2012). Hence, performance measurement should not only focus on the assessment of the e-government services' technical capacity and cost-effectiveness, but also the non-technical aspects that include users' acceptance. For this reason the performance measurement followed two main dimensions: the technical and the non-technical. The technical perspective refers to assessing the operation and performance of OASIS. The non-technical perspective refers to evaluating the behavioural dimensions.

4.1 Background

4.1.1 Behavioural Evaluation

Several researchers have proposed indicators for evaluating citizens' satisfaction with e-government services. Johnston (1995) compiled eighteen determinants of service quality that have been used for assessing e-government services' quality, including availability, reliability, friendliness, functionality, access, aesthetics, etc. Parasuraman et al. (1988) have developed a widely accepted model namely SERVQUAL for measuring service quality, which includes five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Information system researchers have adopted and modified the SERVQUAL model for e-services quality, including dimensions of website design, reliability, fulfilment, security, responsiveness, personalization, information (accuracy, comprehensibility, etc.) and empathy (Li and Suomi, 2009). Similarly, Zeithaml et al. (2001) adopt the SERVQUAL model for e-service quality evaluation and propose eleven dimensions: access, ease of navigation, efficiency, flexibility, reliability, personalization, security/privacy, responsiveness, assurance/trust, site aesthetics, and price knowledge.

Moreover, several information system researchers have applied technology acceptance theories in order to evaluate e-government services from a citizen's perspective. From the middle of 1970s to early 2000s, there have been numerous studies regarding information systems acceptance that have focused on the reasons why potential users do or do not accept information technology. Many research models have been developed and empirically validated mainly including: The theory of Reasoned Action (Fishbein and Ajzen, 1975), Social Cognitive Theory (Bandura, 1986), Technology Acceptance Model (Davis, 1989) and extended Technology Acceptance Models (Venkatesh and Davis, 2000; Venkatesh and Bala, 2008), Theory of Planned Behaviour (Ajzen, 1991), Model of PC Utilisation (Thompson et al, 1991), Motivation Model (Davis et al., 1992), the Innovation Diffusion Theory (Rogers, 1995).

The line of research in technology acceptance models was culminated by the Unified Theory of Acceptance and Use of Technology (UTAUT), which is developed by Venkatesh et al. (2003). The UTAUT aims to explain users' intentions to use an information system and the subsequent usage behavior. The model has been empirically examined by numerous studies. The UTAUT model integrates eight previously developed models and theories that relate to technology acceptance and use. Venkatesh et al. (2003) compared the eight dominant models in explaining technology acceptance behavior that have been used previously by researchers and scholars.

Another dominant stream of research in information systems evaluation field focuses on information systems success including several conceptual and empirical studies. Zmud (1979) conducted an assessment of information system research factors and reviewed issues addressed by most academics and practitioners concerning the influence of individual differences upon management information system design, implementation, and usage. In 1983, Bailey and Pearson (1983) outlined that evaluating and analysing computer user satisfaction is an aspiration to improve the productivity of

information systems by organizational management. According to the authors productivity in computer services means both "efficiently supplied and effectively utilized data processing outputs" (Bailey and Pearson, 1983). Soon after, Ives and Olson (1984) conducted a study emphasizing the importance of users' involvement. After a decade, a study followed by Davis (1989) developed the technology acceptance model, which explained the relationship among information systems beliefs (e.g. perceived usefulness and ease of use, attitudes, behavioural intentions) and systems usage. DeLone and McLean (1992) developed the information systems success model, which consisted of information quality, system quality, use, user satisfaction, individual impact and organizational impact. In the year of 1995, Goodhue and Thompson (1995) developed the task-technology fit model. The authors argued that the model services as the basis for a strong indicative tool to assess whether an information system including systems, policies, IS staff, and services in a given organization are meeting user needs. Among the above mentioned studies, DeLone and McLean's IS success model (1992) has gained a great attention from scholars and a widespread attention in the information success literature (Vaidya, 2007).

Having reviewed the theoretical frameworks that can help us in identifying Key Performance Indicators (KPIs) for evaluating OASIS performance we focused on two prominent models; namely UTAUT model and DeLone and McLean IS success model. An integration of the two research models attempts to tie quality dimensions from IS Success model together with UTAUT model. Ten factors are examined to affect users' intention to use the e-government services: (1) information quality, (2) information satisfaction, (3) system quality, (4) system satisfaction, (5) service quality, (6) service satisfaction, (7) social influence, (8) performance expectancy, and (9) effort expectancy, and (10) facilitating conditions.

4.1.2 Socio-Economic Evaluation

Literature lacks a concrete model for a socio-economic assessment of e-government services. Alshawi and Alalwany (2009) investigate the citizens' perspective in evaluating e-government services, and present a set of evaluating factors that influence citizens' utilization of e-government services, including technical, economic and social dimensions. Technical issues refer to performance and accessibility of e-government services. The economic and social dimensions include cost saving, openness and trust, as further described in Table 5.

Dimension	Construct	Root Construct	Description
Economical Issues	Cost Saving	Money saving	How much money the citizens are saving by using e-government services.
		Time Saving	How much time the citizens are saving by using e-government services
Social Issues	Openness	Openness	A combined function of the amount of data available on a governmental agency websites (transparency) and the ease with which users are able to access people or data (interactivity).
	Trust	Trust in the Internet	Degree of confidence of the citizens in the Internet
		Trust in government organisations	Level of security in handling of information and protecting the privacy of citizens

Table 5: Socio-economic e-Government Evaluation Factors (adopted by Alshawi and Alalwany, 2009)

The study of Alshawi and Alalwany (2009) apply measurements for all above constructs, except from openness whose measurement was hindered by political limitations of the study. However, a dominant approach in the literature (Welch and Wong, 2001; Welch and Wong, 2004) about measuring governmental website's openness is the one presented by the Cyberspace Policy Research Group (CyPRG). The Cyberspace Policy Research Group (CyPRG) surveyes annually national government Web operations worldwide and provides comparative analysis of website openness. CyPRG defines

government websites openness to be a function of two factors: transparency and interactivity. Transparency refers to the extent to which an organization reveals work and decision processes and procedures; a more transparent government allows citizens to monitor the performance of public organization more easily through the increase in the availability of information. Transparency is measured using five constructs: ownership, contacts, issue or organizational information, citizen consequences, and timeliness of data. Interactivity refers to the quality of communication between agency and citizen; a more interactive public organization enhances accountability by being more responsive to the preferences of the citizens. Interactivity is measured as the combination of ownership, reachability, issue or organizational information and citizen consequences.

Additionally, ENISA (2011) provides an in-depth and independent analysis for governmental services in cloud computing and outlines some of the information security benefits and key security risks of cloud computing. ENISA recognizes the challenge of the governmental decision-makers who have to decide whether to deploy public services on the cloud or not, and aims at facilitating the decision making process by highlighting variables that need to be taken into account. Besides the technical parameters, the report emphasises on the business, operational, legal and regulatory issues:

Business/Operational Issues	Operational cost	The increase reduction of expenses related to the operation of the e-government services
	Capital expenditure	The degree to which deployment to the e-services creates future (long-term) benefits
	Cost of migration	The financial cost related to switching to cloud computing (e.g. training)
	Vendon lock-in	The degree to which the governmental agency can migrate cloud services from one provider to another without technical or contractual restrictions or substantial switching costs
Legal and regulatory compliance	Forensics	Extraction of evidence contained in cloud services (e.g. e-discovery, data retention)
	Data retention and track back	Minimum and maximum data retention periods
		Minimum and maximum log retention periods
		Data and log storage modality
Governmental control over the data	The degree to which the government controls the responsibility for the proper data handling and can ensure that the legal obligations to protect the data are satisfied by the providers	

Table 6: Socio-economic parameters for governmental cloud services (adopted by ENISA, 2011)

4.1.3 Technical Evaluation

For the technical evaluation, the indicators were selected to cover a wide range of requirements and consider different technical macro-areas and issues, which can be summarized as follows:

- Scalability & Flexibility
- Fault Tolerance & Reliability
- Maintenance and Monitoring
- Performance
- Hardware resources
- Usability
- Security and Privacy

4.2 Challenges

Since a major prohibit for adopting cloud computing is the perceived customer or end-user perception on information security and privacy (ENISA, 2009), information privacy should be an assessment variable integrated in the model. For that purpose we adopt the research work of Dinev and Hart (2006) who identify the factors representing elements of a privacy calculus in the e-commerce domain. Therefore, under the citizen satisfaction variables, we add the parameter of willingness to provide personal information. The constructs are further described in and the integrated model is presented in.

Willingness to provide personal information to the e-service	Perceived Internet privacy risk	Perceived risk related to the disclosure of personal information submitted by cloud internet users in general
	Internet privacy concerns	Concerns related to the personal information submitted over the cloud internet by the respondent in particular
	Internet trust	Trust beliefs reflecting confidence that personal information submitted to cloud based services will be handled competently, reliably, and safely.
	Personal Internet interest	Personal interest or cognitive attraction to cloud internet content overriding privacy concerns.

Table 7: Information privacy construct (adopted by Dinev and Hart, 2006)

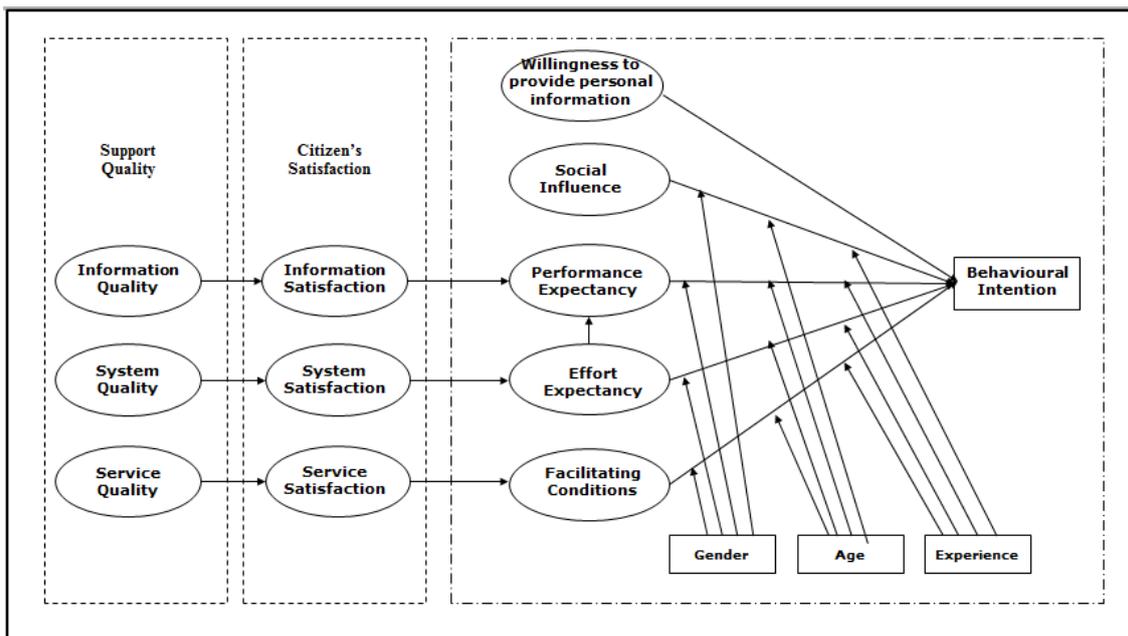


Table 8: Integrated Model for e-Government Services in the Cloud

The technical evaluation is also challenging since cloud oriented platforms are new and they are experimenting a continuous evolvement it is not easy to get information from the existing literature for exclusive cloud oriented KPIs.

4.3 Empirical Findings

Two focus groups were realised with user communities of these pilot sites taking consideration of the e-government services that are currently running. The users also considered their overall experience from generally using e-government services. Five users of e-government services participated in Italy

and six users in France. Table 9 presents the demographic information of the two focus groups' participants.

Pilot Site	Sex		Age		Education		E-government services usage	
	Italy	Male	60%	18-25	-	Primary school	-	1 year<
Female		40%	26-35	-	Secondary School	20%	2 years<	-
		36-45	80%	High School	-	5 years<	20%	
		46-55	20%	Undergraduate University	60%	10 years<	80%	
		56-65	-	Postgraduate University	20%			
France	Male	16,6%	18-25	-	Primary school	-	1 year<	-
	Female	83,3%	26-35	66,6%	Secondary School	50%	2 years<	-
			36-45	-	High School	33,3%	5 years<	20%
			46-55	16,6%	Undergraduate University	16,6%	10 years<	80%
			56-65	16,6%	Postgraduate University	-		

Table 9: Focus groups participants demographic information

4.3.1 Behavioural KPIs

Following the integrated framework for the evaluation of the e-government service we have developed the KPIs depicted in the first two columns of Table 10. The behavioural metrics are measured in a scale of 1-5 (which correspond to Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree replies respectively). The measurement instrument is presented in Appendix A.

The first measurement will calculate the following for the current provision of each e-service, where the service currently exists (adopting the questionnaire to reflect inquiries about the current public agency's website):

- Mean Score per category
- Number of users with high satisfaction scores (4 or 5)
- % Users with high satisfaction scores (4 or 5)

The second measurement will be at the beginning of the pilots, by adding the questionnaire at the OASIS website. The participants will be asked to complete the name(s) of the service(s) that they have used and then complete the questionnaire. A third measurement is planned a year after. The following KPIs will be measured in the annual measurements:

- Mean Score per category
- % Users with high satisfaction scores (4 or 5)
- Users with high satisfaction scores/total number of users
- % of increase for mean score per category
- % of increase to the number of users with high satisfaction scores
- % of increase of ratio for users with high satisfaction scores

KPI		Mean Score per category	% Users with high satisfaction scores (4 or 5)	Users with high satisfaction scores/total number of users	% of increase for mean score per category	% of increase to the number of users with high satisfaction scores	% of increase of ratio for users with high satisfaction scores
<i>Performance Expectancy</i>	Perceived Usefulness						
	Relative Advantage						
	Outcome Expectations						
<i>Effort Expectancy</i>	Perceived Ease of Use						
	Complexity						
	Social Factors						
	Facilitating Conditions						
	Compatibility						
<i>System Quality</i>	Reliability						
	Accessibility						
	Navigation						
<i>Information Quality</i>	Completeness						
	Accuracy						
	Format						
	Currency						
	Relevance						
<i>Service Quality</i>	Responsiveness						
	Assurance						
	Empathy						
<i>User Satisfaction</i>	Information Satisfaction						
	System Satisfaction						
<i>Willingness to provide personal information to the e-service</i>	Perceived Internet privacy risk						
	Internet privacy concerns						
	Internet trust						
	Personal Internet interest						

Table 10: Behavioural KPIs

The performance of the system will be evaluated with accordance to the following metrics levels:

Measured Change	Performance Assessment
3-4%	Acceptable
5-7%	Good
7-10% or more	Excellent

Table 11: Behavioural KPIs levels

4.3.2 Socio-Economic KPIs

The socio-economic metrics refer to the perspectives of both the end-users of the services, as well as the public agencies that provide the service through OASIS platform. It should be noted that the trust related social issues are covered by the behavioural evaluation and hence will not be repeated in the socio-economic assessment.

KPI category	KPI
Openness (User-oriented)	Openness
Legal and regulatory compliance (Provider-oriented)	Forensics
	Data retention and track back
	Governmental control over the data
Cost Saving (User-oriented)	Time Saving
	Money Saving
Operational Savings (Provider-oriented)	Development Cost
	Operational cost
	Cost of migration
	Vendon lock-in

Table 12: Socio-Economic KPIs

The socio-economic assessment from a user perspective will be measure in a scale of 1-5 (which correspond to Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree replies). The socio-economic metrics will be measured periodically for the OASIS services. The measurement instruments are presented in Appendix B.

The first measurement will calculate the following for the current provision of each e-service, where the service currently exists (adopting the questionnaire to reflect inquiries about the current public agency's website):

- Mean Score per category
- Number of users with high satisfaction scores (4 or 5)
- % Users with high satisfaction scores (4 or 5)

The second measurement will be at the beginning of the pilots, by adding the questionnaire at the OASIS platform. The participants will be asked to complete the name(s) of the service(s) that they have used and then complete the questionnaire. A third measurement is planned a year after. The following KPIs will be measured in the annual measurements:

- Mean Score per category
- % Users with high satisfaction scores (4 or 5)
- Users with high satisfaction scores/total number of users
- % of increase for mean score per category
- % of increase to the number of users with high satisfaction scores
- % of increase of ratio for users with high satisfaction scores

KPI		Mean Score per category	% Users with high satisfaction scores (4 or 5)	Users with high satisfaction scores/total number of users	% of increase for mean score per category	% of increase to the number of users with high satisfaction scores	% of increase of ratio for users with high satisfaction scores
Openness	Openness (Transparency)						
	Openness (Interactivity)						
Cost Saving	Time Saving						
	Money Saving						

Table 13: Socio-economic KPIs measurement levels (Provider-oriented)

The performance of the system will be evaluated with accordance to the same metrics levels as in Table 11. The socio-economic assessment from a public agency perspective will be realised per pilot site based on the information depicted in Table 14.

	KPIs category		KPIs	Expected Results
Social Issues	Legal and regulatory compliance	Forensics	Number of audit events that can be kept by the Agency being in OASIS/Number of audit events that are kept for the same services in the original site	Expecting $X > 1$ The bigger the value, the more adequate.
		Data retention and track back	Number of data duplicates	Expecting $X=0$ The closer to 0 is the better.
		Governmental control over the data	Number of accurances in which data cannot be fully deleted by the Agency	Expecting $X=0$ The closer to 0 is the better.
Economical Issues	Operational Savings	Development Cost	Cost to adopt the e-services from OASIS/Cost of actual development for same e-services (original site)	Expecting $X < 1$ The smaller the value, the more adequate.
		Operational cost	Annual operational cost to provide the e-services with OASIS/Annual operational cost to provide the same e-service without OASIS	Expecting $X < 1$ The smaller the value, the more adequate.
		Cost of migration	Migration costs/Cost of actual development for the e-services (original site)	Expecting $X < 1$ The smaller the value, the more adequate.
		Vendon lock-in	Number of times that the agency is "locked" to OASIS	Expecting $X=0$ The closer to 0 is the better

Table 14: Socio-economic KPIs measurement levels (Provider-oriented)

5 CONCLUSIONS/LIMITATION/FUTURE RESEARCH

This paper presents and analyses challenges that public governance might face in developing innovative e-government systems based on cloud computing, such as a centralized platform for providing e-government services across countries. Public authorities can greatly benefit from such

innovative technologies through economies of scale, flexibility, rapid development and use of e-government services, etc. However, embracing such innovation implies a multitude of changes and challenges, including information privacy concerns and personal data protection compliance requirements, new business models and difficulties in measuring performance. Drawing upon previous literature we tackle each one of these challenges and provide insight on the way they were addressed in an actual system under development.

First, having into consideration the legislative framework of four countries, we provide recommendations for the public agencies that participate and the central platform entity. Second, we analyse business models literature and by adopting an e-business and an e-government perspective we highlight the benefits, but also the business changes in using e-government services from the central platform. Third, examine performance measurement from a technical, socio-economic and behavioural perspective. For the latter two we draw upon research models and information technology acceptance theories and develop a set of KPIs and survey instruments to measure them.

Identifying those challenges for innovative design of e-government services through a central portal in Europe we expect to facilitate the work of e-government practitioners and accelerate the adoption of such technologies.

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Appendix A: Behavioural Measurement Instrument

	Attribute Under Evaluation	Your Assessment				
		Strongly Disagree	Disagree	Neutral/ No opinion	Agree	Strongly Agree
1.	Information Quality					
1.1	The information on the OASIS services is free from errors; has no errors and covers all information needed					
1.2	The information on the OASIS services is up-to-date					
1.3	The information presented in the OASIS services is relative to my needs					
1.4	The OASIS services provide me with all the information I need.					
1.5	The information on the OASIS services is presented in a satisfactory format.					
2.	System Quality					
2.1	It is easy to navigate within the OASIS services					
2.2	It is easy to go back and forth between the OASIS services' webpages					
2.3	The OASIS website and services are available all the time					
2.4	OASIS website loads all the text and graphics quickly					
2.5	It only takes a few clicks to locate information on the OASIS website					
3.	Support Quality					
3.1	There is a support team of the OASIS website that understands the specific needs of each user					
3.2	The users' support team of OASIS website is always willing to help me					
3.3	The users' support team of the OASIS website has the knowledge to answer my questions					
3.4	The users' support team of the OASIS website gives special attention to each citizen individually					
3.5	Specialized instructions for the OASIS website and services' use were available to me					
4.	Performance Expectancy					
4.1	Using the OASIS services enables me to carry out my business with the government quickly and efficiently					
4.2	Using the OASIS services saves me time than doing the traditional paper process					
4.3	I do not think that the use of OASIS services saves me time					

4.4	OASIS services give to the users equal opportunities to carry out their business with the government					
5.	Effort Expectancy					
5.1	It's easy to learn how to use the OASIS services					
5.2	I find hard to become skilful in using the OASIS services					
5.3	Overall, I believe that OASIS services are easy to use					
5.4	Dealing with the government via the OASIS services is clear and easy					
6.	Social Influence					
6.1	I use the OASIS services because many people use it					
6.2	I use the OASIS services because my friends and colleagues use it					
7.	Facilitating conditions					
7.1	I have enough Internet experience to use OASIS services on my own					
7.2	I have the necessary resources to use OASIS services, e.g. computer & Internet					
7.3	Using OASIS services fits well with my lifestyle and habits					
8.	Willingness to provide personal information to the e-service					
8.1	There is a low risk for regular Internet users that their personal information could be misused.					
8.2	There is a low risk for regular Internet users that their personal information could be made available to third parties without their knowledge.					
8.3	I am not concerned that the information I submit to OASIS website could be misused.					
8.4	I am not concerned about submitting information on OASIS services because it could be used in a way I did not foresee.					
8.5	E-government websites are safe environments in which to exchange information with others.					
8.6	In general, my need to obtain certain information or services from the Internet is greater than my concerns about privacy.					
9.	User Satisfaction					
9.1	Overall, the information quality of OASIS services is very satisfying					
9.2	The information provided by OASIS services has met my expectations					
9.3	In general, my interaction with OASIS services is very satisfying					
9.4	The functionality and performance of the OASIS services has met my expectations					

Appendix B: Socio-Economic Measurement Instrument

	Attribute Under Evaluation	Your Assessment				
		Strongly Disagree	Disagree	Neutral/ No opinion	Agree	Strongly Agree
1.	Openness (Transparency)					
1.1	Using the OASIS platform to access e-government services I can find online the e-mail addresses of related employees and managers within the agency.					
1.2	OASIS e-services' websites provide me with the e-mail address to someone responsible for both content of the site and technical support for the site					
1.3	Using OASIS to access e-government services, I can find information about the head official of the public agency that provides the service.					
2.	Openness (Interactivity)					
2.1	Accessing an e-service through OASIS allows me to find instructions, help, tips on how meet the requirements or regulations (e.g instructions on how to file a tax form).					
2.2	I can always find the latest published "last updated" date (yyyymmdd) on the main page of the e-service.					
2.3	I can easily download a list of the goals or functions of the agency that provides the e-service.					
2.4	After submitting an application to the agency (e.g. request a certificate) I always receive an automatic response with how long it will take until I receive a response.					
3	Time Saving					
3.1	I feel that I am spending more time when visiting the public agency compared to using online services.					
3.2	Using the online services I am saving time when making a request.					
3.3	Using the online services I am saving time in receiving a response to my request.					
4	Money Saving					
4.1	I feel that I am spending more money when visiting the public agency compared to using online services.					
4.2	I feel that I am spending more money to use the online public services, considering the overall internet cost and other related costs.					

Table 15: Socio-economic Assessment (user-oriented) Survey Instrument

		KPIs category	KPIs
Social Issues	Legal and regulatory compliance (Provider-oriented)	Forensics	Number of audit events that can be kept by the Agency being in OASIS/Number of audit events that are kept for the same services in the original site
		Data retention and track back	Number of data duplicates
		Governmental control over the data	Number of accurances in which data cannot be fully deleted by the Agency
Economical Issues	Operational Savings (Provider-oriented)	Development Cost	Cost to adopt the e-services from OASIS/Cost of actual development for same e-services (original site)
		Operational cost	Annual operational cost to provide the e-services with OASIS/Annual operational cost to provide the same e-service without OASIS
		Cost of migration	Migration costs/Cost of actual development for the e- services (original site)
		Vendon lock-in	Number of times that the agency is “locked” to OASIS

Table 16: Socio-economic Assessment (provider-oriented) Survey Instrument