Deliverable D5.1

Initial KPIs Report and Requirements

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Deliverable abstract:

This deliverable is the result of the Tasks 5.1, 5.2 and 5.3 of Work Package 5 and aims at describing the Key Performance Indicators (KPIs) that will facilitate the evaluation of OASIS pilot. These tasks belong to the first phase of developing the KPIs which refers to a) a comprehensive state of the art literature review analysis and b) focus groups with stakeholders to verify and refine the initial list of KPIs. The KPIs are identified in three categories: behavioural, socio-economic, and technical KPI. For each category, the detailed measurement methods including questionnaires are provided along with the target values for the success of the project. This deliverable will allow pilot partners to select KPIs in their context and develop a dashboard for monitoring the progress of the pilots. This part will be described in D5.2: “Refined KPIs pre-pilot Evaluation Report”.

Project Management Review

	Reviewer 1: Habin Lee			Reviewer 2: Bruno Thuillier		
	Answer	**Comments**	**Type***	**Answer**	**Comments**	**Type***
1. Is the deliverable in accordance with						
(i) the Description of Work and the objectives of the project?	☒ Yes ☐ No		☐ M ☐ m ☐ a	☒ Yes ☐ No		☐ M ☐ m ☐ a
(ii) the international State of the Art?	☒ Yes ☐ No		☐ M ☐ m ☐ a	☒ Yes ☐ No		☐ M ☐ m ☐ a
2. Is the quality of the deliverable in a status						
(i) that allows to send it to European Commission?	☒ Yes ☐ No		☐ M ☐ m ☐ a	☒ Yes ☐ No		☐ M ☐ m ☐ a
(ii) that needs improvement of the writing by the originator of the deliverable?	☐ Yes ☒ No		☐ M ☐ m ☐ a	☐ Yes ☒ No		☐ M ☐ m ☐ a
(iii) that needs further work by the partners responsible for the deliverable?	☐ Yes ☒ No		☐ M ☐ m ☐ a	☐ Yes ☒ No		☐ M ☐ m ☐ a

* Type of comments: M = Major comment; m = minor comment; a = advice

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1. Introduction

This deliverable is the result of the Tasks 5.1, 5.2 and 5.3 of Work Package 5 and aims at describing the Key Performance Indicators (KPIs) that will facilitate the evaluation of OASIS pilot. These tasks belong to the first phase of developing the KPIs which refers to a) a comprehensive state of the art literature review analysis and b) focus groups with stakeholders to verify and refine the initial list of KPIS.

The state of the art literature analysis includes a comprehensive investigation of existing approaches for evaluating e-government services. The analysis is distincted into two perspectives: the technical and the non-technical. The technical perspective refers to assessing the operation and performance of OASIS technologies. The non-technical perspective refers to evaluating the social, economical and behavioural dimensions. Especially for e-government services, an evaluation that takes into consideration technical and non-technical aspects is fundamental, mainly because e-government involves multiple stakeholders with political, social and financial interests. However, e-government evaluation is considered as complex also because of the difficulty to quantify benefits and inefficiencies. In this deliverable, the existing literature for behavioural KPIs includes widely known technology acceptance theories. Following the presentation of the dominant theories applied in information systems, a proposal of an integrated model for evaluation is developed, based on Unified Theory of Acceptance and Use of Technology, IS success model and inclusion of the perception on information privacy. The information privacy concept is taken into consideration; indeed, the several sources state that the wide adoption of cloud computing is hindered by the information security and privacy concerns. The technical KPIs include: metrics proposed in multiple sources for cloud computing evaluation, such as public bodies, standardization bodies, vendors and other cloud elements suppliers, and cloud performance evaluators, as well as metrics for performance, usability, maintenance, monitoring, etc. Finally, the economic and social dimensions include indexes for cost saving, openness, trust, legal compliance and business operation.

After the literature analysis, the focus groups that were realised are described. They were conducted with the contribution of all pilot sites and the participants included end-users and network, application and service providers.

2. Literature Review

2.1. Behavioural KPIs

In this section state of the art, key performance indicators for OASIS are developed, from a behavioural perspective. Hence, the related performance indexes refer to the assessment of the OASIS e-government services from an end-users' point of view, and specifically with regard to their acceptance of using the service and the satisfaction from the e-service. As a result, we strive towards the state of art literature for e-government systems' behavioural evaluation. Several researchers have proposed indicators for evaluating citizens' satisfaction with e-government services. Johnston (1995) compiled 18 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 11 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. During the middle of 1970s and early 2000s, there have been numerous studies regarding IS acceptance and numerous information system acceptance studies have focused on the reasons why potential users accept or do not accept information technology. Many research models have been developed and empirically validated mainly including: The theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), Social Cognitive Theory (SCT) (Bandura, 1986), Technology Acceptance Model (TAM) (Davis, 1989) and extended TAM 2 (Venkatesh and Davis, 2000), TAM 3 (Venkatesh and Bala, 2008), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Model of PC Utilisation (Thompson et al, 1991), Motivation Model (Davis et al, 1992), the model combining TAM and the TPB (Taylor and Todd, 1995), the Innovation Diffusion Theory (IDT) (Rogers, 1995).

The line of research in technology acceptance models was culminated by the Unified Theory of Acceptance and Use of Technology (UTAUT), which was developed by (Venkatesh et al., 2003). The UTAUT aims to explain user intentions to use an information system and subsequent usage behaviour and 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) observed that IT researchers had a choice among a multitude of models and were confronted to choose constructs across models or choose an ideal model, thus ignoring the contribution from alternative ones. Therefore the researchers compared the eight dominant models in explaining technology acceptance behaviour that have been used previously by researchers and scholars. The eight prominent models included are:

1. Theory of Reasoned Action (TRA) by (Fishbein & Ajzen, 1975).
2. Technology Acceptance Model (TAM) by (Davis, 1989).
3. Motivational Model (MM) by (Davis, Bagozzi & Warshaw, 1992).
4. Theory of Planned Behaviour (TPB) by (Ajzen, 1991).
5. Combination of Technology Acceptance and Theory of Planned Behaviour models (combined TAM – TPB) by (Taylor & Todd, 1995b).
6. Model of PC Utilization (MPCU) by (Thompson, Higgins & Howell, 1991).
7. Innovation Diffusion Theory (IDT) by (Moore & Benbasat, 1991).
8. Social Cognitive Theory (SCT) by (Compeau & Higgins, 1995).

Another dominant stream of research in information systems evaluation field focuses on **information systems success** including several conceptual and empirical studies. In 1979, an assessment of IS research factors was conducted by Zmud (1979) to review 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, in 1984, a study was conducted by Ives and Olson (1984) emphasizing the importance of users' involvement. After a decade, a study followed by Davis (1989) developed TAM, 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) reviewed over 180 articles and came up with 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).

Next, we present the two most widely accepted evaluation models – UTAUT and IS success model - that will be used to investigate the Key Performance Indicators (KPIs) for OASIS from a behavioural view. The Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology provides a useful tool for managers that aim at assessing the likelihood of success for new technology introductions and helps them understand the drivers of technology acceptance in order to proactively design interventions targeted at users that might be less inclined to adopt and use new systems respectively (such as, training, marketing, etc.). The UTAUT model consists of three indirect determinants of behavioural intention, and two direct determinants of use behaviour. The three core constructs in the UTAUT model declare to impact behavioural intention (BI) directly are: (1) performance expectancy, (2) effort expectancy, and (3) social influence. Whereas, intention to use, and facilitating conditions (FC) are declared to impact directly on use behaviour. UTAUT includes four moderators (i.e. age, gender, experience and voluntariness of use), which contribute to a better understanding of the complexity of technology acceptance by individuals. Figure 1 illustrates the UTAUT model core constructs.

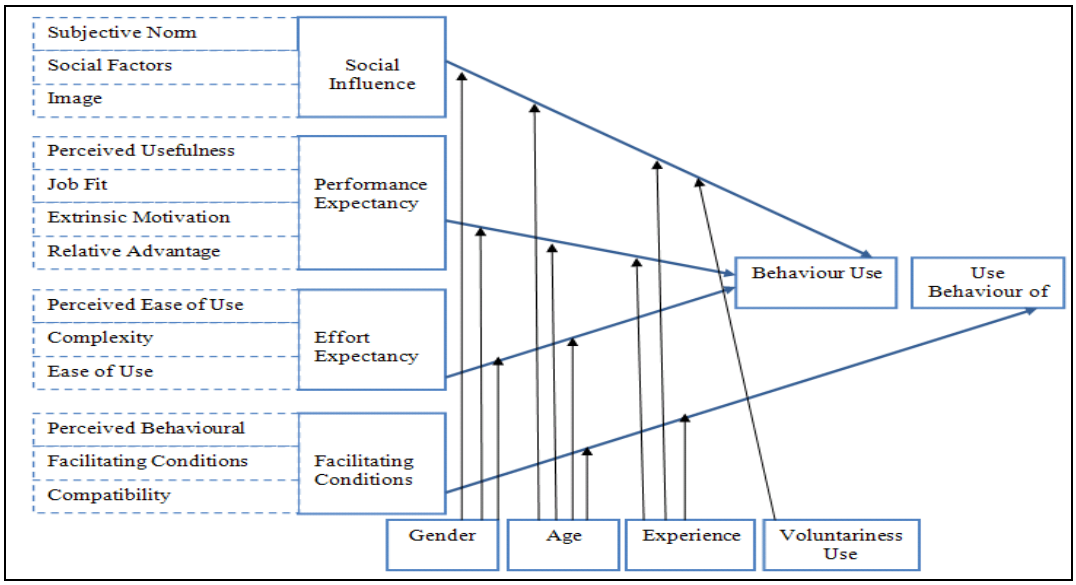

Figure 1: UTAUT's Constructs and Root Core of Constructs

Additionally, the UTAUT model suggests the following: (1) gender and age moderate the relationship between performance expectancy and behavioural intention, (2) gender, age, and experience moderate the relationship between effort expectancy and behavioural intention, (3) gender, age, experience and voluntariness are suggested to moderate the relationship between social influence and behavioural intention, and (4) age and experience are declared to moderate this relationship between facilitating conditions and behavior intention. Table 1 summarizes the core constructs of UTAUT model and its root constructs.

UTAUT Constructs	Definition	Root Constructs	Definition	Models Derived From	References
Performance Expectancy	The degree to which an individual believes that using the system will help him or her to attain gains in job performance (Venkatesh et al., p.447)	Perceived Usefulness	The degree to which a person believes that using a particular system would enhance his or her job performance	TAM	(Davis, 1989, p.320)
		Extrinsic Motivation	The perception that users will want to perform an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions	MM	(Davis, Bagozzi & Warshaw , 1992)
		Job-fit	Defined as perceived job fit and measures the extent to which an individual believes that using a PC can enhance the performance of his or her job	MPCU	(Thompson, Higgins & Howell, 1991, p.129)
		Relative Advantage	The degree to which an innovation is perceived as being better than its precursor	DOI	(Moore & Benbasat, 1991, p.194)
		Outcome Expectations	Relates to the consequences of the behaviour	SCT	(Compeau, Higgins & Huff, 1999; Compeau & Higgins, 1995)
Effort Expectancy	The degree of ease associated with the use of the system (Venkatesh et al., p.440)	Perceived Ease of Use	The degree to which a person believes that using a particular system would be free of effort	TAM	(Davis, Bagozzi & Warshaw, 1989; Davis, 1989)
		Complexity	The degree to which an innovation is perceived as relatively difficult to understand and use	MPCU	(Thompson, Higgins & Howell, 1991)
		Ease of Use	The degree to which an innovation is perceived as being difficult to use	IDT	(Moore & Benbasat, 1991),
Social	The degree to which an	Subjective	The person's perception that most people	TRA,	(Thompson, Higgins

UTAUT Constructs	Definition	Root Constructs	Definition	Models Derived From	References
Influence	individual perceives that important others believe he or she should use the new system	Norm	who are important to him think he should or should not perform the behaviour in question	TPB, C-TAM-TPB	& Howell, 1991)
		Social Factors	The individual's internalization of the reference group's subjective culture & specific interpersonal agreements that the individual has made with others, in specific social situations	MPCU	(Thompson, Higgins & Howell, 1991)
		Image	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system	IDT	(Rogers, 1995; Moore & Benbasat, 1991)
Facilitating Conditions	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system	Perceived Behavioural Control	Reflects perceptions of internal & external constraints on behaviour & encompasses self-efficacy, resource facilitating conditions, & technology facilitating conditions	TPB, C-TAM TPB	(Taylor & Todd, 1995a; Taylor & Todd, 1995b; Ajzen, 1991)
		Facilitating Conditions	Objective factors in the environment that observers agree make an act easy to do, including the provision of computer support	MPCU	(Thompson, Higgins & Howell, 1991)
		Compatibility	The degree to which an innovation is perceived as being consistent with existing values, needs, & experiences of potential adopters	IDT	(Rogers, 1995; Moore & Benbasat, 1991)
Behavioural Intention	A measure of the strength of one's intention to perform a specified behaviour			TRA, TAM	(Davis, Bagozzi & Warshaw, 1989)

Table 1: The Core Constructs and Root Constructs of UTAUT Model

2.1.1. IS Success Model

One of the most popular information systems success assessment models which has result in highly significant contribution in the literature, is the DeLone and McLean IS success model conceptual model (IS Success model). The IS success model categorizes existing IS success measures under six dimensions (Hussein et al., 2007; Hu et al., 2005; Gable, Sedera and Chan, 2003; Molla and Licker, 2001; Seddon, 1997; Seddon and Kiew, 1996). As Gable, Sedera and Chan (2003) note "the development of IS success models, such as the DeLone and McLean model, has been an important contribution toward our improved understanding of IS management." Almost, 1000 studies have used the IS success model and approximately 150 empirical studies have examined some or all of the relationships in the model (Petter and McLean, 2009; Wangpipatwong and Chutimaskul, 2005).

The IS success taxonomy and its six success categories are based on a process model of information systems (DeLone and McLean, 2002; DeLone and McLean, 1992). Additionally, strong cause and effect relations exist among the six dependent variables. The six dimensions are interrelated, resulting in a success model which illustrates that causality flows in the same direction as the information process does (DeLone & McLean, 2002). The six major variables of the IS success model are:

1. system quality
2. information quality
3. use
4. user satisfaction
5. individual impact
6. organizational impact

In the IS Success model, system quality measures technical success, information quality measures semantic success and use, user satisfaction, individual impact, and organizational impact measure effectiveness success of the system measured. Figure 2 illustrates the IS Success model.

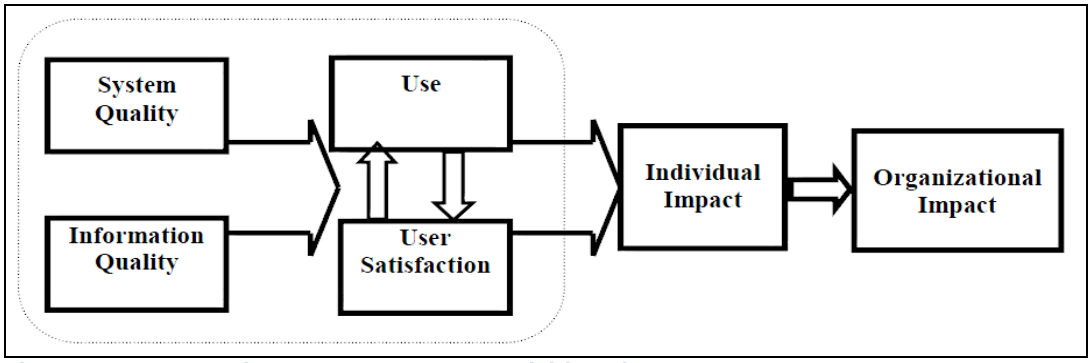

Figure 2: DeLone and McLean IS Success Model (1992)

One of the strongest criticisms about the IS Success model (1992) is the lack of service quality among the variables. According to Pitt, Watson & Kavan (1995), "there is the danger that IS researchers will mis-measure IS effectiveness if they do not include in their assessment package a measure of IS service quality." Service is an important part of information systems department; thus, service quality is a critical measure of information system effectiveness (Chatterjee et al., 2009; Van Dyke, Kappelman & Prybutok, 1997). As a result, in order to measure information systems effectiveness properly, many researchers believed that service quality should be included in the IS success model as a success measure (Kettinger & Lee, 1997; Myers, Kappelman & Prybutok, 1997; Pitt, Watson & Kavan, 1997). According to Pitt, Watson & Kavan (1997, p.210) "IS community needs to be aware of problems that might be experienced in using an instrument to measure so critical a construct as IS service quality".

Having realised the importance of e-services, DeLone & McLean (2003) outlined that the frequent use of the system not only indicates more benefits to the users, but also the quality of the system should be considered as well. In response to the call of other researchers who criticized the original model, and due to the advent and growth of e-commerce, DeLone & McLean (2003)

decided to add service quality to their new model as an important dimension of IS success noting "especially in the e-commerce environment where customer service is crucial" (DeLone and McLean, 2003). Therefore, in an attempt to contribute towards a universal model, DeLone and McLean (2003) introduced their updated model after ten years of its first induction in 1992. The model includes six success dimensions, and holds that the constructs of information quality, system quality, and service quality individually and jointly affect the factors of use and user satisfaction, whereas user satisfaction and use jointly affect net benefit. Figure 3 illustrates the updated D&M Success Model.

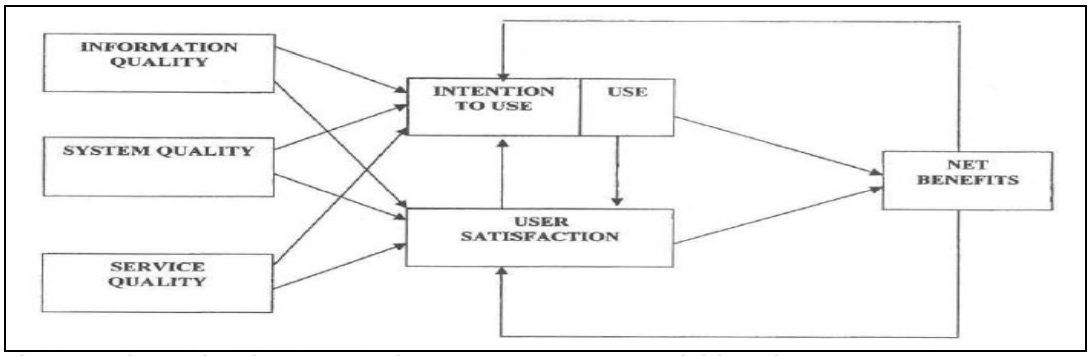

Figure 3: The Updated DeLone and McLean IS Success Model (2003)

The updated of DeLone and McLean (2003) includes six success dimensions to measure the success of a system in the e-commerce domain. The six major variables of the IS success model (2003) are:

1. System quality, which measures the desired characteristics of an e-Commerce system. It refers to the quality of (usability, availability, reliability, adaptability, and response time (e.g., download time),
2. Information quality, which measures the e-Commerce content issues. the dimension of this variable are (personalization, currency, relevance, reliability, completeness, easy to understand and secured for (to gain user's trust when conducting a transactions via the internet),
3. Service quality, which is the "overall support delivered by the service provider, applies regardless of whether the support is delivered by the information systems' department or a new organizational unit or is outsourced to an internet service provider" (DeLone & McLean, 2004, p. 34),
4. Usage, which measures everything from a visit to a web site and navigation within the site to information retrieval and execution of a transaction,
5. User satisfaction, which measures customers' opinions of an e-Commerce system and should cover the entire experience cycle of customers from information retrieval through purchase, payment, receipt, and service, and
6. Net benefits that capture the balance of the positive and negative impacts of e-Commerce on customers, suppliers, employees, organizations, markets and even society as a whole.

Hu et al. (2005) attempted to establish a suitable and systematic appraisal framework of e-Government project success based on the IS Success Model presented by DeLone & McLean in 1992. Table 2 summarizes the KPIs derived from the IS Success model.

System Quality	Reliability	The dependability of system operation	Wixom and Todd (2005)
	Flexibility	The way the system adapts to changing demands of the user	
	Integration	The way the system allows data to be integrated from various sources	
	Accessibility	The ease with which information can be accessed or extracted from the system	
	Timeliness	The degree to which the system offers timely responses to requests for information or action	
Information Quality	Completeness	The degree to which the system provides all necessary information	Wixom and Todd (2005)
	Accuracy	The user's perception that the information is correct	
	Format	The user's perception of how well the information is presented	
	Currency	The user's perception of the degree to which the information is up to date	
Service Quality (SERVQUAL Scale)	Tangibles	Physical facilities, equipment, and appearance of personnel	Parasuraman, Zeithaml & Berry (1988)
	Reliability	Ability to perform the promised service dependably and accurately	
	Responsiveness	Willingness to help customers and provide prompt ability to inspire trust and confidence	
	Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence	
	Empathy	Caring, individualized attention to firm provides its customers	
Information Use	Usefulness	the degree to which a person believes that a particular information system would enhance his or her job performance	Davis (1989)
	Ease of Use	the degree to which a person believes that using a particular system would be free of effort	
User Satisfaction	Information Satisfaction	The application of that information useful in enhancing work performance	Wixom and Todd, 2005
	System Satisfaction	A degree of favourableness with respect to the system and the mechanics of interaction	

Table 2: IS Success Model Factors

2.1.2. **Integration of the models and information privacy**

For this project the two noteworthy models – namely UTAUT model and DeLone and McLean IS success model - are integrated based on theoretical evidences. Figure 4 shows the integration model.

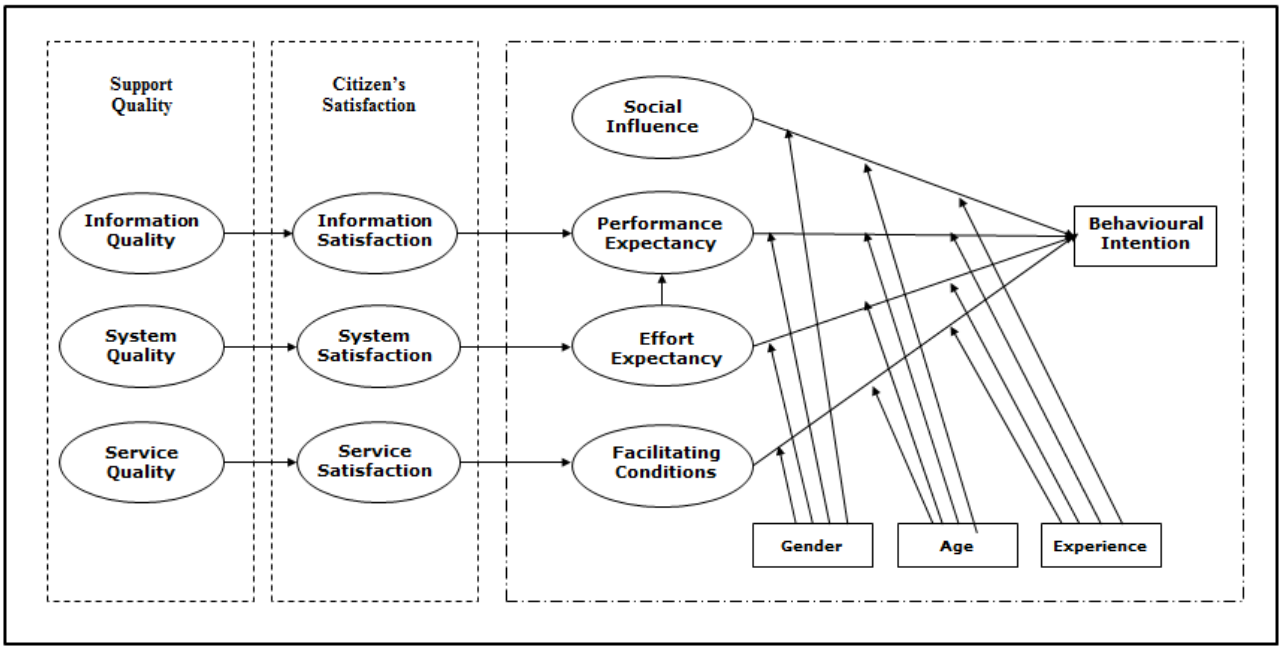

Figure 4: Integrated Model of UTAUT and IS success model

The integrated research model attempts to tie quality dimensions from IS Success model together with UTAUT model as antecedents for intention to use with an attempt to reveal the role of perceived government support quality towards intention of use of e-Government systems. The acceptance of e-government services is defined through the behaviour intention to use e-government services. The proposed integrated research framework consists of eleven constructs; one dependent variable and ten independent variables. The dependent variable is behaviour intention to use e-government services, while the independent variables are: (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, (10) facilitating conditions.

Moreover, 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 as an independent variable. 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 Table 3 and the integrated model is presented in Figure 5.

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

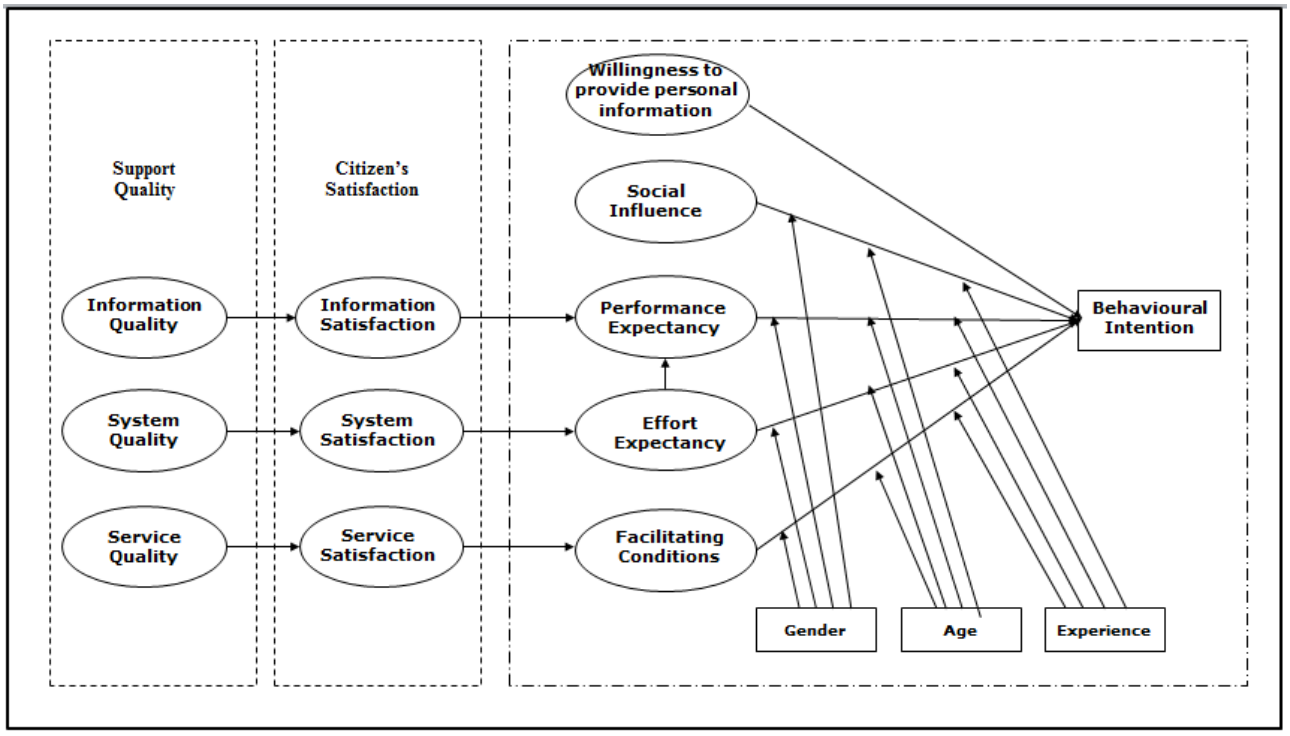

Figure 5: Integrated model for e-government services in the cloud

2.2. Technical KPIs

The inclusion of technical KPI's is a requirement directly derived from the main definition of the project. In any case, as cloud oriented platforms are new and they are experiencing a continuous evolvement it is difficult to get information from the existing literature for exclusively cloud oriented KPIs.

In fact, after the review made, we must consider that there is no great and/or interesting academic (or made under an academic point of view) literature. We have therefore implemented a very simple methodology to construct a set of KPIs and/or drivers focused on cloud environment. It implies the following path:

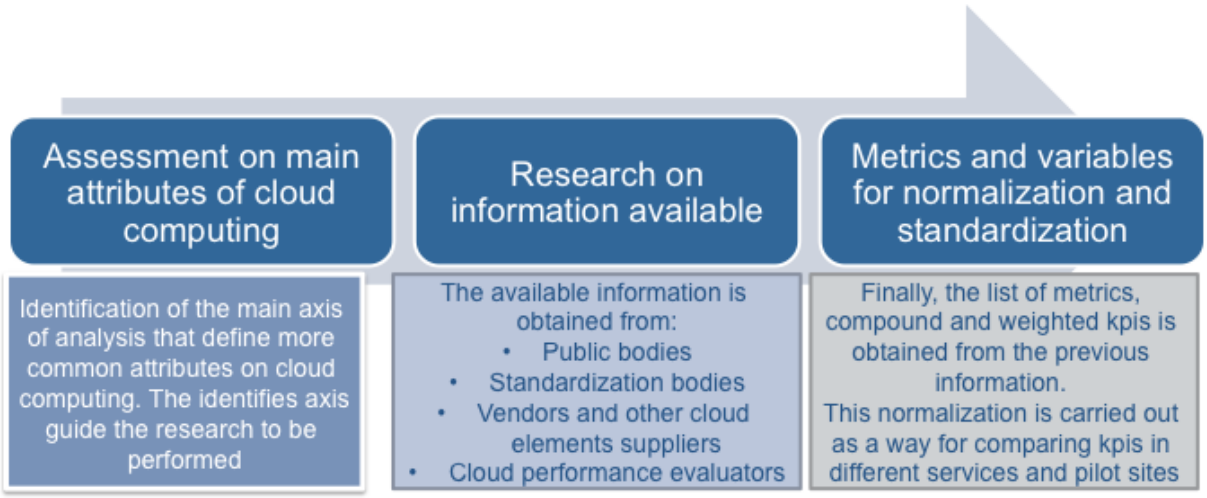

Figure 6: Research methodology for technical KPI

2.2.1. **Assessment on main attributes of cloud computing**

The definition of technical KPIs will allow us to measure the health status of the cloud services and their performance, as well as for determining the causes when the performance of cloud services changes.

In OASIS, cloud-hosted services can be very different from each other and composed by a "mixture" of software components. Some KPIs will be used for evaluating the overall OASIS infrastructure. On the other hand, inevitably, each service offered by the OASIS infrastructure will consider different performance metrics for assessing its health. Therefore, in the cloud architecture, it is also necessary to design service-specific metrics. In order to develop a good profile of the performance of the cloud computing architecture, it is necessary to take into account various aspects. Basically, indicators should 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

Finally, the approach made on the performed work has excluded the section for ubiquitous access as it is covered on other parts of the list of KPIs and it has included an additional section for SaaS management KPIs.

2.2.2. **Research on available information**

This section is a short description of the sources and documentation obtained from a set of bodies and organizations providing key information about the state of the art of cloud technology. Generally speaking, the available information has been obtained from:

- Public bodies
- Standardization bodies
- Vendors and other cloud elements suppliers
- Cloud performance evaluators

2.2.3. **Metrics and variables for normalization and standardization**

According to the main axis of attributes aggregation, information is shown in this chapter according to the same classification.

Scalability & Flexibility

Measuring scalability we must star the evaluation by general elements measured according to the number (absolute values) of general elements as follows:

KPI id	Definition	Comments
scalability-1.1	Number of users	Considered as a total is not giving any occupancy/load or other information. It must be compared against phisical users of front desk of public authorities. Useful for creating combined metrics with most part of the list of KPI.
scalability-1.2	Number of concurrent users	Related to performance. Related to usability. Useful for creating combined metrics with most part of the list of kpi.
scalability-1.3	Number of federated services	Useful for creating combined metrics with most part of the list of KPI.
scalability-1.4	Number of simultaneous sessions for each service	Related to performance. Related to usability. Useful for creating combined metrics with most part of the list of KPI.
scalability-1.5	Number of service requests/queries	Related to performance. Related to usability. Useful for creating combined metrics with most part of the list of KPI.
scalability-1.6	Number of established connections	Related to performance. Related to usability. Useful for creating combined metrics with most part of the list of KPI.
scalability-1.7	Throughput and congestion	Related to monitoring. Congestion must be clearly defined to avoid misunderstandings and errors while comparing.
scalability-1.8	Deployment time needed to add a new service to the catalog...	Related to monitoirng and to SaaS management. Deployment must be clearly defined to avoid misunderstandings and errors while comparing.

The second subsection includes some KPIs related to specific scalability elements in the cloud environment:

KPI id	Definition	Comments
scalability-2.1	Load tolerance: this can be calculated as a ratio of the maximum load a system can handle compared to the normal expected load, eg, the percentage of the normal load by which a system can temporary upscale (bandwidth, processing power, etc).	The unit is relative; it indicates the allowed variation in the system's load without impacting the performance as a whole. It should be noted also that the load tolerance for two service providers of the same size, with the same ratio of maximum load to normal load, can result in different levels of tolerance if one serves thousands of small customers and the other a handful of very large ones.
scalability-2.2	Traffic tolerance (including anti-DoS/DDoS provisions, eg, filtering, firewalling, rerouting, shut- off of clients producing excessive traffic, etc): the ability of a system to tolerate unpredictable offered load without a significant drop in carried load (including congestion collapse), as well as to isolate the effects from cross-traffic, other flows and other nodes.	The traffic can either be unexpected but legitimate, such as from a flash crowd, or malicious, such as a DDoS attack.

KPI id	Definition	Comments
scalability-2.3	Load variability of the services (the difference between peak and mean demand)	This metric allows two interesting works: First we need to allocate this load variability in the time in order to study possible work balancing among nodes. Second it allows us to stablish alarms to prevent downtime periods and to define needs of growth for HW elements
scalability-2.4	Elasticity degree	Related to HW resources. Comparing current used capacity with maximum available capacity we can define the number of aditional users/services that theorically must be supported by the current infrastructure. This is a very high level KPI that must be defined by aggregating and weitghing other KPIs. A clear definition must be set in order to avoid misunderstandings and errors while comparing.

Fault Tolerance & Reliability

In this area we also propose two groups of indicators. The first one relies on general availability elements. The second one is focused on response times.

KPI id	Definition	Comments
fault_tolerance-1.1	Cloud availability ratio (access to cloud functionalities)	In terms of uptime and downtime metrics. This could be defined on several points of the stack of services but the end user layer will be used by the public bodies as a tool of measuring the SLA that the service provider must cover. So probably this is interesting on a service provider level but not for the public body contracting the service
fault_tolerance-1.2	Service availability ratio (access to federated services)	In terms of uptime and downtime metrics. A clear definition of service availability is needed. Availability could refer to web access, to forms submitting, end to end service….
fault_tolerance-1.3	Data loss, corrupted data (in terms of size or time equivalent)	Metric related to some lements on the SaaS management side. As we talk about public services we must discuss about the accepted value for this metric. We must take into account the legla framework about the elements regarding to data consistency, data access and data custody and care

On the response time side we have:

KPI id	Definition	Comments
fault_tolerance-2.1	Mean time to incident discovery (delay): the time that it takes from the time an incident occurs to when the incident is discovered;	Directly related to maintenance and monitoring. This metric has two point of view: -incident discovery by service provider while running the system -incident discovery by users and public bodies due to problems while accessing to the servies. Timewindow of this delay must be clearly defined to avoid misunderstandings and errors while comparing.
fault_tolerance-2.2	Time to invoke: the time it takes to realise that the recovery-response phase should be invoked (mean time to invoke);	Directly related to maintenance and monitoring. Timewindow of this phase must be clearly defined to avoid misunderstandings and errors while comparing.
fault_tolerance-2.3	Time to repair (mean time to repair): the time it takes to bring the service back to an acceptable level;	Directly related to maintenance and monitoring. Timewindow of this phase must be clearly defined to avoid misunderstandings and errors while comparing. The definition of service acceptable level must be cleraly dfined
fault_tolerance-2.4	Mean time to incident recovery.	Directly related to maintenance and monitoring. This metric colud be defined as an aggregation/combination of previosones Timewindow of this phase must be clearly defined to avoid misunderstandings and errors while comparing.

Maintenance and Monitoring

For this group of KPIs the following breakdown is proposed:

- generic maintenance elements

KPI id	Definition	Comments
maint & monitor-1.1	Number of recovery mechanisms activated	Metric defined in order to retrieve the ratio between recovery processes and failures detected/solved.
maint & monitor-1.2	Maintenance actions	It must included reactive, proactive and random activities.
maint & monitor-1.3	Time to repair	Metric very close to the ones in the fault tolerance section. It must be defined as a mean time in order to define SLA's coverage ratio. A clear definition of the timewindow mesure must be done in order to avoid misunderstandings

KPI id	Definition	Comments
maint & monitor-1.4	Recovery time	Metric very close to the ones in the fault tolerance section (data loss mainly) It must be defined as a mean time in order to define SLA's coverage ratio. A clear definition of the timewindow mesure must be done in order to avoid misunderstandings

- KPIs for action prior to impact on the service

KPI id	Definition	Comments
maint & monitor-2.1	Failures on back-up processes	As back-ip processes are normally done under an schedulled program we must validate that it results is correct. This metrics needs a future analisys as recurring failures must convert imply breaking laws according to data protection
maint & monitor-2.2	Failures on restoring processes	This metrics has the aim of evaluating that the whole cycle for data protection is handled.
maint & monitor-2.3	% of repairs covering SLA	Related to SaaS management. It must be under the maximum allowed as a warranty of well doing. A clear definition of SLA elements included in the valuation of the SLA coverage must be done in order to avoid misunderstandings.
maint & monitor-2.4	Statefulness metrics	refers to how well the application responds correctly in the subsequent states. While most applications are inherently stateful, you never know when they become unstateful
maint & monitor-2.5	Versioning metrics	refers to how well a new build avoids breaking an existing application's functions even if the previous application's statefulness has responded correctly from one state to another until the application tasks end. Versioning breaks can occur when assigning duplicate version names or numbers to the application.
maint & monitor-2.6	Resource threshold	refers to how well resource consumption is balanced dynamically for applications in the cloud. The threshold level should be at or below the maximum number of additional resource instances that could be consumed. When resource consumption exceeds the threshold level during a spike in workload demands, additional resource instances are allocated. When the demand returns at or below the threshold level, resources instances that have been created are freed up and put to other use.

KPI id	Definition	Comments
maint & monitor-2.7	User threshold	refers to how well a user can access concurrently the application up to the limit specified in user license from the provider. For example, if a the license is limited to 3,000 users but only allows a maximum of 2.500 users to access concurrently, then the threshold level is set at 2,000 concurrent users. If the number of concurrent user is at or below the application threshold, the application is continuously available assuming that resource consumption and data requests are below their respective threshold level.
maint & monitor-2.8	Data request threshold	refers to the data requests that can be processed quickly. The threshold level is set below the maximum number of data requests and the maximum size of data requests that users can send concurrently. If the number of data requests exceeds the threshold level, a message should pop up to show how many data requests are in queue waiting to be processed.
maint & monitor-2.9	Response threshold	refers to how quickly the application responds to a user's data request or one part of the application to another part. The threshold level is set below the maximum, tolerable response time.

- KPIs related to ITIL change and release management

KPI id	Definition	Comments
maint & monitor-3.1	Total number of RFCs raised	The RFC could be originated by the public body or the service provider
maint & monitor-3.2	Percentage for each category	The number of RFC must be splitted depending on the source originating the RFC (incident, problem, new feature…)
maint & monitor-3.3	Percentage of urgent changes	RFC related to elements affecting to the serveice conitnuity must be marked as urgent. The anlysys of this metric allows to determine the maturity level of the software as a high volume of urgent RFC can derive from a bad test period
maint & monitor-3.4	% of successful changes	An RFC is expected to has a successfull change reflected in the software. This metrics evaluate the capacity of the developing teams to manage petitions
maint & monitor-3.5	% of changes backed out	Rejecting a change is a decission that means that the change is not interesting, not affordable or other situations. An increase of this metric must be analyzed as it could imply that our SaaS offer is out of the market needs
maint & monitor-3.6		
maint & monitor-3.7	Backlog of changes by CI/priority	We need to dimension our developing teams according to estimated work load. This metrics allows as to validate if we are able to process the queue of changes pending

KPI id	Definition	Comments
maint & monitor-3.8	Percentage of urgent releases	Releases related to elements affecting to the serveice conitnuity must be marked as urgent. The anlysys of this metric allows to determine the maturity level of the software as a high volume of urgent releases can derive from a bad test period. This Kpi could be measured on a federated service level or an oasis portal level
maint & monitor-3.9	% of successful software installations	When releasing new soft packages we must consider that they're expected to be succesfully installed. Errors could imply SLAs to be uncovered
maint & monitor-3.10	Percentage of installations performed to time	In a cloud environment we need to control the installation process of every single software elemetn as it affects to the whole system so we need this metric to control it
maint & monitor-3.11	% of builds/distributions aborted during process	Metric partially complementary to % of successful software installations
maint & monitor-3.12	Number of failed or backed out implementations plus builds rolled back after implementation	Metric partially complementary to % of successful software installations

Performance

First we have defined a set of generic performance KPI

KPI id	Definition	Comments
performance-1.1	Average service access time (latency time for service utilization request)	In a federation of services this metric must be measured under every single service. As ubiquitous acces is a need on cloud, we suggest to measure it for different network and/or devices uses for accessing to the services
performance-1.2	Average application response to user's requests (completion time of provided services)	In a federation of services this metric must be measured under every single service. As ubiquitous acces is a need on cloud, we suggest to measure it for different network and/or devices uses for accessing to the services
performance-1.3	Download/upload of documents time	As ubiquitous acces is a need on cloud, we suggest to measure it for different network and/or devices uses for accessing to the services
performance-1.4	Bandwidth/network utilization	Metric also related to monitoring and scalability. As the cloud service stack implies different layers in the netwark peovision we must consider this mainly in the link between datacenters and POA
performance-1.5	Page load time	In a federation of services this metric must be measured under every single service. As ubiquitous acces is a need on cloud, we suggest to measure it for different network and/or devices uses for accessing to the services

KPI id	Definition	Comments
performance-1.6	Service computation time	Related to datacenter performance If we're using dedicated servers for every single service probably we need to allocate this value per concurrent user or similar
performance-1.7	Number of services successfully delivered	It has two scopes: -related to the public body as a metric of service availability -related to the cityzen in which we must consider every single succesfull transaction per service
performance-1.8	Processor time	Related to datacenter performance If we're using dedicated servers for every single service probably we need to allocate this value per concurrent user or similar
performance-1.9	Instructions per second	Related to datacenter performance If we're using dedicated servers for every single service probably we need to allocate this value per concurrent user or similar
performance-1.10	Latency	In a federation of services this metric must be measured under every single service. As ubiquitous acces is a need on cloud, we suggest to measure it for different network and/or devices uses for accessing to the services

The second subset is related to integration performance:

KPI id	Definition	Comments
performance-2.1	third party influence on page load for content components	i.e. Content related to third party services (shopping carts, ads…)
performance-2.2	third party influence on page load for external tools	i.e. Apps and elements for increasing costumer satisfaction or service deliverer app control (google analytics, social networking…)
performance-2.3	% of lost transactions with remote services	In a federation of services this metric must be measured under every single service. As ubiquitous acces is a need on cloud, we suggest to measure it for different network and/or devices uses for accessing to the services

The last group is related to ITIL KPIs on performance:

KPI id	Definition	Comments
performance-3.1	APPLICATION "WORKLOAD"	The load or "demand" made on the system by users. In a stable system this is also equal to the throughput, and is usually described by the business in terms of business transactions. IT will need to put some effort into translating a business transaction into units of work that are executed within the IT infrastructure, but this is often addressed through established capacity planning and chargeback methodologies.

KPI id	Definition	Comments
performance-3.2	RESPONSE TIME	The main measurement of performance. This is the time each transaction takes to complete. End-user transactions can be externally "clocked" in many ways, and this is often accomplished through implementation of service level management solutions.
performance-3.3	UTILIZATION	The effective "busy-ness" of the IT system that services the workload. Once utilization reaches 100 percent, no more work can be do
performance-3.4	TRANSACTION WORKLOAD	The amount of actual work required from each domain to service a customer's request.
performance-3.5	INTERNAL RESPONSE TIME	The response time for a transaction to complete its work across a specified set of domains (See figure 1). For example, if you manage IT infrastructure that includes Server and Storage domains, you might create an "Infrastructure Response Time" that will serve as your primary service metric.
performance-3.6	EFFECTIVE UTILIZATION	The effective utilization of the physical and virtual resources assigned to a service. For example, a virtual server with a specified "limit" would be at 100 percent utilization at that limit.
performance-3.7	PERFORMANCE INDEX	A score for how well a particular workload's set of assigned resources are being utilized compared to the optimum level. This index immediately shows whether resources have remaining capacity, are being over
performance-3.8	SYSTEM EFFICIENCY	A key performance indicator (KPI) that tracks alignment of IT resources to workload demand over time. Highly efficient systems allocate just enough resource to meet current loads. Inefficient systems might be ripe for consolidation or technology refresh initiatives.
performance-3.9	SYSTEM AGILITY	A KPI showing the variance in the efficient alignment of IT resources to workload over time. A high variance indicates low agility of the IT domains to respond to changing workload, likely because of inflexibly dedicated resources. Virtualized and dynamically re

Hardware resources

On the hardware side only a single set of Kpis is proposed:

KPI id	Definition	Comments
HW_resources-1.1	Number of CPU	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level
HW_resources-1.2	Available memory	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level
HW_resources-1.3	Available storage	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level

KPI id	Definition	Comments
HW_resources-1.4	CPU usage	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level
HW_resources-1.5	Memory usage	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level
HW_resources-1.6	Storage usage to measure available and busy space	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level
HW_resources-1.7	I/O complexity (searching through databases)	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level
HW_resources-1.8	Elasticity level on storage	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level. We must consider work load balancing among nodes as an option an d then this metric could be used as an alarm
HW_resources-1.9	Elasticity level on databases	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level. We must consider work load balancing among nodes as an option an d then this metric could be used as an alarm
HW_resources-1.10	Redundancy level	Related to datacenter dimension In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level. We must consider work load balancing among nodes as an option an d then this metric could be used as an alarm

Usability

Usability has been understood in two ways: generic friendly design of web pages and accessibility according to barriers and complexity.

KPI id	Definition	Comments
usability-1.1	bounce rate	The bounce rate is one of the most important usability metrics and thanks to Google Analytics or Woopra easy to follow nowadays. 100k visitors with a bounce rate of 95% means that in the worst case only 5.000 actually visited your site while the others just fled. So a site with a much lower visitor number AND bounce rate can be much more successful than a “stupid traffic” site with huge traffic numbers. Targeted quality traffic is key for a successful site.

KPI id	Definition	Comments
usability-1.2	form/shopping cart abandonment rate	Forms are the most important parts of most websites in business terms, be it the contact form, or the shopping cart which technically in most cases is a form. Now imagine a super market where half or more of the customers abandon their cart in the middle of the checkout process or while perusing the market. Count these people and try to make them stay. The simplest way of checking the shopping cart abandonment rate is by sending a message to customer support each time a cart or other form gets abandoned. Sometimes you might be able to get back to the potential client with the incomplete data he entered.
usability-1.3	links clicked (heat maps)	Modern "Web 2.0" web analytics solutions sometimes offer heat maps views or at least a site overlay way of checking clicks. This way you can determine where your visitors click or try to click (to no avail sometimes in cases of not linked logos or underlines words which are not links). Do people click where you want them to click or not?
usability-1.4	next pages	To make people visit more than one page on a site we use internal links. Some of the links are links that we really want the people to follow. Checking the "next pages" from a particular landing page we can determine whether the readers followed our advice or wanted to see more of it. When on your home page the next page is in most cases the search or the sitemap page you've got a problem.
usability-1.5	pageviews per visit	While measuring pageviews is sometimes futile as bad websites where you have to click more can have higher numbers of pageviews the number of pageviews per visit often will tell you a whole lot about how much your visitors like your website. A 1 to 1 ratio is bad unless they all click the buy button instantly.
usability-1.6	returning visitors	This is obvious, only returning visitors really like your site. So the more come back the better, the more successful you are. One time search visitors and casual social media visitors are not the backbone of your site. The subscribers and returning visitors (often the same people) are.
usability-1.7	time on page	The time spent on a page can be read in manifold ways but you can deduct from it whether people just skim your content or read your whole article among others.
usability-1.8	time on site	It's not always the longer the better but 5 minutes is in most cases better than 30 seconds, especially for a publishing site or simply a blog.

According to barriers and complexity the KPIs are the following:

KPI id	Definition	Comments
usability-2.1	Failure Rate	The first study published about accessibility measurement was purposed by Sullivan and Matson [23]. Authors consid- ered the ratio between the total number of points of failure encountered in a page (Bp) and the total number of poten- tial barriers (Pp).
usability-2.2	WAB score	This metric uses the concepts of potential problems and weights for barriers. Besides, it also takes into account the total number of pages that a given site contains (N P). The weights are defined as the inverse of the priority of each WCAG
usability-2.3	UWEM Aggregation Formula	The final value represents a probability of finding a barrier in a Web site that could prevent a user from completing a task. This metric also applies the concepts of potential problems and weights for barriers
usability-2.4	A3 (Improvement on UWEM agg formula)	They have used some probability properties and aggregated some issues related to the complexity of the page, considering the number of violations of a given check- point in relation to the total number of violations (Bn).
usability-2.5	WAQM	The metric WAQM (Web Accessibility Quality Metric) [24] considers the guidelines from WCAG 2.0 [26] classified according to the principles: Perceivable, Operable, Under- standable and Robust. Different from other metrics, this metric also considers problems identified as warnings by evaluation tools

Security and Privacy

The first subset is related to generic security and privacy issues:

KPI id	Definition	Comments
security-1.1	Impairment of the system, security breaches	In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level
security-1.2	Network intrusion detection to identify suspicious traffic (e.g. port scan, denial	In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level. This metric must be understood under two approaches: -External intrusion detection: We can control how many intrusions do we detect but we're not able to know how many intrusions the system have suffered -Self created intrusions: We can create intrussions attempts in order to evaluate how many of that can be detected

KPI id	Definition	Comments
security-1.3	Host intrusion detection to monitor the security state of servers and signalling abnormalities (e.g. unauthorized accesses, attacks)	In a descentralyzed architecture as expected in OASIS it must be estimated at a single service level. This metric must be understood under two approaches: -External intrusion detection: We can control how many intrusions do we detect but we're not able to
security-1.4	Data leakages	
security-1.5	Number of security updates	
security-1.6	Hardware and platform technologies protection in data center (physical access to cloud resources)	

The second one is based on ITIL and other standards on information security:

KPI id	Definition	Comments
security-2.1	Number of security incidents opened by severity	Metric related to SaaS management. It's interesting to split this metric depending of the source of the incident detection
security-2.2	Number of security incidents closed by security	Metric related to SaaS management. It's interesting to split this metric depending of the source of the incident detection
security-2.3	Number of services that have had security reviews	Metric related to SaaS management. It's interesting to split this metric depending of the source of the incident detection
security-2.4	Number of security reviews pending	This metric is interesting if we compare this values considering severity. A lot of pending reviews belonging to the maximum severity could imply a legal problem
security-2.5	Number of risks identified	Metric related to SaaS management. It's interesting to split this metric depending of the source of the incident detection
security-2.6	Number of risks mitigated to an acceptable level	Metric related to SaaS management. It's interesting to split this metric depending of the source of the incident detection A clear definition of what an acceptabl e level is must be done in order to avoid misunderstandings

SAAS Management

Finally we include some general SaaS SLA related KPIs:

KPI id	Definition	Comments
SAAS_management-1.1	Number of calls received	Defined at a service provider level. The estructure of OASIS and its service federation must be taken into account when defining the customer service to provide. This definition will allocate responsabilities and the way for covering it. All of these metrics must be incorporated in the pilot execution as a way for defining future SaaS SLA models
SAAS_management-1.2	Number of calls missed	
SAAS_management-1.3	Number of rings before the phone is answered	
SAAS_management-1.4	Average duration of calls	
SAAS_management-1.5	Number of calls logged	
SAAS_management-1.6	Percentage number of incidents compared to incoming calls	
SAAS_management-1.7	Percentage of repeat calls for the same incident	
SAAS_management-1.8	Percentage of incidents resolved by help desk - first level	
SAAS_management-1.9	Percentage of operations support requests closed	
SAAS_management-1.10	Mean time to achieve incident resolution	
SAAS_management-1.11	Number of calls escalated	
SAAS_management-1.12	Initial trend analysis	
SAAS_management-1.13	Results of customer satisfaction surveys	
SAAS_management-1.14	Number of complaints and/or letters of praise	
SAAS_management-1.15	Actual spend against budget	
SAAS_management-1.16	Results of audits	
SAAS_management-1.17	Number of staff suggestions, requests for transfer, disputes etc.	

2.3. Socio-economic KPIs

Literature lacks a concrete model for a socio-economic assessment of e-government services. Alshawi and Alalwany (2009) investigated 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, openess and trust, as further described in Table 4.

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 4: 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) surveys 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 5: Socio-economic parameters for governmental cloud services (adopted by ENISA, 2011)

3. Summary of KPIs for OASIS

KPIs category	KPIs
Performance Expectancy	Perceived Usefulness
	Extrinsic Motivation
	Job-fit
	Relative Advantage
	Outcome Expectations
Effort Expectancy	Perceived Ease of Use
	Complexity
	Ease of Use
Social Influence	Subjective Norm
	Social Factors
	Image
Facilitating Conditions	Perceived Behavioural Control
	Facilitating Conditions
	Compatibility
System Quality	Reliability
	Flexibility
	Integration
	Accessibility
	Timeliness
Information Quality	Completeness
	Accuracy
	Format
	Currency

KPIs category	KPIs
	Relevance
Service Quality	Tangibles
	Reliability
	Responsiveness
	Assurance
	Empathy
Information Use	Usefulness
	Ease of Use
User Satisfaction	Information Satisfaction
	System Satisfaction
Willingness to provide personal information to the e-service	Perceived Internet privacy risk
	Internet privacy concerns
	Internet trust
	Personal Internet interest

Table 6: Summary of behavioural KPIs

KPIs category	KPIs
Scalability & Flexibility	Number of users
	Number of concurrent users
	Number of federated services
	Number of simultaneous sessions for each service
	Number of service requests/queries
	Number of established connections
	Throughput and congestion
	Deployment time needed to add a new service to the catalog
	Load tolerance
	Traffic tolerance
	Load variability of the services
	Elasticity degree
Fault Tolerance & Reliability	Cloud availability ratio (access to cloud functionalities)
	Service availability ratio (access to federated services)
	Data loss, corrupted data (in terms of size or time equivalent)
	Mean time to incident discovery (delay)
	Time to invoke
	Time to repair (mean time to repair)
	Mean time to incident recovery
Maintenance and Monitoring	Number of recovery mechanisms activated
	Maintenance actions
	Time to repair
	Recovery time
	Failures on back-up processes
	Failures on restoring processes
	% of repairs covering SLA
	Statefulness metrics
	Versioning metrics
	Resource threshold
	User threshold
	Data request threshold
	Response threshold

KPIs category	KPIs
	Total number of RFCs raised
	Percentage for each category
	Percentage of urgent changes
	% of successful changes
	% of changes backed out
	Backlog of changes by CI/priority
	Percentage of urgent releases
	% of successful software installations
	Percentage of installations performed to time
	% of builds/distributions aborted during process
	Number of failed or backed out implementations plus builds rolled back after implementation
Performance	Average service access time (latency time for service utilization request)
	Average application response to user's requests (completion time of provided services)
	Download/upload of documents time
	Bandwidth/network utilization
	Page load time
	Service computation time
	Number of services successfully delivered
	Processor time
	Instructions per second
	Latency
	third party influence on page load for content components
	third party influence on page load for external tools
	% of lost transactions with remote services
	Application "workload"
	Response time
	Utilization
	Transaction workload
	Internal response time
	Effective utilization
	Performance index
	System efficiency
	System agility
Hardware resources	Number of CPU
	Available memory
	Available storage
	CPU usage
	Memory usage
	Storage usage to measure available and busy space
	I/O complexity (searching through databases)
	Elasticity level on storage
	Elasticity level on databases
	Redundancy level
Usability	bounce rate
	form/shopping cart abandonment rate
	links clicked (heat maps)
	next pages
	pageviews per visit

KPIs category	KPIs
	returning visitors
	time on page
	time on site
	Failure Rate
	WAB score
	UWEM Aggregation Formula
	A3 (Improvement on UWEM agg formula)
	WAQM
Security and Privacy	Impairment of the system, security breaches
	Network intrusion detection to identify suspicious traffic (e.g. port scan, denial
	Host intrusion detection to monitor the security state of servers and signalling abnormalities (e.g. unauthorized accesses, attacks)
	Data leakages
	Number of security updates
	Hardware and platform technologies protection in data center (physical access to cloud resources)
	Number of security incidents opened by severity
	Number of security incidents closed by security
	Number of services that have had security reviews
	Number of security reviews pending
	Number of risks identified
	Number of risks mitigated to an acceptable level
SAAS Management	Number of calls received
	Number of calls missed
	Number of rings before the phone is answered
	Average duration of calls
	Number of calls logged
	Percentage number of incidents compared to incoming calls
	Percentage of repeat calls for the same incident
	Percentage of incidents resolved by help desk - first level
	Percentage of operations support requests closed
	Mean time to achieve incident resolution
	Number of calls escalated
	Initial trend analysis
	Results of customer satisfaction surveys
	Number of complaints and/or letters of praise
	Actual spend against budget
	Results of audits
	Number of staff suggestions, requests for transfer, disputes etc.

Table 7: Summary of technical KPIs

KPIs category		KPIs
Social Issues	Openness	Openness
	Trust	Trust in the Internet
		Trust in government organisations
	Legal and regulatory compliance	Forensics
		Data retention and track back
		Governmental control over the data
Economical Issues	Business/Operational Issues	Operational cost
		Capital expenditure
		Cost of migration
		Vendon lock-in
	Cost Saving	Money saving
		Time Saving

Table 8: Summary of socio-economic KPIs

4. Focus Groups Methodology

The previous sections describe the state of the art analysis that has led to the formulation of a list of KPIs summarized in Table 6, Table 7 and Table 8. Following this analysis, the consortium has set up focus groups in order to identify evaluation requirements and has refined the initial set of KPIs. The focus groups can be divided in two groups: a) focus groups with user communities and b) focus groups with the network, application and service providers. The first focus group was mainly aiming at identifying evaluation requirements regarding the behavioural and socio-economical evaluation, while the latter was targeting at the identification of technical evaluation indicators.

4.1. Focus groups with e-services users

Taking into consideration that most of the OASIS services that are currently running are established in two of the five pilot sites – Provincia di Torino and France – the focus groups were realised with user communities of these pilot sites. Specifically, the following services already exist in the fore mentioned pilot sites:

- ✓ Ushahidi
- ✓ City planning
- ✓ Mapping of territorial economic activities

The users also considered their overall experience from using e-government services.

Five users of e-services provided by Provincia di Torino were interviewed and six users of e-services provided in France. Table 9 presents the demographic information of the two focus groups' participants.

Pilot Site	Sex		Age		Education		E-government services usage	
Provincia di Torino	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%		

Pole Numerique	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

4.1.1. Materials for the focus group

- ⇨ Participant Information Sheet (Appendix A)
- ⇨ Demographic Information Sheet (Appendix A)
- ⇨ Consent Form (Appendix A)

4.1.2. Introduction and Consent Process

Script for the Facilitator

Good morning/afternoon ladies and gentlemen and thank you for being here today. My name is [*full name of the facilitator*] and this/there is/are [*full names of any other participants*]. We work for the European Project OASIS and we are conducting this focus group interview on behalf of the OASIS consortium which is comprised by 13 partners, including academic institutions, public authorities, and software development and cloud computing private enterprises.

Through this focus group interview we hope to learn more about how citizens evaluate the electronic services provided by the public administration. This way we expect that we can design more accessible, more user-friendly and more efficient e-services run by public authorities. For that reason, it is really important for us to get your opinion on the available e-government services and the criteria that matter the most to you for their attractiveness, quality, effectiveness and friendliness.

Before we get started, we want to draw your attention to the participation information sheet and the consent form. These documents provide you with important information about the process, the voluntary nature of this research and how we view confidentiality. We would like to highlight the following:

- ✓ It is important to capture the thoughts, opinions, and ideas expressed within the group in the natural setting. This is the reason why we would like to ask your permission to record the focus group interview. No names will be attached to the recordings and the tapes will be destroyed as soon as they are transcribed.
- ✓ The focus group is voluntary; you may refuse to answer any question or withdraw from the study at any time.
- ✓ The information exchanged within the focus group is strictly private and confidential. We kindly ask participants to respect each other's confidentiality.

Please take a minute to read the provided documents, complete the consent form and return it to one of the interviewers. Moreover, please fill in the demographic information form; all demographic information is collected only for the research purposes.

Explanation of the process

Previous participation: We would like to ask if any of the participants has previously participated to a focus group. If so, please share your experience.

Background on focus groups: Focus groups are a form of qualitative research in which a group of people are asked about their perceptions, opinions, beliefs, etc. towards a product, service,

concept, advertisement, idea, and others. Focus groups have mainly been used in the health, social and marketing fields. The foundation of the focus group research is that the group discussions produce data and insights that would not be otherwise produced; they are generated by the interaction within the group members, such as listening to others' experiences which stimulates memories, ideas, concerns etc.

Ground Rules: We would like to establish some commonly agreed ground rules for the focus group. Would the participants like to suggest any?

[The facilitator should make sure that after any brainstorming the following should be established:

- ✓ Everyone should participate and express ideas
- ✓ It is commonly agreed that information exchanged will be kept confidential
- ✓ There will be no side conversations
- ✓ Cell phones should be closed

In case the group is reluctant to propose ground rules the facilitator should help the process. Any other suggested and agreed ground rules should be recorded and followed throughout the process.]

4.1.3. **Focus Group Process**

Turning on recorder: The facilitator should remind to the participants that the focus group will be recorded and turn on the recorder.

Questions: The facilitator should ask the participants if they have any questions. If so, these questions should be addressed.

Introductions: The facilitator should ask everyone to introduce themselves in a go around the table sequence. The participants would present information that they find relevant, such as name, job, residence, how often they have used internet to be served by the public administration, etc.

Scope of the focus group: Focus groups interviews are conducted in an unstructured and natural way and respondents are free to express naturally their views for the relevant issues. The facilitator should each time set the scope of the focus group and that people take their time to think before answering to the questions. When repetitive information is exchanged, then the discussion should be the discussion should be moved forward.

4.1.4. **Questions for the Facilitator**

The facilitator should repeat the purpose of the research and try to convince the participants to reply thoughtfully.

1. What is your overall opinion on the available e-services provided by the government?
2. Can you please recall from your experience an e-service provided by government/governmental agencies that you are frequently using and you find satisfying? Can you describe why the particular e-service is satisfying?
3. Can you please recall from your experience an e-government service that you have abandoned after attempting to use? What were the reasons for your choice?
4. Can you recall an e-government service that you are reluctant to use? What are the reasons that prevent you from doing so?
5. [The facilitator should have in mind the most frequently used e-services or improvise from the discussion so far] Could you name the criteria that you would use to evaluate and rank the following e-services [list of services]?
6. What are the reasons that motivate you to use an electronic service to interact with the public administration instead of visiting the public agency?
7. What are the reasons that prevent you from using an electronic service and prefer to visit the public agency?
8. Where do you commonly learn about new e-government services and initiate to use them?
    a. People from your social environment are using them
    b. You try to be up to date with regard to available e-government services

   c. Regulation is obliging you to use them
9. Let's imagine a public agency and your interaction with it. Imagine a specific task that the public agency performs for you. Let's assume that we are working as consultants for the government we can develop the perfect e-government service that would make possible to complete this task via internet. Can you describe this e-service and the attributes that you would you pay attention to?
10. [The facilitator should provide a short description of the cloud computing and the scope of the project, in simple words and avoiding any technical terms] If you are aware that an e-service is hosted in cloud computing would you be more sceptical in using it? Please explain. What would ease your concerns?
11. Which one of the following would concern you to use an e-government service hosted on cloud computing?
    a. The uncertainty of the location in which your data are stored
    b. The period of time for which your data will be retained
    c. The degree to which the cloud provider might control your data instead of governmental agency
    d. The degree to which evidence can be collected in case of data privacy violation

    Can you prioritize them with increasing importance to you?
12. Which one of the following criteria you would consider to evaluate the information quality of an e-government service?
    a. Accuracy of information provided
    b. Currency of the information presented
    c. Completeness of the information provided
    d. Comprehensiveness of information
    e. Presentation format of information

    Can you prioritize them with increasing importance to you?
13. Which one of the following criteria you would consider to evaluate the technical quality of an e-government service?
    a. Reliability of the e-service
    b. Response time when you are interacting with the e-service
14. Which one of the following criteria you would consider to evaluate the performance and usage of an e-government service?
    a. The degree to which it is easy to use
    b. The degree to which it is useful to you and you frequently need to use it
    c. The degree to which the e-service provides the result needed (e.g. certificate)
    d. The degree to which the service is innovative

    Can you prioritize them with increasing importance to you?

4.1.5. **Closure Process**

The facilitator should thank the participants for their time and for sharing their opinions. The participants should be ensured that the information provided is going to be useful for the project and for designing better and more user-friendly e-government services within the project, with respect to their concerns. Contact information should be reminded in case the participants have more questions.

4.2. Focus groups with network, application and service providers

The same processes were adopted for the focus groups regarding the technical evaluation of OASIS platform. The focus group was set up during the General Assembly meeting held on 14-15 June 2012. The participants expressed their opinion on the evaluation of e-services provided in cloud computing. The following questions were designed to guide the interview:

1. What criteria would you use to evaluate the technical performance of e-government services provided in cloud computing?
2. What criteria would you use to evaluate the reliability of the e-government services?
3. Which metrics would you use to measure the hardware resources usage?
4. How would you evaluate the security and privacy of the e-services?
5. What other aspects would you consider to technically evaluate the e-government services?
6. How would you evaluate the quality of maintenance and monitoring?
7. How would you compare the usability of various e-government services?

5. Focus groups findings

5.1. Analysis of interviews with users

5.1.1. **Opinions about E-government Services**

The participants from the Italian pilot site noticed that e-government services are currently sufficient, but could be significantly improved. Their opinion is that the available e-government services are rarely used. However, it is perceived that when they are working properly they provide great comfort due to the **time** that they can save.

The participants from the French pilot site have highly stressed the benefits of e-government services in terms of **time savings, mobility requirements, availability (24/7**). Moreover, they highlighted that the **response time** of the public services is stricter and pre-determined, than in offline services. When a document needs to be issued the online services can provide it immediately while offline services and mail can take up to a week. However, they have also pointed out these benefits are present when the service is **reliable** or when the **guidance** is sufficient; in the opposite case that the user is facing difficulties the problem resolution becomes very complex and cannot be reached without personal contact.

5.1.2. **E-government Services' Satisfaction Criteria**

The users from the French pilot site have named as more satisfactory the services that are allowing them **multiple functions** and **rich and usable information**. They have also stressed that the provision of **monitoring of progress** is very important. The users from the Italian pilot site have also insisted on the **quality and richness of information** provided by the e-services.

5.1.3. **E-government Services' Dissatisfaction Criteria**

The interviewee asked the participants to name e-services that are not satisfactory and the reasons that. Users of French e-services named an insurance service due to the **incomprehensibility and inaccuracy of information, complexity and incoincissness of the service**. Users of Italian services could not recall of a service.

5.1.4. **Overall Evaluation Criteria**

The participants were asked to name the criteria that they would use to evaluate a number of e-government services. The following criteria were mentioned by the participants of the French pilot site:

- Legibility of information on the site
- Ergonomics of the website to find their bearings and quickly access desired information
- Preservation of information to avoid having to re-enter it
- Ease of access to information without having to spend time filling out information
- Federation of services because with one account you can access all sorts of services

The participants using services in Provincia di Torino named the following criteria:

- Simplicity
- Usability
- Conciseness
- Reliability

5.1.5. **Information quality evaluation criteria**

The participants were asked to rank the importance of pre-determined criteria for evaluating e-government services' information quality. Completeness and currency of information are the most important criteria according to them. Currency of information is important, but completeness is the most crucial factor, as it determines if the user will have to also visit or contact the agency.

The users of the French pilot site determined the following sequence of criteria, with decreasing importance:

- Completeness of the information provided
- Comprehensiveness of information
- Accuracy of information provided
- Currency of the information presented (Update)
- Presentation format of information

The users of Provincia di Torino services determined the following ranking:

- Currency of the information presented (Update)
- Completeness of the information provided
- Accuracy of information provided
- Comprehensiveness of information
- Presentation format of information

5.1.6. **Technical quality evaluation criteria**

Participants from both pilot sites struggled to select among the reliability and the response time of an e-service in order to evaluate technical quality.

During the focus group of the French pilot site it initially seemed obvious that the most important criteria is the reliability of the e-service. However, during the conversation everyone agreed that if an e-service is too slow, they would not use it.

Similarly, during the focus group of the Provincia di Torino found reliability as more important initially; however response time should be acceptable. They finally agreed that the two criteria are of equal importance.

5.1.7. **Performance evaluation criteria**

The attendees were asked to rank the ease of use, usefulness, results' provision and innovation according to the criterion that they believe is more important for e-service performance. The participants from the French pilot site perceive performance as synonymous to usefulness and efficiency. They ranked the criteria with decreasing importance as:

- The degree to which it is useful to you and you frequently need to use it
- The degree to which the e-service provides the result needed (e.g. certificate)
- The degree to which it is easy to use
- The degree to which the service is innovative

The participants from Provincia di Torino provided similar results with ease of use to be ranked higher than the ultimate result provided.

5.1.8. Reasons for using e-government services instead of visiting the public agency

The main reasons for using an e-service instead of physical presence to the public agency according to the users of French e-services are:

- Faster services
- Ability to have as much time as needed to complete the steps of the process
- Ability to stop during the request and resume when it is convenient

5.1.9. Reasons for visiting the public agency instead of using e-government services

The reasons specified were by the participants of both pilot sites are:

- Special cases that are not covered by the online service
- Mistrust to the system
- Cases that are complicated and the system does not help as much as a public agent would

5.1.10. Dissemination of e-government services

The participants try mostly on their own to remain updated for available e-government services. However, word of mouth is crucial for spreading e-government services that are very useful and provide multiple opportunities.

5.1.11. Concerns about public services on cloud computing

The only concern raised by the participants was – as expected – the security of data. The participants noticed that the services are more sensitive in terms of data protection when they use cloud computing technology. However, after the discussion among the participants they agreed that security concerns would be an obstacle, as in fact the data would be more securely managed by a private partner than the public agency. Being unanimous the participants stressed the following concerns with decreasing importance:

- The uncertainty of the location in which your data are stored
- The degree to which evidence can be collected in case of data privacy violation
- The degree to which the cloud provider might control your data instead of governmental agency
- The period of time for which your data will be retained

5.2. Analysis of interviews with network, application and service providers

5.2.1. Technical performance evaluation criteria

The participants initially struggled to distinct technical performance from other aspects of the technical evaluation. However, as soon as the first criteria were discussed, all participants begun contributing to the identification of criteria. The criteria that were expressed by the participants were:

- Availability
- Loading time (considering UI and remote services response)
- Waiting time
- Independence from internet browser
- Independence from the device (mobile phone, tablet, PC, laptop, etc.)
- Usability
- Number of actions/clicks to reach the result

- Scalability
- Availability of developers guide (in multiple languages)
- Necessity to install an application to run the service or not

5.2.2. **Reliability evaluation criteria**

The participants stressed that the criteria to evaluate reliability would be the same as in e-government services that are not hosted on cloud computing. Among the criteria discussed, the following were agreed as important:

- Availability
- Data consistency
- Recovery time (after a crash)
- Times that the services was not availability
- Downtime

5.2.3. **Hardware resources usage evaluation criteria**

Similarly the interviewees expect that the hardware resource indicators that are currently used, should remain for the services on cloud computing. The criteria discussed are the following:

- Ratio between the actual TB and the provided TB
- CPU usage
- Storage usage
- Electric Power consumed
- Number of instances being executed
- Number of cores involved

5.2.4. **Security and privacy evaluation criteria**

The participants were initially struggling to identify objective measurements for the security and privacy evaluation. It was noticed that the criteria might be differentiated according to the service each time. The following criteria were identified:

- Number of encrypted transactions
- Dropped sessions
- Intrusion attempts detected
- DoS attempts
- Encryption key size
- Lost session
- Encryption and decryption time

5.2.5. **Maintenance and monitoring quality evaluation criteria**

Keeping in mind that the services will be hosted on cloud computing the participants reported the following indicators for evaluating maintenance and monitoring:

- Number of bugs reported by the user
- Number of bugs reported by the system
- Number of time the service must be restarted
- Number of updates
- Number of tickets/problems reported and created
- Duration of service unavailability
- Auditing data
- Time needed to insert a new service/machine

5.2.6. **Usability evaluation criteria**

The attendees again stressed that the known criteria used for evaluating usability are applicable in cloud computing as well:

- Time to complete a task
- Nielsen 10 usability heuristics:
  - *Visibility of system status*: The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
  - *Match between system and the real world*: The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
  - *User control and freedom*: Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
  - *Consistency and standards*: Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.
  - *Error prevention*: Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.
  - *Recognition rather than recall*: Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
  - *Flexibility and efficiency of use*: Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.
  - *Aesthetic and minimalist design*: Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
  - *Help users recognize, diagnose, and recover from errors*: Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
  - *Help and documentation*: Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

5.2.7. **Scalability evaluation criteria**

The following criteria were reported for evaluating scalability of the services:

- Number of concurrent users
- Response time when the concurrent users increase
- Scalability of the indexing system (service providers, services)
- Number of services that the OASIS platform can support

5.2.8. **Other evaluation aspects**

The following criteria were discussed as also being important to be measured for the technical evaluation:

- Latency

- Response time
- Ability to manage different type of devices
- Number of attempts to use a service and was not possible
- Fault tolerance
- System status

5.3. KPIs requirements

The objective of the focus groups with users of e-government services was to validate/reject the evaluation indexes identified from the literature analysis and specify additional evaluation requirements.

Table 10 presents the mapping of literature indicators with the users' viewpoints. It can be concluded that the evaluation approach based on the Integrated Model of UTAUT and IS success model covers all users' requirements. Moreover, the users were requested to comment on the security and privacy of their personal data processed by the e-services. The evaluation criteria for this aspect also correspond to the socio-economic perspective; however only trust and legal and regulatory compliance apply. Table 11 presents the measurements that were discussed. Regarding the technical evaluation, Table 12 presents that validated metrics.

KPIs category	KPIs	Mentioned by the users
Performance Expectancy	Perceived Usefulness	x
	Extrinsic Motivation	
	Job-fit	
	Relative Advantage	
	Outcome Expectations	x
Effort Expectancy	Perceived Ease of Use	x
	Complexity	x
	Ease of Use	x
Social Influence	Subjective Norm	
	Social Factors	x
	Image	
Facilitating Conditions	Perceived Behavioural Control	
	Facilitating Conditions	
	Compatibility	
System Quality	Reliability	x
	Flexibility	
	Integration	
	Accessibility	x
	Timeliness	x
Information Quality	Completeness	x
	Accuracy	x
	Format	x
	Currency	x
	Relevance	x
Service Quality	Tangibles	
	Reliability	x
	Responsiveness	x
	Assurance	x
	Empathy	

KPIs category	KPIs	Mentioned by the users
Information Use	Usefulness	x
	Ease of Use	x
User Satisfaction	Information Satisfaction	x
	System Satisfaction	x
Willingness to provide personal information to the e-service	Perceived Internet privacy risk	x
	Internet privacy concerns	x
	Internet trust	
	Personal Internet interest	x

Table 10: Validation of behavioural KPIs

KPIs category	KPIs	Mentioned by the users/providers
Cost Saving	Money saving	
	Time Saving	
Openness	Openness	
Trust	Trust in the Internet	x
	Trust in government organisations	x
Business/Operational Issues	Operational cost	x
	Capital expenditure	
	Cost of migration	x
	Vendon lock-in	
Legal and regulatory compliance	Forensics	
	Data retention and track back	x
	Governmental control over the data	x

Table 11: Validation of socio-economic KPIs

KPIs category	KPIs	Mentioned by providers
Scalability & Flexibility	Number of users	x
	Number of concurrent users	x
	Number of federated services	x
	Number of simultaneous sessions for each service	x
	Number of service requests/queries	
	Number of established connections	
	Throughput and congestion	
	Deployment time needed to add a new service to the catalog	
	Load tolerance	
	Traffic tolerance	
	Load variability of the services	
	Elasticity degree	
Fault Tolerance & Reliability	Cloud availability ratio (access to cloud functionalities)	
	Service availability ratio (access to federated services)	
	Data loss, corrupted data (in terms of size or time equivalent)	x
	Mean time to incident discovery (delay)	x
	Time to invoke	
	Time to repair (mean time to repair)	x
	Mean time to incident recovery	x
Maintenance and Monitoring	Number of recovery mechanisms activated	
	Maintenance actions	
	Time to repair	

KPIs category	KPIs	Mentioned by providers
	Recovery time	
	Failures on back-up processes	
	Failures on restoring processes	
	% of repairs covering SLA	
	Statefulness metrics	
	Versioning metrics	
	Resource threshold	
	User threshold	
	Data request threshold	
	Response threshold	
	Total number of RFCs raised	
	Percentage for each category	
	Percentage of urgent changes	
	% of successful changes	
	% of changes backed out	
	Backlog of changes by CI/priority	
	Percentage of urgent releases	
	% of successful software installations	
	Percentage of installations performed to time	
	% of builds/distributions aborted during process	
	Number of failed or backed out implementations plus builds rolled back after implementation	
Performance	Average service access time (latency time for service utilization request)	
	Average application response to user's requests (completion time of provided services)	
	Download/upload of documents time	
	Bandwidth/network utilization	
	Page load time	x
	Service computation time	
	Number of services successfully delivered	
	Processor time	
	Instructions per second	
	Latency	x
	third party influence on page load for content components	
	third party influence on page load for external tools	
	% of lost transactions with remote services	
	Application "workload"	
	Response time	x
	Utilization	
	Transaction workload	
	Internal response time	
	Effective utilization	
	Performance index	
	System efficiency	
	System agility	
Hardware resources	Number of CPU	x
	Available memory	x

KPIs category	KPIs	Mentioned by providers
	Available storage	x
	CPU usage	x
	Memory usage	x
	Storage usage to measure available and busy space	
	I/O complexity (searching through databases)	
	Elasticity level on storage	
	Elasticity level on databases	
	Redundancy level	
Usability	bounce rate	
	form/shopping cart abandonment rate	
	links clicked (heat maps)	
	next pages	
	pageviews per visit	
	returning visitors	
	time on page	x
	time on site	x
	Failure Rate	
	WAB score	
	UWEM Aggregation Formula	
	A3 (Improvement on UWEM agg formula)	
	WAQM	
Security and Privacy	Impairment of the system, security breaches	x
	Network intrusion detection to identify suspicious traffic (e.g. port scan, denial	x
	Host intrusion detection to monitor the security state of servers and signalling abnormalities (e.g. unauthorized accesses, attacks)	
	Data leakages	
	Number of security updates	
	Hardware and platform technologies protection in data center (physical access to cloud resources)	
	Number of security incidents opened by severity	x
	Number of security incidents closed by security	x
	Number of services that have had security reviews	
	Number of security reviews pending	
	Number of risks identified	
	Number of risks mitigated to an acceptable level	
SAAS Management	Number of calls received	x
	Number of calls missed	x
	Number of rings before the phone is answered	
	Average duration of calls	
	Number of calls logged	
	Percentage number of incidents compared to incoming calls	
	Percentage of repeat calls for the same incident	
	Percentage of incidents resolved by help desk - first level	x
	Percentage of operations support requests closed	
	Mean time to achieve incident resolution	
	Number of calls escalated	

KPIs category	KPIs	Mentioned by providers
	Initial trend analysis	
	Results of customer satisfaction surveys	
	Number of complaints and/or letters of praise	
	Actual spend against budget	
	Results of audits	
	Number of staff suggestions, requests for transfer, disputes etc.	

Table 12: Validation of technical KPIs

6. Measurement Strategy

The behavioural evaluation of the e-services will be performed by the end-users after using the e-services of the OASIS platform, the socio-economic evaluation by the end-users and the public authorities (pilot sites) and finally the technical evaluation by the technical service and application providers.

6.1. Behavioural evaluation

6.1.1. Measurement Instruments

As described in section 2 the behavioural assessment will be based on an integrated model of the IS Success model with the UTAUT model and information privacy aspects. Both models have been widely applied in the information systems research using questionnaire instruments. We will follow the same approach in OASIS; hence in this subsection we present the questionnaire that will be used to collect end-users assessments.

It should be noted that in some cases due to overlapping of the two theories' constructs, some metrics are merged. For example, 'Perceived Usefulness' (a metric of 'Performance Expectancy' category) and 'Perceived Ease of Use' (a metric of 'Effort Expectancy' category) overlap with the 'Information Use' category ('Ease of Use' and 'Usefulness' metrics). Similarly, 'Reliability' appears in both 'System Quality' and 'Service Quality' categories. 'Perceived Behavioural Control' regards personal constraints to the adoption of the service, which however is covered by the 'Facilitating Conditions' metric. Similarly, 'Timeliness' metric (a metric of 'System Quality' category) overlaps with 'Currency' metric (a metric of 'Information Quality' category). Furthermore, some constructs derive from the origins of the theories to measure the adoption of a system by the employees of an organization, such as 'Job-fit', 'Extrinsic Motivation' and 'Subjective Norm'. Therefore, those metrics will not be measured. Similarly, 'Image' metric is not closely relevant to the use of e-government systems (e.g. would be more relevant to the adoption of a social networking service). 'Tangibles' refers to a metric that is more appropriate for offline services. 'Flexibility' and 'Integration' are technical features that the users would not be able to observe immediately.

	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					

	Attribute Under Evaluation	Your Assessment				
		Strongly Disagree	Disagree	Neutral/ No opinion	Agree	Strongly Agree
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					

	Attribute Under Evaluation	Your Assessment				
		Strongly Disagree	Disagree	Neutral/ No opinion	Agree	Strongly Agree
	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					

Table 13: Behavioural Evaluation Survey Instrument

KPIs category	KPIs	Question No.
Performance Expectancy	Perceived Usefulness	Q4.1
	Relative Advantage	Q4.2, Q4.3
	Outcome Expectations	Q4.4
Effort Expectancy	Perceived Ease of Use	Q5.2, Q5.3
	Complexity	Q5.1, Q5.4
	Social Factors	Q6.1, Q6.2
	Facilitating Conditions	Q7.1, Q7.2
	Compatibility	Q7.3
System Quality	Reliability	Q2.3
	Accessibility	Q2.5
	Navigation	Q2.1, Q2.2
Information Quality	Completeness	Q1.4
	Accuracy	Q1.1
	Format	Q1.5
	Currency	Q1.2
	Relevance	Q1.3
Service Quality	Responsiveness	Q3.5
	Assurance	Q3.3, Q3.4
	Empathy	Q3.1, Q3.2
User Satisfaction	Information Satisfaction	Q9.1, Q9.2
	System Satisfaction	Q9.3, Q9.4
Willingness to provide personal information to the e-service	Perceived Internet privacy risk	Q8.1, Q8.2
	Internet privacy concerns	Q8.3, Q8.4
	Internet trust	Q8.5
	Personal Internet interest	Q8.6

Table 14: KPIs Index of Questions

6.1.2. **Metrics Levels**

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 behavioural metrics will be measured periodically for the OASIS services.

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
Performance Expectancy	Perceived Usefulness						
	Relative Advantage						
	Outcome Expectations						
Effort Expectancy	Perceived Ease of Use						
	Complexity						
	Social Factors						
	Facilitating Conditions						
	Compatibility						
System Quality	Reliability						
	Accessibility						
	Navigation						
Information Quality	Completeness						
	Accuracy						
	Format						
	Currency						
	Relevance						
Service Quality	Responsiveness						
	Assurance						
	Empathy						
User Satisfaction	Information Satisfaction						
	System Satisfaction						
Willingness to provide personal information to the e-service	Perceived Internet privacy risk						
	Internet privacy concerns						
	Internet trust						
	Personal Internet interest						

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

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

Table 15: Behavioural KPIs levels

6.2. Socio-economic Evaluation

6.2.1. **Measurement Instruments**

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.

KPIs category	
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

Similarly to the behavioural evaluation, the socio-economic assessment from the end-user perspective will be made through questionnaires to the users, as shown in Table 16.

	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					

	Attribute Under Evaluation	Your Assessment				
		Strongly Disagree	Disagree	Neutral/ No opinion	Agree	Strongly Agree
	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 (yyyymmmdd) 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 16: 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 17: Socio-economic assessment (provider-oriented) measures

6.2.2. **Metrics Levels**

The socio-economic assessment from a user perspective will be measured 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 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
Openness	Openness (Transparency)						
	Openness (Interactivity)						
Cost Saving	Time Saving						
	Money Saving						

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 18: Socio-economic KPIs levels

The socio-economic assessment from a public agency perspective will be realised per pilot site based on the information depicted in Table 19.

	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 19: Socio-economic KPIs measurement levels

6.3. Technical Evaluation

6.3.1. **Measurement Instruments**

The technical metrics refer to the perspectives of the quality and performance of ICT systems involved in the cloud based eservices delivery. The content of section 2.2. provides the consortium with a detailed and exhaustive set of KPIs that will allow the audience to valuate in an objective manner the real capacity of the tested platform during pilot execution.

The extension and potential measurement availability of the KPI set provokes the need of the definition of a measurement strategy based on the following elements:

- The number of KPIs included in the list is very large. It provokes a hard work for data collection and a freat effort for its analysis.
- The architecture of the platform requires the identification of different levels of measurement (platform level, pilot site level and service provision level). KPIs are measurable at least at one of the identified level.
- Not all the KPIs could be measured. It depends on the fact that the original list of KPIs includes different technical scenarios that are not fully covered by the final implementation of OASIS platform.

According to the elements in the list above, the consortium has made a selection process of KPIs including:

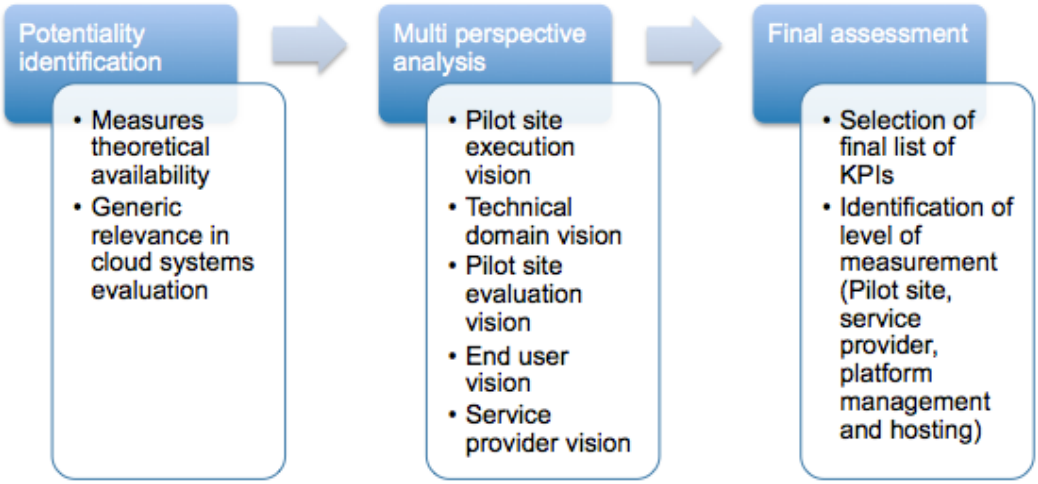

Figure 7: KPI selection

The assessment made has allowed the consortium to identify an other point of interest for dashboarding the pilot, for its economic model in the long run and the evaluation of its success :the measurement of data. A group of KPIs must be considered in order to evaluate part of the evolution and results of the Pilot. This group of KPIs will be measured by using logging information handled by the OASIS platform. Due to that, the new group of KPIs is called Log-KPIs.

As a result the consortium has obtained a final set of KPIs covering all the required areas and with the level of measurement fully identified according to the assessment made by the consortium. The following tables show the selected KPIs and the measurement level.

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
scalability-1.1	Number of users	x		
scalability-1.2	Number of concurrent users	x		
scalability-1.3	Number of federated services	x		
scalability-1.4	Number of simultaneous sessions for each service	x		
scalability-1.5	Number of service requests/queries	x		
scalability-1.7	Number of established connections			x
scalability-1.8	Throughput and congestion			x
scalability-1.9	Number of total users per service	x		
scalability-2.1	Load tolerance: this can be calculated as a ratio of the maximum load a system can handle compared to the normal expected load, eg, the percentage of the normal load by which a system can temporary upscale (bandwidth, processing power, etc).			x
scalability-2.2	Traffic tolerance (including anti-DoS/DDoS provisions, eg, filtering, firewalling, rerouting, shut- off of clients producing excessive traffic, etc): the ability of a system to tolerate unpredictable offered load without a significant drop in carried load (including congestion collapse), as well as to isolate the effects from cross-traffic, other flows and other nodes.			x

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
scalability-2.4	Elasticity degree			x

Table 20: Scalability metrics

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
fault_tolerance-1.1	Cloud availability ratio (access to cloud functionalities)	x		
fault_tolerance-1.2	Service availability ratio (access to federated services)		x	
fault_tolerance-2.1	Mean time to incident discovery (delay): the time that it takes from the time an incident occurs to when the incident is discovered;	x		
fault_tolerance-2.2	Time to invoke: the time it takes to realise that the recovery-response phase should be invoked (mean time to invoke);	x		
fault_tolerance-2.3	Time to repair (mean time to repair): the time it takes to bring the service back to an acceptable level;	x		
fault_tolerance-2.4	Mean time to incident recovery.	x		
fault_tolerance-3.1	Maximum down-time	x		
fault_tolerance-3.2	Failure frequency	x		
fault_tolerance-4.1	Percentage of incidents defined as problems	x		
fault_tolerance-4.2	Number of problems logged	x		
fault_tolerance-4.3	Percentage of problems escalated	x		
fault_tolerance-4.4	Number of problems fixed	x		
fault_tolerance-4.5	Resolution times with respect to service level requirements	x		
fault_tolerance-4.6	Number of problems outstanding	x		
fault_tolerance-4.7	Hardware, software and help desk support, response and performance		x	
fault_tolerance-5.1	Agreed service hours, per service		x	
fault_tolerance-5.2	Total down time per service		x	
fault_tolerance-5.3	Detection elapsed time per incident		x	
fault_tolerance-5.4	Response times per incident		x	
fault_tolerance-5.5	Time taken to repair per incident		x	

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
fault_tolerance-5.6	Actual availability compared with SLA requirements		x	
fault_tolerance-5.7	Reliability - compared to expectations		x	
fault_tolerance-5.8	Maintainability - compared to expectations		x	

Table 21: Fault tolerance metrics

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
HW_resources-1.2	Available memory	x		x
HW_resources-1.6	Storage usage to measure available and busy space	x		x

Table 22: Hardware resources metrics

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
maint & monitor-1.1	Number of recovery mechanisms activated	x	x	x
maint & monitor-1.2	Maintenance actions	x	x	x
maint & monitor-1.3	Time to repair	x	x	x
maint & monitor-1.4	Recovery time	x	x	x
maint & monitor-2.1	Failures on back-up processes	x	x	x
maint & monitor-2.2	Failures on restoring processes	x	x	x
maint & monitor-2.3	% of repairs covering SLA	x	x	x
maint & monitor-2.5	Versioning metrics	x	x	x
maint & monitor-3.1	Total number of RFCs raised	x	x	
maint & monitor-3.2	Percentage for each category	x	x	

Table 23: Maintenance and monitoring metrics

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
performance-1.1	Average service access time (latency time for	x	x	

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
	service utilization request)			
performance-1.2	Average application response to user's requests (completion time of provided services)	x	x	
performance-1.3	Download/upload of documents time	x	x	
performance-1.7	Number of services successfully delivered	x	x	
performance-2.3	% of lost transactions with remote services	x		
performance-3.2	Response time	x		

Table 24: Performance metrics

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
usability-1.2	Form/shopping cart abandonment rate	x		
usability-1.3	Links clicked (heat maps)	x		
usability-1.4	Next pages	x		
usability-1.5	Pageviews per visit	x		
usability-1.6	Returning visitors	x		
usability-1.7	Time on page	x		
usability-1.8	Time on site	x		

Table 25: Usability metrics

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
security-1.1	Impairment of the system, security breaches	x		x
security-1.2	Network intrusion detection to identify suspicious traffic (e.g. port scan, denial	x		x
security-1.3	Host intrusion detection to monitor the security state of servers and signalling abnormalities (e.g. unauthorized accesses, attacks)	x		x
security-2.1	Number of security incidents opened by severity	x	x	x
security-2.2	Number of security incidents closed by security	x	x	x
security-2.3	Number of services that have had security reviews	x	x	x
security-2.4	Number of security reviews pending	x	x	x
security-2.5	Number of risks identified	x	x	x
security-2.6	Number of risks mitigated to an acceptable level	x	x	x

Table 26: Security metrics

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
SAAS_management-1.1	Number of calls received	x	x	
SAAS_management-1.2	Number of calls missed			
SAAS_management-1.3	Number of rings before the phone is answered			
SAAS_management-1.4	Average duration of calls			
SAAS_management-1.5	Number of calls logged			
SAAS_management-1.6	Percentage number of incidents compared to incoming calls			
SAAS_management-1.7	Percentage of repeat calls for the same incident			
SAAS_management-1.8	Percentage of incidents resolved by help desk - first level			
SAAS_management-1.9	Percentage of operations support requests closed			
SAAS_management-1.10	Mean time to achieve incident resolution			
SAAS_management-1.11	Number of calls escalated			
SAAS_management-1.12	Initial trend analysis			
SAAS_management-1.13	Results of customer satisfaction surveys			
SAAS_management-1.14	Number of complaints and/or letters of praise			
SAAS_management-1.15	Actual spend against budget			
SAAS_management-1.16	Results of audits			
SAAS_management-1.17	Number of staff suggestions, requests for transfer, disputes etc.			
SAAS_management-2.1	Number of occasions when agreed service levels are not provided	x	x	
SAAS_management-2.3	The elapsed time to follow up and resolve issues			
SAAS_management-2.7	Service reports are produced and distributed on time, and to right people			

Table 27: SaaS metrics

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
OASIS_log-1	Authentication : this counter is increased each time a user log	x	x	
OASIS_log-2	Ticket external verification : this counter is			

KPI id	Definition	OASIS Side's KPIs	Pilot Site/Service Provider Side's KPIs	Hosting Side's KPIs
	increased each time a service verify a authentification ticket			
OASIS_log-3	Ticket datacore verification: this counter is increased each time the datacore verify an authentification ticket			
OASIS_log-4	Ticket social graph requester verification: this counter is increased each time the social graph requester verify a authentification ticket			
OASIS_log-5	Data read : this counter is increased each time a read request is made on datacore			
OASIS_log-6	Data create : this counter is increased each time a create request is made on datacore			
OASIS_log-7	Data delete : this counter is increased each time a delete request is made on datacore			
OASIS_log-8	Data update : this counter is increased each time a update request is made on datacore			
OASIS_log-8	Acces rejected : this counter is increased each time a acess request is rejected			
OASIS_log-9	Acces error : this counter is increased each time a access request is incorrect			
OASIS_log-10	Data moderation : reject writing transmits to a moderator			
OASIS_log-11	Data moderation : writing notify to the moderator			
OASIS_log-12	Data moderation : update rejected by OASIS, then validate by moderator			

Table 28: Logged activity metrics

6.3.2. **Metrics Levels**

The technical KPIs will be measured in their correspondent unit (shown in the tables below). The metrics will be measured continuously for the OASIS pilot sites and will be reported on a monthly basis.

The measurements will include:

- Mean value
- Maximum value
- Minimum
- Trend values including:
  - Comparison with previous periods
  - Cumulative values if relevant for the period covered from the start of the pilot till the measurement moment.

One important element is the one related to the target values that could be acceptable. The available literature does not provide a general framework for determining the expected values a pilot will score in order to be successful under the technical point of view. This lack of target values is derived from different elements:

- Technical KPIs are based in general network performance and other attributes KPIs defined for internal network measurement.
- Cloud technical KPIs are usually defined on contract terms and these definitions are kept in confidence.
- There are no specific use cases similar to the ones in OASIS so there is no easy way to extrapolate values from similar experiences.

The project definition is providing an additional element conditioning the existence of target values due to the following reason:

> OASIS services are conceived for having its logic separated from the data, being possible to host this data remotely from the logic.

This element has a direct impact in the baseline identification for defining target values of KPIs and for evaluating improvements in the performance of the platform alongside the time. Performance automatically decreases as users and logic, as well as logic and data, are forced to interact through Internet.

Taking into account this key element, the baseline for evaluating KPIs will be defined according two main values:

- The **minimum acceptable value** defined at service level that will be set at the KPI measure when pilots start.
- The **optimal target value** to which measure must tend to set at the KPI measure at service level out of OASIS platform. This will not be possible for all KPIs (i.e. Log Activity Metrics).

After the initial measures obtained, the evaluation of OASIS will be based on a timely series of measures. The measures will be obtained at different levels (pilot site, platform manager, service provider) and will be used for a defined internal benchmarking of obtained values. The technical measures will be made on a monthly basis.

The scoring of values will be done according to a two-stage procedure. First, measured values below the minimum acceptable value will be considered as not acceptable. After it, the non-discharged measures will be evaluated according to percentiles. The scoring will be done as follows:

- Measured KPIs with a value having a percentile from 100% to 85% will be considered good,
- Measured KPIs with a value having a percentile from 85% to 40% will be considered acceptable,
- Measured KPIs with a value having a percentile lower than 40% will be considered not acceptable.

The picture below describes the procedure

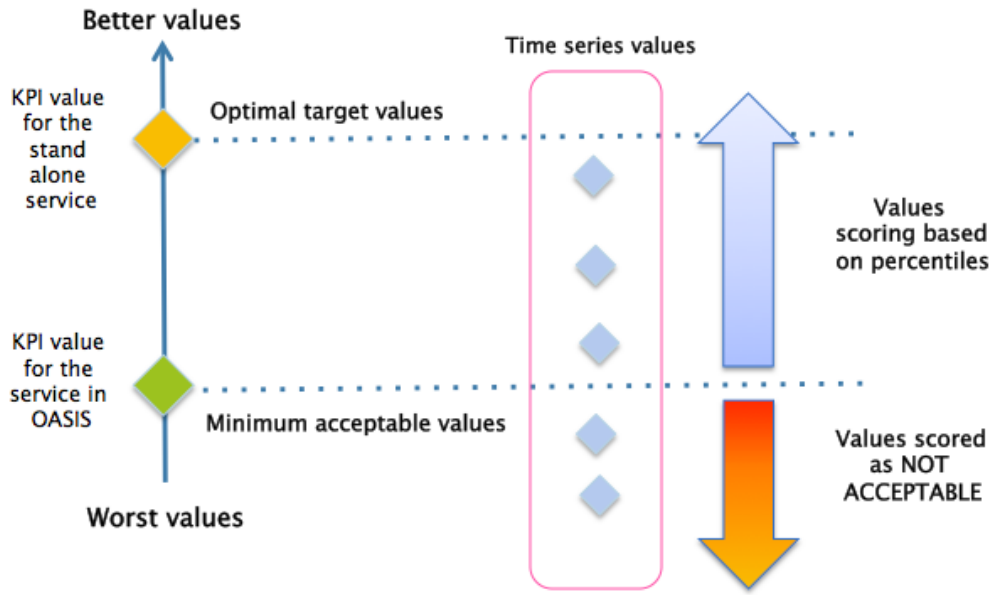

Figure 8: Procedure for values scoring

The following tables will be used for storing KPIs values.

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
scalability-1.1	Number of users	number					
scalability-1.2	Number of concurrent users	number					
scalability-1.3	Number of federated services	number					
scalability-1.4	Number of simultaneous sessions for each service	number					
scalability-1.5	Number of service requests/queries	number					
scalability-1.7	Number of established connections	number					
scalability-1.8	Throughput and congestion	percentage					
scalability-1.9	Number of total users per service	number					
scalability-2.1	Load tolerance: this can be calculated as a ratio of the maximum load a system can handle compared to the normal expected load, eg, the percentage of the normal load by which a system can temporary upscale (bandwidth, processing power, etc).	percentage					
scalability-2.2	Traffic tolerance (including anti-DoS/DDoS provisions, eg, filtering, firewalling, rerouting, shut- off of clients producing excessive traffic, etc): the ability of a system to tolerate unpredictable offered load without a significant drop in carried load (including congestion collapse), as well as to isolate the effects from cross-traffic, other flows and other nodes.	percentage					
scalability-2.4	Elasticity degree	percentage					

Table 29: Scalability metrics

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
fault_tolerance-1.1	Cloud availability ratio (access to cloud functionalities)	Percentage					
fault_tolerance-1.2	Service availability ratio (access to federated services)	Percentage					
fault_tolerance-2.1	Mean time to incident discovery (delay): the time that it takes from the time an incident occurs to when the incident is discovered;	miliseconds					

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
fault_tolerance-2.2	Time to invoke: the time it takes to realise that the recovery-response phase should be invoked (mean time to invoke);	miliseconds					
fault_tolerance-2.3	Time to repair (mean time to repair): the time it takes to bring the service back to an acceptable level;	minutes					
fault_tolerance-2.4	Mean time to incident recovery.	minutes					
fault_tolerance-3.1	Maximum down-time	miliseconds					
fault_tolerance-3.2	Failure frequency	hours					
fault_tolerance-4.1	Percentage of incidents defined as problems	Percentage					
fault_tolerance-4.2	Number of problems logged	Number					
fault_tolerance-4.3	Percentage of problems escalated	Percentage					
fault_tolerance-4.4	Number of problems fixed	Number					
fault_tolerance-4.5	Resolution times with respect to service level requirements	Number					
fault_tolerance-4.6	Number of problems outstanding	Number					
fault_tolerance-4.7	Hardware, software and help desk support, response and performance	Percentage					
fault_tolerance-5.1	Agreed service hours, per service	hours					
fault_tolerance-5.2	Total down time per service	hours					
fault_tolerance-5.3	Detection elapsed time per incident	minutes					
fault_tolerance-5.4	Response times per incident	minutes					
fault_tolerance-5.5	Time taken to repair per incident	miliseconds					
fault_tolerance-5.6	Actual availability compared with SLA requirements	Percentage					
fault_tolerance-5.7	Reliability - compared to expectations	Percentage					
fault_tolerance-5.8	Maintainability - compared to expectations	Percentage					

Table 30: Fault tolerance metrics

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
HW_resources-1.2	Available memory	Gb					
HW_resources-1.6	Storage usage to measure available and busy space	Gb					

Table 31: Hardware resources metrics

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
maint & monitor-1.1	Number of recovery mechanisms activated	Number					
maint & monitor-1.2	Maintenance actions	Number					
maint & monitor-1.3	Time to repair	Hours					
maint & monitor-1.4	Recovery time	Hours					
maint & monitor-2.1	Failures on back-up processes	Number					
maint & monitor-2.2	Failures on restoring processes	Number					
maint & monitor-2.3	% of repairs covering SLA	Percentage					
maint & monitor-2.5	Versioning metrics	Number					
maint & monitor-3.1	Total number of RFCs raised	Number					
maint & monitor-3.2	Percentage for each category	Percentage					

Table 32: Maintenance and monitoring metrics

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
performance-1.1	Average service access time (latency time for service utilization request)	miliseconds					
performance-1.2	Average application response to user's requests (completion time of provided services)	miliseconds					
performance-1.3	Download/upload of documents time	miliseconds					
performance-1.7	Number of services successfully delivered	number					

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
performance-2.3	% of lost transactions with remote services	Percentage					
performance-3.2	Response time	miliseconds					

Table 33: Performance metrics

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
usability-1.2	Form/shopping cart abandonment rate	Percentage					
usability-1.3	Links clicked (heat maps)	Number					
usability-1.4	Next pages	Number					
usability-1.5	Pageviews per visit	Number					
usability-1.6	Returning visitors	Number					
usability-1.7	Time on page	Minutes					
usability-1.8	Time on site	Minutes					

Table 34: Usability metrics

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
security-1.1	Impairment of the system, security breaches	Number					
security-1.2	Network intrusion detection to identify suspicious traffic (e.g. port scan, denial	Number					
security-1.3	Host intrusion detection to monitor the security state of servers and signalling abnormalities (e.g. unauthorized accesses, attacks)	Number					
security-2.1	Number of security incidents opened by severity	Number					
security-2.2	Number of security incidents closed by security	Number					
security-2.3	Number of services that have had security reviews	Number					

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
security-2.4	Number of security reviews pending	Number					
security-2.5	Number of risks identified	Number					

Table 35: Security metrics

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
SAAS_management-1.1	Number of calls received	Number					
SAAS_management-1.2	Number of calls missed	Number					
SAAS_management-1.3	Number of rings before the phone is answered	Number					
SAAS_management-1.4	Average duration of calls	Minutes					
SAAS_management-1.5	Number of calls logged	Number					
SAAS_management-1.6	Percentage number of incidents compared to incoming calls	Percentage					
SAAS_management-1.7	Percentage of repeat calls for the same incident	Percentage					
SAAS_management-1.8	Percentage of incidents resolved by help desk - first level	Percentage					
SAAS_management-1.9	Percentage of operations support requests closed	Percentage					
SAAS_management-1.10	Mean time to achieve incident resolution	Hours					
SAAS_management-1.11	Number of calls escalated	Number					
SAAS_management-1.12	Initial trend analysis	Number					
SAAS_management-1.13	Results of customer satisfaction surveys	Percentage					
SAAS_management-1.14	Number of complaints and/or letters of praise	Number					

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
SAAS_management-1.15	Actual spend against budget	Percentatge					
SAAS_management-1.16	Results of audits	Number					
SAAS_management-1.17	Number of staff suggestions, requests for transfer, disputes etc.	Number					
SAAS_management-2.1	Number of occasions when agreed service levels are not provided	Number					

Table 36: SaaS management metrics

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
OASIS_log-1	Authentication : this counter is increased each time a user log	Number					
OASIS_log-2	Ticket external verification : this counter is increased each time a service verify a authentification ticket	Number					
OASIS_log-3	Ticket datacore verification: this counter is increased each time the datacore verify an authentification ticket	Number					
OASIS_log-4	Ticket social graph requester verification: this counter is increased each time the social graph requester verify a authentification ticket	Number					
OASIS_log-5	Data read : this counter is increased each time a read request is made on datacore	Number					
OASIS_log-6	Data create : this counter is increased each time a create request is made on datacore	Number					
OASIS_log-7	Data delete : this counter is increased each time a delete request is made on datacore	Number					
OASIS_log-8	Data update : this counter is increased each time a update request is made on datacore	Number					
OASIS_log-8	Acces rejected : this counter is increased each time a acess request is rejected	Number					

KPI id	Definition	Unit	Mean score	Max value	Min value	% increase previous period	YTD value
OASIS_log-9	Acces error : this counter is increased each time a access request is incorrect	Number					
OASIS_log-10	Data moderation : reject writing transmits to a moderator	Number					
OASIS_log-11	Data moderation : writing notify to the moderator	Number					
OASIS_log-12	Data moderation : update rejected by OASIS, then validate by moderator	Number					

Table 37: Log activity metrics

7. Conclusion

The KPIs for the evaluation of OASIS services and platform during the planned pilots have been identified in three categories: behavioural, socio-economic, and technical KPIs. The identification of the KPIs went through rigorous literature review and focus groups interviewed against potential stakeholders of the OASIS platform and services.

Taking into consideration that the cloud oriented platforms are new and that they are experiencing a continuous evolvement, limited academic literature exists specifically for the evaluation of public services on the cloud. For that reason we draw upon existing e-government services and added constructs that are especially important for cloud computing, such as information privacy. Moreover, we also draw on practical knowledge, such as public bodies reports. The final list of KPIs includes 10 categories of behavioural metrics, 8 categories technical metrics, and 5 categories of socio-economic ones.

Following the state of the art analysis, three focus groups were organized with end-users, network, service and application providers. The scope of the focus groups was differentiated for end-users and network, service, and application providers. In the first case, the end-users were guided in a discussion on the evaluation of e-government services from the users' point of view, with the aim to identify behavioural and socio-economical criteria. In the second case, the participants were requested to discuss the indicators they find applicable to evaluate technically the OASIS platform. The focus groups have confirmed the evaluation approaches proposed in the literature, since all points of views were covered by the identified KPIs.

The main result of the work done is the availability of a detailed set of KPIs that:

- will allow the consortium to have a dashboard of pilot site evolution and current status, targeting users (citizens, administrative staff, service providers), OASIS platform, cloud hosting and shared data,
- will help OASIS platform managers, pilot site exploitation teams and service providers to have a deep and strong control of service delivery according to their daily activities,
- will be analyzed for the final evaluation of the Pilot B via indicators.

The main steps to perform before the start of the pilot are:

- ❑ Identification of selected KPIs for dashboarding the Pilot B,
- ❑ Identification of information sources for KPIs measurement,
- ❑ Data acquisition for stimating target values when possible,
- ❑ Definition of thresholds for KPI scoring.

8. References

Johnston R. (1995), “The determinants of service quality: satisfiers and dissatisfiers”, International Journal of Service Industry Management, 6 (5), pp. 53-71

Parasuraman A., Zeithaml V.A. and Berry L.L., (1988) “SERVQUAL: A multiple-item scale for measuring customer perceptions of service quality”, Journal of Retailing, 64 (1), pp. 12-40.

Li H., and Suomi R., (2009), “A proposed scale for measuring e-service quality,” International Journal of u-and e-Service, Science and Technology, 2(1), pp. 1-10.

Zeithaml, V., Parasuraman, A., Malhorta, A. (2001), "A conceptual framework for understanding e-service quality: implications for future research and managerial practice", Marketing Science Institute, Cambridge, MA, working paper, 00-115

Alshawi, S., Alalwany, H. (2009), “E-Government Evaluation: Citizen’s Perspective in Developing Countries”, Information Technology for Development, 15 (3), pp. 193–208

ENISA (2011), Security & Resilience in Governmental Clouds- Making an informed decision, European Network and Information Security Agency

Ajzen, I. (1991) “The Theory of Planned Behavior”. Organizational Behavior and Human Decision Processes 50, pp. 179-211.

Bandura, A. (1986) “The Explanatory and Predictive Scope of Self-Efficacy Theory”. Journal of Social and Clinical Psychology 4(Special Issue: Self-Efficacy Theory in Contemporary Psychology), pp. 359-373.

Davis, F. D. (1989) “Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology”]. MIS Quarterly 13(3), pp. 319-340.

Davis, F. D. et al. (1992) “Extrinsic and Intrinsic Motivation to Use Computers in the Workplace”. Journal of Applied Social Psychology 22(14), pp. 1111-1132.

Fishbein, M. and Ajzen, I. (1975) “Belief, Attitude, Intention, and Behavour: An Introduction to Theory and Research”, Addison-Wesley.

Goodhue, D. L. and Thompson, R. L. (1995) “Task-Technology Fit and Individual Performance”. MIS Quarterly 19(2), pp. 213-236.

Rogers, E. M. (1995) “Diffusion of Innovations” (4th ed.). New York: The Free Press.

Taylor, S. and Todd, P. (1995) “Assessing IT Usage: The Role of Prior Experience”. MIS Quarterly 19(4), pp. 561-570.

Thompson, R. L. et al,. (1991) “Personal Computing: Toward a Conceptual Model of Utilization”. MIS Quarterly 15(1), pp. 124-143.

Venkatesh, V. and Bala, H. (2008) “Technology Acceptance Model 3 and a Research Agenda on Interventions”. Decision Sciences 39(2), pp. 273-315.

Venkatesh, V. and Davis, F. D. (2000) “A Theorieical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies”. Management Science 46(2), pp. 186-204.

Wixom, B. H. and Todd, P. A. (2005) “A Theoretical Integration of User Satisfaction and Technology Acceptance” Information Systems Research 16(1), pp. 85-102.

ENISA (2009). An SME perspective on Cloud Computing – A survey, European Network and Information Security Agency

Dinev T. and Hart P. (2006) “An extended privacy calculus model for e-commerce transactions”, Information Systems Research, 17 (1), pp.61-80.

Cyberspace Policy Research Group (CyPRG), http://www.cyprg.arizona.edu.

Welch E and Wong W. (2001), Global Information Technology Pressure and Government Accountability: The Mediating Effect of the Domestic Context on Website Openness, Journal of Public Administration Research and Theory, Vol. 4, pp. 509-538

Welch E and Wong W. (2004), Does E-Government Promote Accountability? A Comparative Analysis of Website Openness and Government Accountability, Governance, Vol. 17, No. 2, pp. 275–297.

9. Appendix A: Focus Groups' Material

Participation Information Sheet

1. **Title of Research**: Openly Accessible Services and Interacting Society - Evaluating e-government services

2. **Focus Group Interview Facilitator:** [NAME OF THE FACILITATOR]
   Contact Email: [MAIL ADRESS OF THE FACILITATOR]

3. **Purpose of the research:** This research is part of the European Project "Openly Accessible Services and Interacting Society" (OASIS). The purpose of the project is to face the difficulty of citizens to find information and services provided by local public authorities on the web, due to the fact that such information are often segmented and isolated in a non-user friendly manner. The project aims at facilitating access to information, public services and economic promotion by grouping online services in a unified portal following a user-centered logic, using federating services in a unique environment. Through the focus group we hope to learn how the citizens (who are the end-users of e-government services) assess e-government services.

4. **What is involved:** The participants to the focus group are expected to engage in the discussion with regard to their perceptions, opinions, beliefs, concerns, etc. about e-government services that they have used in the past.

5. **Voluntary nature of participation:** Participation in this research is voluntary. All participants may refuse to answer any question or withdraw from the study at any time.

6. **Confidentiality:** We would like to record the focus groups so that we can capture the thoughts, opinions, and ideas expressed in the group. No names will be attached to the focus groups and the recorded data will be destroyed as soon as they are transcribed. The information exchanged during the focus group interview is confidential; you are expected to respect other participants' confidentiality.

Demographic Information

***Instructions**: Please provide a response for each of the following questions.*

1. **Gender**: Please choose of the following options.			
a. Male		b. Female	
2. **Age**: Please tick the appropriate box from the following categories.			
a. 18-25			
b. 26-35			
c. 36-45			
d. 46-55			
e. 56-65			
f. Other:			
3. **Education Level**: Please tick the highest level you have completed.			
a. Primary school			
b. Secondary School			

c. High School	
d. Undergraduate University	
e. Postgraduate University	
4. **Usage of e-government services**: How many years are you using internet to be served by the public administration?	
a. Less than one year	
b. Less than two years	
c. Less than five years	
d. Less than ten years	

Consent Form

Many thanks for agreeing to participate in OASIS research project. This research has to be completed in part fulfilment of the European Project “Openly Accessible Services and Interacting Society” (OASIS) and so your assistance is much appreciated.

Consent:

I have read the Participation Information Sheet and hereby indicate my agreement to participate in the study and for the data to be used as specified.

Name of participant or informed third party:

Signature:

Date: