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Abstract

Governments started e-government strategies to renew the public sector and eliminate existing bureaucracy and therefore reduce costs. Interoperability appears as the mean for accomplishing the interlinking of information systems, applications and ways of working not only within governments but also in their interaction with the administration, enterprises and public sector. The main source of administration costs is the traditional use of paper as the linkage element between public agencies. Integrated electronic processes between public agencies can be the solution to reduce these costs and create a more efficient public sector. This paper proposes an approach for measuring the benefit of incorporating interoperability in e-government. This approach is based on the identification and analysis of certain processes (business process modelling) and on the activity based costing method. In particular, this approach concerns the measuring of benefit of applying interoperability in e-government services.

Keywords: *Business Process Modeling, Activity- Based Costing, Benefit Evaluation of Interoperability*

1 INTRODUCTION

E-Government (EG) aims at the modernisation of Public Administration with the adoption of peak technologies and the development of digital connection among governmental information systems in order to achieve saving of resources and the qualitative upgrade of public services (IDABC, 2005). Another goal of EG is to enable the seamless information flow between organizations (IDA, 2003). That is the reason why the interoperability among Public Administration (PA) agencies has been identified as a major issue to be addressed by every e-government initiatives (Guijarro, 2008) and as a critical prerequisite for the effective functioning of contemporary Public Administration systems (IDABC, 2005; Gottschalk, 2009; Pardo & Tayi, 2007; Wang, et al., 2007). 2007). Currently, there are several research efforts that try to address interoperability/integration issues in e-government (Guijarro, 2004; Klischewski, 2004; Peristeras, et al., 2007; Peristeras, et al., 2008; Ralyté, et al., 2008). Last years, different interoperability frameworks have been developed that aim at providing the basic standards to PA agencies in order to provide services to citizens and businesses in an integrated way (Cabinet Office, 2005; Guijarro, 2007; Information Society, 2008; Tambouris & Tarabanis, 2005).

Governments started e-government strategies to renew the public sector and eliminate existing bureaucracy and therefore reduce costs (Riedl, 2003; Tambouris, et al., 2001). Interoperability appears as the mean for accomplishing the interlinking of information, systems, applications and ways of working not only within governments but also in their interaction with the administration, enterprises and public sector (Laskaridis, et al., 2007). As public budgets are shrinking all over the world and society is increasingly calling for more accountable public administration, governments try to reduce administration costs. The main source of these costs is the traditional use of paper as the linkage element between public agencies. Integrated electronic processes between public agencies can be the solution to reduce these costs and create a more efficient public sector (Joia, 2004).

This paper proposes an approach for measuring the benefit of incorporating interoperability in e-government. This approach is based on the identification and analysis of certain processes (business process modelling) and on the activity based costing method (Brimson, 1991; Ellis-Newman, 2003). In

particular, this approach concerns the measuring of benefit of applying interoperability in services that KEP provides. KEP has the role of an intermediary enabling communication among citizens and various public authorities. The citizen makes a request for a service to KEP and then KEP exchange information with relative public authorities in order to complete the transaction. However, at the submission of a request, citizens have to submit all the prerequisites documents so as the service that was requested to be fulfilled. In this point, the need of applying interoperability and of establishing communication among public authorities is emerged. The collection of prerequisites with the use of transparent processes would involve important savings for the public authorities and it would have as direct result the citizens' satisfaction.

The paper is organized as follows. Section II presents a literature review of the field of EG and interoperability. Section III presents analytically the methodology for measuring the benefit of incorporating interoperability in e-government. Finally, section V summarizes the outcomes of the research, the basic conclusions and gives directions for future research.

2 LITERATURE REVIEW

The digital governments tend to simplify drastically the flow of information between the different public agencies and the citizens. On - line services of EG are expected to lead to an important reduction in the use of documents and the sending e – mails. Consequently, it is anticipated improvement in the provided services (Dawes, et al., 1999). Different approaches exist to estimate the benefits of EG. Different approaches are followed for the assessment of profits of EG. An approach inquires technical issues in EG. It focuses in the identification of the reasons- problems that ordains the adoption of new technologies. It also examines the way that these technologies solve the particular problems and finally assess the profits of this decision (Abramson & Means, 2001; Fountain, 2001; Ho, 2002; Moon, 2002).

In another approach, the assessment of benefits has as central point the citizen, his satisfaction and the degree of confidence for the government and the public administration. The supporters of EG believe that the decreased confidence of citizens for the government as well as their dissatisfaction can be limited via the use of technology. This can be achieved by providing higher level of services or by enhancing citizens' participation in governance. In the last approach, known as electronic democracy (Fountain, 2001), the technology undoubtedly plays an important role in strengthening democracy (Thomas & Streib, 2003). Electronic democracy intends to render public information easily accessible in the public and give citizens the ability to express themselves and exchange opinions via the internet. Also, a future goal is to give citizens the possibility of voting for various subjects in which are direct or indirect involved (Orr, 2000). However, the dynamics of the electronic democracy in EG is still limited and various open issues should be examined and take place the appropriate actions (Berntzen & Karamagioli, 2008; Carenini, et al., 2007; West, 2004).

In the frame of this approach, extensive studies and researches that concern the quality in the development and the provision of EG services have been elaborated (Halaris, et al., 2007).

Some of the approaches for the control of the quality are the following:

- Customer satisfaction level in e-government (e.g.-CSI) (Kim, Im, & Park, 2005).
- American Customer Satisfaction Index for e-government (egov-ACSI) (American Customer Satisfaction Index, 2006).
- Quality of Norwegian public web sites (Jansen & Olnes, 2001)
- European top of the web (e-Government Unit, DG Information Society, European Commission, 2004).
- Interactive e-government (Barnes & Vidgen, 2003).
- User satisfaction of e-government services (Horan & Rayalu, 2006).
- E-government in Thai (Sukasame, 2004)

Furthermore, approaches that concern the electronic services can be followed for the case of EG services. In order to apply these approaches in the field of EG, the characteristics of this field must be taken into account. Indicatively, some of these approaches are the Consumer perspective of e-service quality (Zhang, & Prybutok, 2005) and the E-service quality (Lee & Lin, 2005).

Another approach focuses in the assessment of administrative burdens that involve the provided services in the public administrations and in public sector generally. Furthermore, it is examined whether investments in information and communications technologies are cost - effective. For this case, various approaches have been developed as cost - benefit analysis (Lu & Zhang, 2003), the Standardised Model of Cost (Organisation of the International Standard Cost Model Network, 2008) and the Activity Based Costing.

Finally, many studies focus on the evaluation of interoperability frameworks both in technical and semantic dimension. According to these, a practical approach may be followed for the assessment of technical repercussions of interoperability frameworks (Laskaridis, et al., 2007; Lea & Min, 2003; Moon, 2002) or the assessment of semantic interoperability frameworks (Green & Rosemann, 2005). So, different evaluation frameworks are proposed that measure the integration in applications level, the degree of usage of frameworks, the degree that requirements are covered as well as their quality (Mykknen & Tuomainen, 2008).

3 METHODOLOGY

The first step of measuring the benefits of EG and interoperability includes measuring the administrative burden that execution of services involves. There are certain approaches that focus on the measurement of administrative burdens and provide an insight into whether investments in information technologies and communications are cost – effective. These are the cost - benefit analysis (Lu & Zhang, 2003), the Standardised Model of Cost (Organisation of the International Standard Cost Model Network, 2008) and the Activity Based Costing (Hadzilias, 2005). In our study, we use the Activity Based Costing technique (Cooper & Kaplan, 1992; Horngren, et al., 2000 Kaplan & Cooper, 1997) as it is simpler than the Standardised Model of Cost. In addition, we make this choice as our aim at this study is to make a first estimation for the time that public authorities spend to serve the citizens because of the lack of interoperability. It is not our intent to evaluate how much does it cost for the enterprises or for the citizens to comply with each information requirement imposed by a legislative act. The Activity Based Costing technique is a model of cost accounting that specifies the activities in an organization, determines and attributes the cost of each resource of an activity in the services according to the real consumption of these resources from every service (Cooper & Kaplan, 1992; Dawes, et al. 1999; Fountain, 2001; Kaplan, 1991; Mykknen & Tuomainen, 2008).

In order to follow this approach, documenting and understanding activities is necessary so as to calculate the cost of a business process, since activities are the building blocks of business processes. When employees understand the activities they perform, they can better understand the costs based on the activities. So, it is practical to model business processes as in that way all the individual activities that take place in a business process from the beginning to the end are clearly identified.

Finally, the methodology which was followed and which is consisted by four phases will be described. Our research is limited in a sample of 360 services out of 1035 that KEP provides. The data that are used concern the frequency of submission of requests at the period of 2007- 2008, as these are recorded by the KEP.

3.1 1st Phase: Modeling business processes by BPMN

The first phase of our research includes the analysis of business processes and the examination of their individual steps. Then, the procedure of process execution is represented by using BPMN, based on the results of the preceding analysis.

Moreover, Figure 1 shows one of the BPMN diagrams that resulted. This illustrates the procedure for handling a request for issuing a professional authorisation in an electrician.

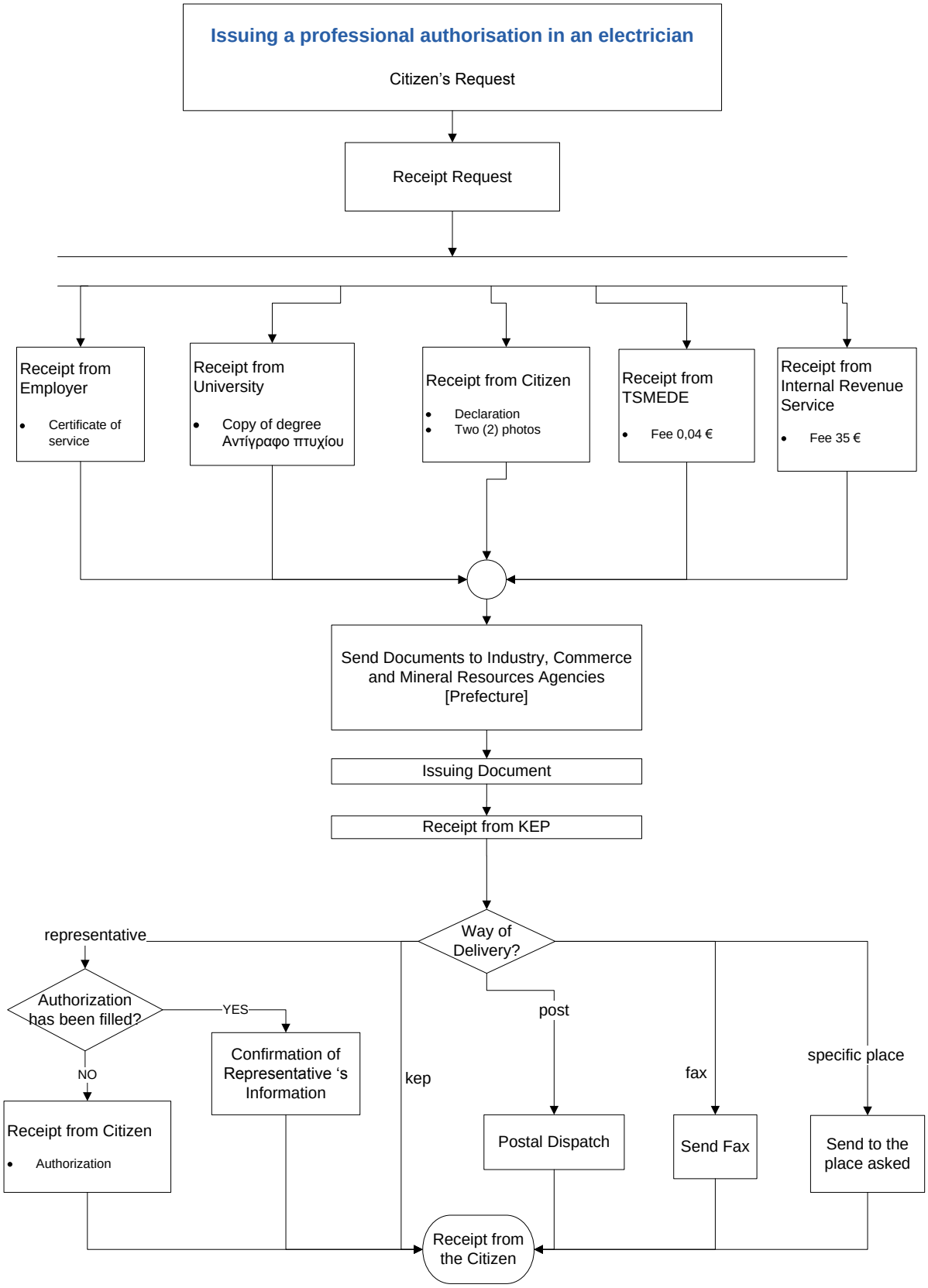

Figure 3: BPMN Diagram

3.2 2nd Phase: Classification of business processes

In this phase, based on the BPMN diagrams that generated, some general models are exported which include the abundance of processes. The next step of this phase includes the specification of the exact number of activities performed in the execution of a process. As activity, we consider an activity which will not be nested within one another and which has an output - a result. Also, in BPMN diagrams presented, an activity is represented by a rectangle. Furthermore, the control conditions (the shape of the diamond in the diagrams of the models) constitute activities since their examination requires time and concequently this involves cost for the state. Finally, it should be noted that when the number of activities is estimated the following assumptions took place: During the execution of a service, different conditions may occur. Additionally, there are no statistical data which prove the frequency of these conditions. As a result, in the calculation of the number of steps we assume two scenarios: the worst case scenario in which the longest path is used and the best case scenario in which the shortest path is used.

3.3 3rd Phase: Measuring the cost of each process by using Activity Based Costing

The purpose of this phase is to assess the cost of executing each process. To achieve this, we adjust the Activities Based Costing in our case study. This phase consists of 3 steps:

- **1st Step:** Identification of key activities, sources and related cost drivers. The main activities are the actions that cause costs to a process and in this step is used the definition given above. The cost of each particular process includes: salaries, software development and hardware infrastructure expenses, leased lines, etc. In our case, the main cost dimension is the man effort which for the shake of simplicity it is considered to be the only one. So, we consider cost staff salaries to be the only source and the frequency of the processes execution to be the cost driver.
- **2nd Step:** In this step the time allocated to the employees of each agency to each process is estimated. In order for the results to be more reliable, the processing time was appreciated initially with the assumption that the time required to perform an activity is 5 minutes, 15 minutes and finally 30 minutes. In order to calculate the required time, the execution of a process must be multiplied by the number of activities performed, that were calculated in the second phase, regarding the execution time of an activity.
- **3rd Step:** In this step, cost is assigned to each process. The cost of staff is calculated by multiplying the average salary by the time spent on each activity. It was considered that the average salary of a KEP employee amounts in 1600 Euros. Given therefore the results of the previous step we calculate the cost of a process by multiplying the execution time by the average salary of an employee. So the cost per certified process was calculated.

3.4 4th Phase: Evaluating total cost

The total cost of a process is calculated by multiplying the cost of each process by the frequency of its transactions. The output of the above analysis is an estimation of the cost that burdens public sector due to offering manually services to the citizens. Additionally, the benefit of achieving interoperability amongst public agencies is assessed and the advantages of complete electronic transition of public services are evaluated. Furthermore, based on this estimation, a proposal can be submitted considering the strategy that should be followed to implement the above transition. A vital part of this proposal will be a clear definition of the services that should be considered as a top priority, accompanied by the benefits and costs reduction that will be introduced to the public sector.

4 RESULTS

The first two phases of our methodology result five models whose characteristics are listed in Table 1. The table also shows the number of businesses processes that are classified in each model. The Column #documents specifies the number of prerequisites documents for supporting a process. The #conditions determines whether conditions in the execution of a process exist some circumstances in which the number of prerequisites documents is altered. The processes that are included in Model A have a number of prerequisite documents equal to 0 and these that are included in Model B are equal to 1. The Model C includes processes with different number of prerequisite documents. The only differentiation that can occur depending on the type of process is found in the number of activities running in parallel. This number is directly dependent on the number of prerequisite documents and the number of involved agencies. Also, the number of prerequisite documents remains constant for each process separately. In Model D, the flow which is followed to execute a process is similar to that of model C. What differentiates this model from C is the existence of a condition which determines which are the prerequisites documents. In this model, as in the precedent one, there are included the processes which require different number of prerequisite documents and different public agencies involved in their execution. Finally, Model E presents similar structure with the Model D. The difference is located in the existence of an additional condition. As a general observation, it can be noted that the processes that are classified in models D and E and the existence of the condition would imply requirement for an additional document or signify the presence of 2 (in Model D) or 3 (in Model C) categories with different number of prerequisite documents sometimes common and others not.

Also, in table 1 it is presented the way by which the activities in each model were calculated. In Model A, B, C estimation of the number of steps is quite simple as the number of prerequisite documents for each process is stable for all citizen cases. For models D and E there is no general rule for calculating the activities since the number of prerequisite documents for a certified process is not always the same. The only thing that remains common is the number of 6 and 8 activities for the best and worst case respectively in the main body of the models.

Afterwards, it is shown an aggregation table which contains the five models that emerged, their characteristics and the number of processes that classified in each one of them.

Models	#documents	#conditions	# activities		#processes
			Best Case	Worst Case	
Model A	0	0	6	8	71
Model B	1	0	7	9	59
Model Γ	Not stable	0	6 +# documents	8 + # documents	59
Model Δ	Not stable	1	Process dependent	Process dependent	58
Model E	Not stable	2	Process dependent	Process dependent	19

Table 4: Models for processes

Furthermore, the results of our survey have highlighted the processes that cause the greatest cost to the government. The diagram below shows the percentage of a process contribution to total costs.

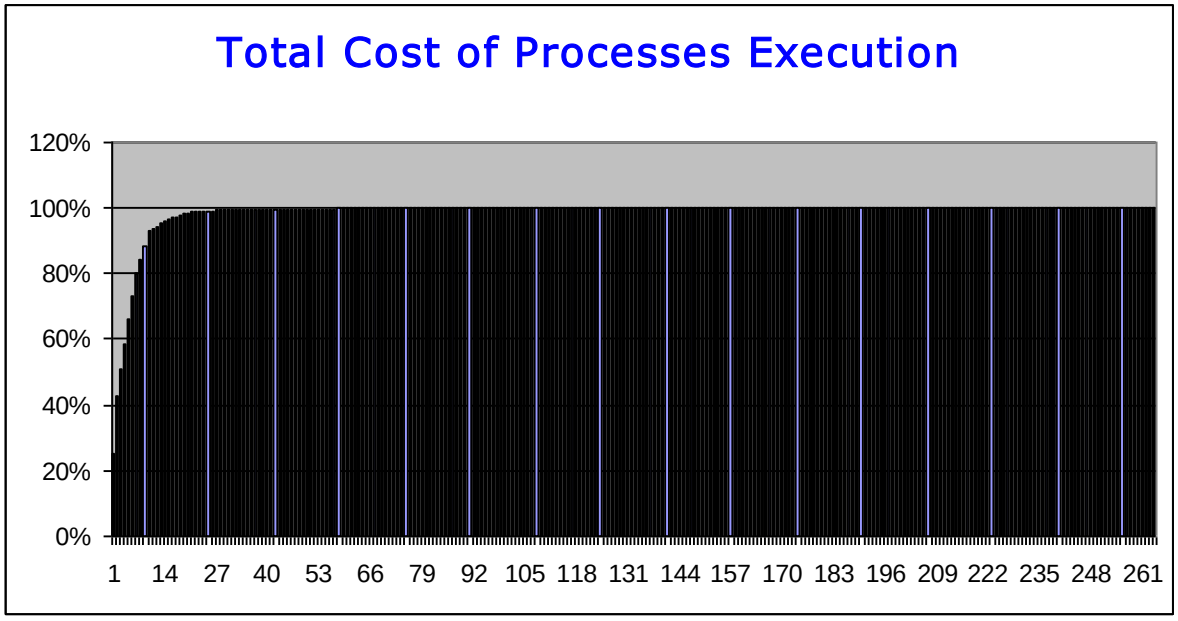

Figure 4: Percentage of each process contribution to total cost in best case (15 min per activity)

Based on the above chart and the overall results of the survey we conclude that 90% of total costs come from 10 processes. However, what is particularly interesting is the fact that these processes are neither the most expensive nor the most time-consuming. Examining more extensively the results, it was shown that the decisive factor for the configuration of total cost is the frequency of the executing processes. It should be noted that one of the customary practices of KEP employees is to decompose complex processes into simple. This may cause fictitious demand for certain processes and it influences the results of our research.

Furthermore, the output of the above analysis is an estimation of the cost that burdens public sector due to offering manually services to the citizens. Additionally, the benefit of achieving interoperability amongst public agencies is assessed and the advantages of complete electronic transition of public services are evaluated. Furthermore, based on this estimation, a proposal can be submitted considering the strategy that should be followed to implement the above transition. A vital part of this proposal will be a clear definition of the services that should be considered as a top priority, accompanied by the benefits and costs reduction that will be introduced to the public sector.

The conclusions obtained can be used by the government for the redefinition of strategy in the field of EG. The main factor for the configuration of EG strategy so far is the degree of citizens' satisfaction and the level of provided services. The savings of resources, however, constitutes a new dimension that will bring direct economic benefits in the public service.

The development of interoperability is a strategic objective of the Greek government. Although, there is general belief that the development of interoperability will be a profitable investment for the public administration and will bring a set of tangible and non-tangible benefits, its implementation has not be given high priority. So, the results illustrate the need to put the implementation of interoperability in the first priority for the government.

5 CONCLUSIONS

Our methodology developed based on Activity Based Costing method. The aim of our research was to determine the cost of each individual activity that constitutes a service. Also, another aim was to identify the most expensive services and lower the cost of them or eliminate some of them. In order to fulfill these objectives, the Activity Based Costing method is considered to be the most appropriate. This fact combined with the simplicity of applying the method in our case study was the selection criteria of the method. As such, ABC has predominantly been used to support strategic decisions such as identification and measurement of process improvement initiatives which are the ultimate target of the research carried out. .

In the future, the approximate method that was developed could be extended so that the estimation of the cost of lack of interoperability for public administration is more accurate. It might carry out an empirical research to estimate the execution time of an activity instead of using static values for this variable. Also, simulation methods could be used with the time taking different random values.

Also, it could carry out an empirical research so as to approximate the frequency of different conditions and therefore we could export more precise conclusions for the total cost.

Finally, until now the efforts for the evaluation of interoperability do not follow an approach of measuring costs and profits that result from its existence. Thus, this research could extend to and deal with the assessment of profits and the cost of implementing interoperability. Also, a relative research which examines the way of distribution of cost and profits in all the involved agencies does not exist. Therefore, another research could aim at demonstrating issues that should be examined as well as the obstacles that emerge at its implementation because of the uneven distribution of benefits and costs.

However, interoperability does not concern only the area of e-government but also areas such as supply chain and e-commerce. So, the research methodology developed could be extended and used for evaluating costs and benefits for the case of inter-organizational information systems. This methodology can also be applied by various companies for the measuring of the cost savings from the implementation of interoperability in the enterprise. Furthermore, it could be used to formulate future investments in information technology and reengineer business processes.

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