

Information Sharing - Benefits

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Abstract—Government Information Sharing (GIS) allows information exchange and integration between different government departments, agencies, as well as between public and private institutions. Sharing information enables enhanced efficiency - avoiding duplication of processes updating the same data; better quality of processes and services - removing inconsistent data and reducing error; and improved transparency - facilitating access to information. The implementation of GIS initiatives requires technological, organizational, institutional and environmental changes. Therefore, the definition of compelling business cases is required, while studying the feasibility of such initiatives. In this work, we present findings of our research work studying benefits of GIS. Based on secondary data collection and surveyed GIS initiatives implemented in several countries, we present a comprehensive study of benefits in GIS. The main contribution of this paper is to provide a detailed list of feasible GIS benefits and a classification of such benefits, providing a rigorous benchmark to justify the implementation of GIS initiatives.

Keywords—Information Sharing, Electronic Government, Benefits, Risk, Barriers.

I. INTRODUCTION

Information integration is considered one of the most representative tools to change the function and structure of an organization. It allows decision makers to manage information from several sources at the same time. It has the potential to support the transformation of organizational structures and to provide communication channels between multiple organizations working in different locations.

Electronic Government (e-Government) is a tool to achieve better policy outcomes, higher quality of public services, more efficiency in government processes, more efficient use of public funds, and to facilitate citizen participation, among others [8]. There are several maturity models that assess the level of e-Government development [16], [8], [1], [17]. All models agree that the highest maturity level is only possible to achieve when institutions are able to share information.

Information sharing (IS) and integration is relatively a new challenge for public organisms. Tra-

ditional government structures have organized the capture, processing and usage of information along their organizational boundaries. The breaking of these deeply-rooted culture of information “silos” is a particular challenge that government agencies need to overcome to achieve the benefits of information integration.

IS is defined as the exchange of information between parties that allows one party to access information collected or maintained by another party. It involves providing the proper technical solutions - including hardware and software, instituting formal agreements between organizations, adopting standards, and changing business processes to allow organizations to share data and information with many other organizations ([2], [5], [15], [9]). Information exchange and integration can help government agencies to provide better public services and solve critical public problems through inter-institutional collaboration.

IS projects are becoming increasingly important in both public and private organizations. As any other project, organizations base their decision to move forward with an information-sharing initiative based on a detailed analysis of the project’s expected benefits, such as better services, operational savings, and increased program effectiveness.

GIS is also useful to transform political culture - i.e. promoting stakeholders participation through access to information; design and implement innovative programs - i.e. facilitating private companies to access government information to deliver new services to the public; and improve government services at all government levels - i.e. facilitating local governments to access national data registries. The ultimate aim of GIS is to improve the quality of citizens’ life while facilitating economic development.

While planning GIS initiatives, the following aspects should be exhaustively considered due to their impact on the implementation of such initiatives:

- Benefits - added value provided to the public, businesses, as well as services and client processes. They are useful consequences of the

utilization of GIS.

- Barriers - obstacles that can appear during the implementation, such as resilience to change, different criteria on service level agreements, etc.
- Risks - negative value that can produce damage to processes, services and clients. Possible threats affecting GIS initiatives.

The rest of this paper is structured as follows. Section 2 provides a short survey of related work. Section 3 introduces the proposed classification applied to benefits. This classification is multi-view, each view considers different aspects. The proposed views are *Nature*, *Beneficiary*, *Target*, *Impact* and *Horizontal* (NBTIH). In Section 4, a consolidated list of benefits and an analysis of several implementations of GIS are presented. Finally, Section 5 draws some conclusions and outlines future work.

II. PREVIOUS WORK

The two most influential theoretical models of GIS were published several years ago. The first one was presented by Dawes in 1996 [4] and the other was introduced by Landsbergen and Wolken in 2001 [10].

In Dawes [4], a learning cycle followed by government agencies involved in the IS practice is defined. Findings of such work show that information integration, and so information exchange, requires better capacity to share information through organizational boundaries. In addition, that IS helps the discovery of patterns and interactions, and provides better decision making based on more complete databases. In such work, benefits obtained through any initiative of information integration or information sharing are classified in three categories: technical, organizational and political.

- Technical benefits are those related to data processing and information management.
- Organizational benefits are related to solutions of wide-organization problems or the improvement of the organization capabilities.
- Political benefits may deal with the enhanced public image or public value created information-sharing projects. They include a better interpretation of government-wide political aims, higher yields of public accounts, more complete public information, integrated planning and improved service delivery among others.

Dawes's classification (technical, organizational, political) could also be applied to barriers and risks. The last two concepts are outside the scope of this work.

Landsbergen and Wolken [10] proposed a kind of interoperability model for agencies. As an extension of Dawes's model, the proposed model considers three maturity stages: stage 1 - experience agency-to-agency, stage 2 - infrastructure support and stage

3 - interoperability between agencies. In stage 1, the IS promotion emerges from one agency experience. In stage 2, an architecture/infrastructure to support IS between agencies is required to achieve this challenge. The architecture/infrastructure is based on three elements: 1) *technical* - support for software and hardware compatibility, and greater participation in standard processes and integration of best practices into standard processes; 2) *interoperability policy architecture* - meta-data infrastructure to increase access to relevant and useful information, and process management from hierarchical to hierarchical/lateral; and 3) *institutional* - supply of a clearinghouse of best practices, and development of a formbook of contracts to support IS, among other initiatives. Finally, stage 3 benefits from the lessons learned of the architecture/infrastructure, it synthesizes legal, managerial, and policy approaches to interoperability and IS.

Estevez et al [7] proposed a conceptual model for GIS (GISF model), based on well-known theoretical integration frameworks and the use of information interoperability frameworks. The most significant characteristic of the GISF model is the merge between the concepts on Landsbergen and Wolken's three maturity stages, and Dawes's classification, producing a four dimensional model: technological, organizational, inter-organizational and political. In a revised version of the framework [6], they rename the political dimension as environmental dimension to extend its scope.

The GISF adopts a holistic view of GIS problems. It highlights the specific areas that need to be dealt with in their development, such as service agreements and collaborative capacity of institutions involved in IS practice. Besides, it improves the conceptual clarity of IS initiatives and their relationship with interoperability - initiatives in the government context. Furthermore, it identifies main areas and concrete examples of GIS initiatives for responsible politicians and public administrators.

III. NBTIH CLASSIFICATION

Benefits, barriers and risks are influential factors in IS practice. These factors can be classified according to different points of view. According to Dawes's model [4], such factors are classified into technical, organizational and political.

To study benefits of GIS initiatives, we consider IS benefits like product qualities and we rely on principles of the engineering discipline, in particular those of software engineering. Therefore, we consider the ultimate aim of an IS initiative as the construction of a high quality product. From the analysis of the discipline, we propose the following benefits classification:

- *Beneficiary* - citizenship and government
- *Target* - product and process

- *Impact* - primary and secondary

Benefits to beneficiaries can be external - like benefits received by citizens, businesses, government employees, and other stakeholders usually associated with their role of public service users; or internal - benefits received by government agencies generally associated with improvements introduced in each agency for the development of their activities.

Benefits can also be considered from the target perspective, including product and process. Benefits targeting processes are directly associated with the quality of services offered by each government agency. From the process viewpoint, the benefits are related with each stage/phase of the underlying business process supporting the delivery of public services. It is important to consider that processes must be analyzed and reformulated to achieve improved efficiency and effectiveness in the service delivery. Considering the second target, on our approach, products refer to programs, data and documentation.

Finally, regarding the impact category, primary benefits are directly obtained from the implementation -i.e. *cost reductions* -data collection, information utilization- *design of integrated and collaborative methods for service delivery*, while secondary benefits are achieved from primary ones - i.e. *improvements in transparency*.

Following the above, we propose a multiple-view classification of benefits:

- *View 1 - Nature*. This view is the initial point and considers the nature of the benefit. Inspired by Dawes’s proposal (technical, organizational and political), the classification of benefits is modified and the scope is extended to GISF dimensions: technical, organizational, inter-organizational and environmental.
- *View 2 - Impact*. This aspect identifies the impact of benefits - primary and secondary. While primary benefits are a direct consequence of the implemented IS initiative, secondary benefits are achieved from primary ones.
- *View 3 - Beneficiary*. Benefits are classified in internal and external ones. The internal benefits are those obtained by government agencies and the external ones are obtained by stakeholders outside government organizations - citizens, businesses.
- *View 4 - Target*. This view considers benefits as product and process.
- *View 5 - Horizontal*. Several benefits are horizontal - cross-cutting benefits obtained by the whole system. Horizontal benefits cover all aspects and are essential to any development, such as efficiency, effectiveness and response.

Figure 1 shows the views of this classification. The horizontal view is a cross-cutting view to the other four - benefits of this view can also be considered part of the other views. The other views are shown as

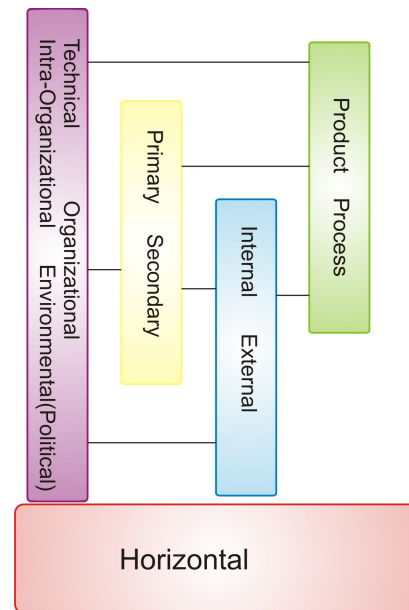


Fig. 1. Views of GIS Benefits

rectangles with connected lines. The connecting lines mean that some benefits could belong to a particular aspect in each view. Depending on the organization and the benefit and organization, the same benefit can belong to different options of the views. For example, one benefit is classified technical (view 1), obtained internally by a government agency (view 3) and targeting a process (view 4).

The classification is holistic. Each view emphasizes different aspects to be considered at the moment of decision taking. Furthermore, they have to consider the organization. Some benefits are more influential than others. In section 4, a list of benefits is presented and examples are introduced to show the relationship between views.

IV. BENEFITS

At present, several countries have implemented IS initiatives at the highest level of e-Government maturity. Australia, New Zealand, United Kingdom, United States of America and Estonia have influential frameworks related to IS. A consolidated list of benefits of the study and analysis of GIS implementations in such countries, such as [12], [13], [14], [3] and [11], is presented in table I. The identified list of benefits will be later used to validate the classification proposed above.

The consolidated list of benefits presented in table IV gives the details of the classification according to view 1. This view is the basis for the study and it gives a holistic conception of the benefits applied to GIS.

Table III shows the details of the classification in accordance with view 3 and view 4. The first one

Benefit Id	Benefit Description
Be1	Cost reductions (data collection, information management, information utilization, infrastructure sharing).
Be2	Improvement in decision making of political and business processes.
Be3	Improvement of punctuality, consistency, and quality of responses.
Be4	Better and greater surrender of public accounts.
Be5	Improvements in transparency.
Be6	Incorporation of added value for government because of the reutilization of existing information.
Be7	Design of integrated and collaborative methods for service delivery.
Be8	Improvement in national security.
Be9	Improvement in national competitiveness.
Be10	Reduction of bureaucracy.
Be11	Reduction of complexity and inconsistencies.
Be12	Promotion of media access with high quality information.
Be13	Obtaining comparable information.
Be14	Improvement of emergency and health services.
Be15	Improved communication between government agencies and other related organisms.
Be16	Supply of public services where they are most needed.
Be17	Public access to different government services among various levels of government.
Be18	Promotion of the consistency of these approaches.
Be19	Promotion of the construction of systems, knowledge and experience reusable from one agency to another.
Be20	Promotion of better standards and the sharing of technical resources.
Be21	Coordination improvements.
Be22	Efficiency.
Be23	Effectiveness.
Be24	Response.
Be25	Efficiency in mass processing tasks and operations of public administration.
Be26	Improvement of business productivity through better regulation.
Be27	Improved trust between government and citizens.

TABLE I
LIST OF BENEFITS

Benefit	Technical	Organizational	Inter-Organizational	Environmental (Political)
[Be1.]		✓		
[Be2.]			✓	✓
[Be3.]		✓		
[Be4.]		✓		✓
[Be5.]				✓
[Be6.]				✓
[Be7.]	✓			
[Be8.]		✓	✓	
[Be9.]		✓		✓
[Be10.]		✓		✓
[Be11.]	✓	✓		
[Be12.]	✓	✓		
[Be13.]	✓	✓		
[Be14.]				✓
[Be15.]		✓	✓	
[Be16.]				✓
[Be17.]		✓		
[Be18.]	✓			
[Be19.]	✓		✓	
[Be20.]	✓			
[Be21.]		✓		
[Be22-Be24.] (horizontal)	✓	✓	✓	✓
[Be25.]	✓			
[Be26.]				✓
[Be27.]				✓

TABLE II
VIEW 1 - NATURE (GISF)

identifies the benefits as internal (government) and external (citizenship). A successful Project is one that satisfies the user's needs. GIS projects solve the requirements of government agencies. These requirements are proposed by the responsible team to provide services to citizens. Some requirements are needed to improve the internal processes and simplify government employee's work (internal). Others are associated with the service improvements provided to citizens (external). At the moment of decision taking in GIS projects, the contribution of this view is important. The other view classifies the benefits as product and process. This categorization is useful from the designer's point of view.

Table IV and figure 1 show examples of benefits. These examples link the views according to the proposed classification.

Benefit «*cost reductions*» (Be1.), is a desirable objective for the agency or organization. According to View 1, it belongs to the organizational option. Cost reduction is an aim that promotes the study and analysis of a project development. Therefore, it is considered as primary achievement and so, it is associated as an internal option (view 3). This benefit includes a set of elements. One of them is the reduction in the cost of information compilation (collection). Considering this aspect, it can be associated to process.

Benefit «*Incorporation of added value for government because of the reutilization of existing information*» (Be6.) is considered as environmental (political) (view 1) and also primary (view 2) and it is linked to the agencies as internal (view 3).

Benefit «*Design of integrated and collaborative methods for service delivery*» (Be7.) is considered as technical (view 1). It is also associated to process (view 4), internal (view 3) and primary (view 2).

Benefit «*Improvements in transparency*» (Be5.) is an environmental (political) benefit, that is associated with citizenship (external) and as secondary. Moreover, it is inferred as a consequence of (Be7.) and (Be11.).

Benefit «*Promotion of media access with high quality information*» (Be12.) promotes the internal and external use and it is associated as primary. It is related to organizational and technical benefits.

Benefit «*Improved communication between government agencies and other related organisms*» (Be15.) is considered organizational and inter-organizational, favouring different agencies. Also, this benefit is internal because it encourages the relationships and collaboration between government agencies; and it is considered secondary as well. Furthermore, it is inferred as a consequence of (Be16.) and (Be17.).

Benefit «*Supply of public services where they are most needed*» (Be16.) is considered as environmental (political). It is also related to product and it is

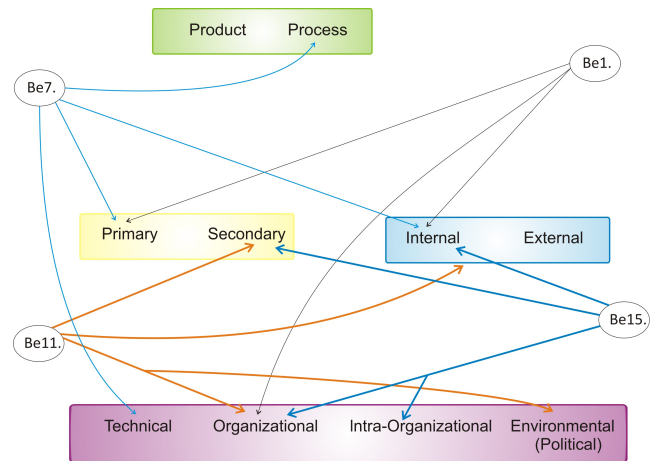


Fig. 2. Classification of some exemplary benefits

external.

Several advantages are provided by the proposed systematic categorization into a coherent scheme. Benefit categories can be named, remembered and discussed with a broader common background. Moreover, e-Government is an interdisciplinary area, common concepts and vocabulary play a relevant role. Therefore, the tasks of GIS policy definition, evaluation and validation may be improved by this common background.

V. CONCLUSIONS

Information Integration offers benefits. These benefits may differ from one organization to another, according to the specific characteristics of the projects. However, there are certain types of benefits that can be expected in almost any information integration or initiative of information exchange.

In this work, a rigorous study of obtained benefits has been done from the implementation of IS in several countries. One of the most significant contributions to this study is an exhaustive and consolidated list of obtained benefits. The importance of this list is that it allows the analysis of the benefits. This analysis provides the basis to group and classify the benefits with useful topics for IS implementation. The proposed classification in view, highlights different aspects to be considered at the moment of studying the feasibility, taking a decision, developing process (analysis, construction, production/operation), evaluating and monitoring them in the IS implementation in governmental agencies. These views improve the understanding of the contribution of the benefits according to the different points of view evaluated in this work.

Beside the benefits, it is necessary to identify the barriers and risks that may occur in the implementation of information integration. Understanding the benefits and objectives of integration is necessary to

Benefits	View 3		View 4	
	Internal	External	Product	Process
[Be1.]	✓			✓
[Be2.]	✓		✓	
[Be3.]	✓	✓	✓	
[Be4.]		✓	✓	
[Be5.]		✓	✓	
[Be6.]	✓			
[Be7.]	✓			✓
[Be8.]	✓			
[Be9.]	✓			
[Be10.]		✓		
[Be11.]	✓	✓	✓	✓
[Be12.]	✓	✓		
[Be13.]	✓		✓	
[Be14.]		✓		
[Be15.]	✓			
[Be16.]		✓	✓	
[Be17.]		✓	✓	
[Be18.]	✓			✓
[Be19.]	✓		✓	✓
[Be20.]	✓		✓	✓
[Be21.]	✓			
[Be22-Be24.] (horizontal)	✓	✓	✓	✓
[Be25.]	✓		✓	
[Be26.]		✓		
[Be27.]	✓			

TABLE III
VIEW 3 - BENEFICIARY AND VIEW 4 - TARGET

	Primary		Secondary	
	Internal	External	Internal	External
Organizational	[Be1.]		[Be15.]	
	[Be12.]			
Environmental (Political)			[Be11.]	
				[Be5.] (Prod)
	[Be6.]			[Be16.] (Prod)
Technical	[Be7.] (Proc.)			
	[Be12.]			
Intra-Organizational			[Be15.]	

TABLE IV
EXAMPLES BENEFITS

identify barriers, and from them develop strategies to overcome them.

Future work will continue with the addition of a detailed study of the concepts of barriers and risks. Also, this work provides the basis for a formal ontology definition that would help in the development of tools of aid in the task of policy definition and evaluation.

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