

Electronic Government: a Multi-Criterion Approach to Prioritizing Projects by Integrating Balanced Scorecard Methodology Indicators

Mônica Maria Leal Canedo

Agência Estadual de Tecnologia da Informação – ATI, Recife, PE, Brazil
E-mail: monicalealcanedo@gmail.com

Adiel Teixeira de Almeida

Universidade Federal de Pernambuco – UFPE, Recife, PE, Brazil
E-mail: almeidaatd@gmail.com

Abstract

Electronic Government is a term that refers to governmental policies and strategies, as well as to concrete initiatives that represent a government's commitment to Management by means of the intensive use of Information Technology (IT). Since public managers are being increasingly pressed to find ways of reducing costs and improving results, it is important to observe that the potential benefits of Electronic Government are linked to costs and risks that must be balanced and carefully monitored. This study proposes a multi-criterion model so as to prioritize Electronic Government projects, the scope of which is to provide electronic services from Government to Citizen - G2C (initiatives on behalf of citizens and companies). Particularly in the phase of structuring a problem, the model proposed makes use of a Balanced Scorecard (BSC) in the context of Multiple Criteria Decision-aid (MCDA). To illustrate how to apply the model, simulations using the PROMETHEE method were conducted. The study demonstrated that, in the context of the governance model proposed, some conditions should be taken into account in order to integrate the use of BSC and MCDA. The model can be applied to public and private organizations, irrespective of the area of activity, with minimal adaptation.

Keywords: electronic government, it governance, multiple criteria decision-aid, balanced scorecard

Introduction

Electronic Government is a term that refers both to governmental policies and strategies and to concrete initiatives by government and that represents a commitment to Management by means of using Information Technology intensively.

Improving public services, not only in terms of caring for citizens, but also of results achieved as a consequence of implementing Public Policies, is a great challenge faced by managers in all spheres of Government. Government has discovered that the intensive use of IT is the tool that best promotes State reforms which target having a public administration focused on meeting citizens' demands and that IT helps to generate positive results.

Yet it needs to be emphasized that the failure rates of Electronic Government projects are, according to Heeks (*apud* Esteves and Joseph, 2007), as high as 85%. This high level of project failure shows how complex IT management in this environment is.

The perception that investments made in IT do not attain the results expected by the organization is common and reflects its misunderstanding of the factors that relate IT to organizational performance and the ability to aggregate value to business.

One of the most frequently-occurring issues discussed in the literature refers to the need to align IT strategies and business-oriented strategies (Henderson and Venkatraman, 1993, Almeida and Costa, 2003). Therefore, the alignment of Information Systems (IS) and Information Technology (IT) projects with a government's strategic objectives is of fundamental importance to achieving the desired results from the investments made.

In this context, a good IT governance strategy can contribute to achieving the results expected from Electronic Government initiatives. Given that few academic papers have focused on the analysis and observation of Electronic Government related processes, and also the non-existence of formal methods for prioritizing this type of project (Yildiz, 2007), this study puts forward a proposal for integrating activity related to performance measurement using a Balanced Scorecard, with the process of prioritizing projects, by defining a procedure that integrates a Balanced Scorecard (BSC) and Multiple Criteria Decision-aid (MCDA) in the context of IT governance. The model proposed will be applied with the aim of prioritizing Electronic Government projects related to Government to Citizen (G2C) initiatives. To demonstrate the application of the model, the context of a public organization responsible for environmental matters was simulated.

Research Methods

The methodology for conducting this research was based on a model-building approach (Gomes et al., 2009) in order to propose the BSC e-GOV G2C model presented in this paper. Based on the literature review, the aspects that have benefited IT/IS were exploited which, in turn, determined a set of adaptations to the Extended Platform Logic Model by Schwarz and Hirschheim (2003), adopted as a governance model in this study. Also based on the Literature review, possible restrictions on the integration of BSC into the context of AMD were explored and the results served as a platform on which to build the model.

Finally, a five-phase procedure to construct the Model for Prioritizing e-Gov Projects was developed and its use demonstrated for a Brazilian State Organization for the Environment

(OEMA), by means of simulation. Sensitivity analysis was conducted on the model to certify the robustness of the results.

Literature Review

The literature says that, when certain factors that are important for the IT function to perform well are managed inadequately, this can lead to a negative perception of the role of IT in the organization. In the context of IT governance, some factors deserve prominence as shown in Figure 1. This has had a direct influence on the design of the model considered in this study.

Aligning the IT and business-oriented strategies is claimed to be one of the main factors that contribute to the success of the IT function. However, the alignment process is complex and, therefore, requires the compiling of vision statements, shared by business and IT managers, on the role that the IT function ought to play in the organization. Therefore, there is a fundamental need to develop good communication and cooperation abilities.

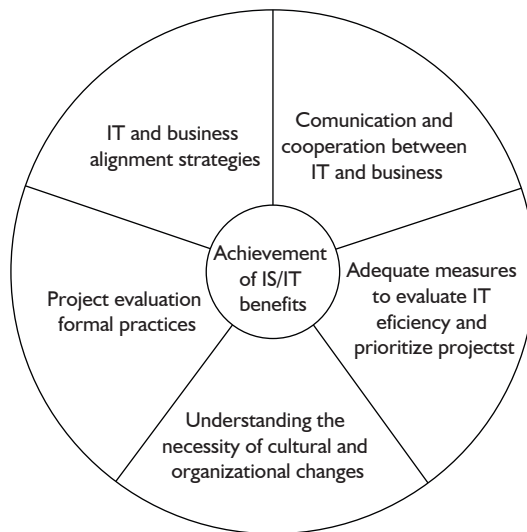


Figure 1 - Factors of influencing the achievement of IS/IT benefits.

Good communication is necessary to identify the information that needs to be used in the alignment process and to understand the organizational and cultural changes that will be necessary in order to exploit the maximum potential of IT (Coughlan et al., 2005).

Wards and Elvin (1999) studied the adoption of methods for managing IT benefits in a universe of 60 organizations. They identified that most organizations adopted a reactive stance, since changes took place after the delivery of the IT product instead of being

undertaken throughout the project life cycle. Wards and Elvin (1999) state this was the main reason for the low achievement of potential project benefits.

Very often, the real benefits of IT are embedded in the processes of transformation made possible by the incorporation of technology. According to Lee and Kim (2007), it is important that IS/IT projects occur in parallel to, or are preceded by, re-engineering a process. As a consequence of the lack of understanding of this factor, implementing technology very often brings processes that are obsolete or do not reach the desired results.

Just as important as good communication is cooperation between the business and IT areas. When cooperation does exist, it will be translated into agreements related to selecting priority projects and the schedule for carrying them out (Newkirk and Lederer, 2006), thus minimizing conflicts between these areas and contributing to the establishment of a common vision of the future, which will improve the perception that other areas of the organization have with regard to the IT function.

The formal practices of evaluating IS/IT projects contribute to establishing these agreements since they provide a well-structured decision process, thus helping to ensure that the organization will choose the projects best suited to supporting organizational needs.

Although there are several assessment methods mentioned in the literature, little attention is given to the formal evaluation of IT investments (Farbey et al., 1999). Therefore, it is possible to assume that informal practices for evaluating IS/IT projects may be contributing, partly, to the incorrect selection and management of projects and, consequently, that the benefits gained do not correspond to the expectations of the business area (Farbey et al., 1999; Stewart, 2007). This gives added emphasis to the need to tackle the fact that, in the governmental context, there is still a lack of formal methods for monitoring and evaluating e-Government initiatives (Kunstelj and Vintar, *apud* Esteves and Joseph, 2007).

The selection of IS/IT projects, as emphasized by Almeida and Costa (2003), could be carried out within the planning context. In this case, it will be inserted in the IS planning process. Once an IS portfolio is built, the investment and the applications to be implemented and their order must be defined.

In this context, formal methods for prioritizing investments in IS based on adaptations of BSP methodology - *Business System Planning* (Almeida, 2002; Almeida and Costa, 2002; Costa et al., 2002) - receive prominence.

It is emphasized that among the companies that use formal methods for selecting IS/IT projects, many still fall into the trap of using inadequate measurements in their evaluations, which will result in a low perception of the IT benefits to the business, thus making new forms of evaluation necessary. This is why a great many studies have been undertaken in the fields of IT projects and of evaluating the IT function, which make use

of contemporary measures (involving financial and non-financial aspects) and incorporate metric systems that have an external focus, targeted on customer care and incrementing organizational performance (Milis and Mercken, 2004, Hyvonen, 2007).

Having pointed out that a good governance strategy is an essential factor for the IT function to succeed in an organization and having analyzed what factors lead to IS/IT benefits being realized, it is affirmed that the model for prioritizing projects must be inserted into a governance model that fosters communication and cooperation between the IT and business fields, thus allowing a strategy that aligns these areas to be established. This study used a governance model which meets these objectives, and which integrates the BSC and MCDA methodologies.

The selection of BSC is due to its potential as a tool for alignment and communication, capable of translating the vision and the strategy of an organization into objectives and balanced measures between financial and non-financial aspects (contemporary measures), covering the short and long term, and which are external and internal to the organization.

These measures are organized under four perspectives (Financial, Customer, Internal Processes, and Learning and Growth), as per Kaplan and Norton (1997), that balance the desired results and the vectors of future financial performance.

The measures must reflect the hierarchical relationships of cause and effect, under which the strategy was drawn up, linearly pervading the different perspectives of scorecard, and linked, in the final analysis, to the financial objectives.

Based on the correlations among the measures, it is possible to identify if the implementation of the strategy is correct and if the hypotheses on which they were based continue to be viable and valid. This analysis allows the strategy to be confirmed or shows that adjustments are necessary, and must be used as a system of strategic management, with the emphasis on communication, information and learning. Based on the adjustments, mainly in relation to the perspectives of the original BSC, the tool has been suitable and widely used as an instrument of IS/IT governance.

On the other hand, the multi-criteria approach deals with decision-making problems involving the choice between, at least, two alternatives or well-defined courses of action, which have more than one criterion to be considered during the evaluation and which represent objectives that can be conflicting among themselves. The decision process involves consideration of what is unsatisfactory, the planning of courses of action to deal with the situation and the evaluation and comparison of these courses of action (Belton and Stewart, 2002).

Multiple Criteria Decision-aid (MCDA) can be particularly useful in environments in which the decision process is complex (i.e. in businesses and in government), involves several agents and may lead to consequences, depending on the course of action taken, that will affect a great many people. In this context, MCDA leads to a decision process

with clearer objectives and evaluation attributes; it supplies a framework for argument on the advantages and disadvantages of several alternatives and a basis on which to explain actions and justify choices (Kenney, 2007).

Belton and Stewart (2002) define the three main phases in an MCDA process:

- Problem identification and structuring;
- Model building and use; and
- Development of action plans.

The two first phases of the MCDA process were contemplated in the model. The phase of Problem identification and structuring deals with questions related to identifying the decision context, which involves: identifying the problem or opportunity; specifying the objectives; generating the alternatives to be analyzed; and specifying the criteria of evaluation, the decision makers, the stakeholders affected by the decision, the facilitators and the decision analysts. It is emphasized that the list of objectives and alternatives supplies a well-defined vision of the decision context (Keeney, 2007).

For the phase of Model building and use, this paper used the PROMETHEE Method, which makes use of the outranking approach and was considered adequate for the decision context and the structure of the decision maker's preferences.

The outranking methods are also assigned as non-compensatory, because they favor balanced actions, with better average performance, and do not permit limitless compensations of broad disadvantages. Another remarkable characteristic of these methods is the possibility of disregarding small differences in the evaluations when they are not considered relevant by the decision maker (Vincke, 1992; Gomes et al., 2009).

The family of PROMETHEE methods

The family of PROMETHEE methods is based on the construction and exploration of valued outranking relations, involving concepts and parameters that have some physical or economic meaning for the decision maker (Vincke, 1992), displayed under a logic of non-compensatory aggregation which is easy to understand.

Outranking relations are associated with the notion of outranking flow, in which the value of each alternative is determined by procedures that evaluate the power of outranking and the weakness of being outranked by other alternatives.

The relative comparisons allow the decision-maker to evaluate his preference for each pair of alternatives, based on the meaning that he/she attributes to the difference among their performances $[g_j(a) - g_j(b)]$, shaped by preference functions $[F_j(a, b)]$, also referred to in the literature as the generalized criteria.

In the literature, there are references to six generalized types of basic functions or criteria, which are, in most cases, sufficient to describe the decision-maker's preferences when comparing two alternatives, with there being no restrictions on the introduction of new types of functions (Vincke, 1992; Almeida and Costa, 2002), thus making it possible to choose differentiated functions for each criterion.

The application of the method consists of two phases:

- Building the values of the outranking relation; and
- Exploiting the values of the outranking relation.

The PROMETHEE I Method uses the notion of outranking flow to define two structures of complete pre-order, based on the results of the rates of the positive and negative overcoming flow.

The positive outranking flow, also called outgoing flow, expresses the power that an alternative surpasses all the others and is obtained by the Equation 1:

$$\Phi^+(a) = \sum_{b \neq a} \Pi(a, b) \quad (1)$$

The preference rate $\Pi(a, b)$ for each pair of actions (a, b) is defined as (Equation 2):

$$\Pi(a, b) = \frac{1}{p} \sum_{j=1}^n p_j F_j(a, b), \text{ with } P = \sum_{j=1}^n p_j \quad (2)$$

The negative outranking flow, also called ingoing flow, expresses the weakness which an alternative is surpassed by all others, and is obtained by the Equation 3:

$$\Phi^-(a) = \sum_{b \neq a} \Pi(b, a) \quad (3)$$

The intersection of these indices defines a partial order of the alternatives (allows incomparability). The PROMETHEE II Method eliminates the incomparability for the calculation of the overcoming net flow of each alternative, generated from its positive and negative flows, as below (Equation 4):

$$\Phi(a) = \Phi^+(a) - \Phi^-(a) \quad (4)$$

Thus, a outranks b if $\Phi(a) > \Phi(b)$.

The proposed governance model

The governance model adopted in this study is the Extended Platform Logic by Schwarz and Hirschheim (2003), with adaptations. Schwarz and Hirschheim (2003) elaborated the Extended Platform Logic Model for the organization of IT activities, which shifted the focus of attention of governance studies, until then centered on the way that decisions are taken (centralized, decentralized or hybrid), to a view of how of the relationships between the IT function and the other areas of an organization are managed.

The Extended Platform Logic Model establishes a structure of IT governance emphasizing the management of these relationships and centered on its critical abilities, which involves identifying these abilities, the design of a relational architecture and an architecture for integrating IT into the business, besides a mechanism for effectively measuring the area, as demonstrated in Figure 2.

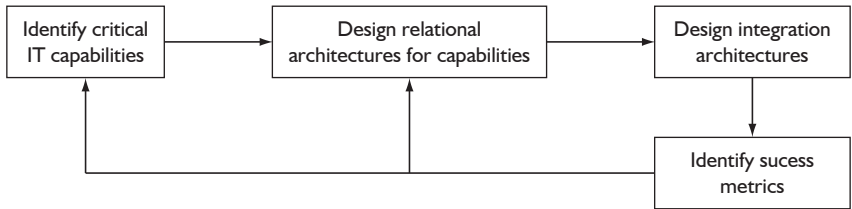


Figure 2 - Extended Platform Logic Model (Schwarz and Hirschheim, 2003).

The Model for Prioritizing Projects

The model for prioritizing projects, inspired by the Extended Platform Logic Model, uses the Balanced Scorecard in the MCDA context, in the Problem structuring phase.

Given that the BSC does not have modeling preferences as an objective, its concepts will need to be adapted in order to integrate it into the multi-criterion decision model for prioritizing projects.

The BSC contributes to the process of decision-making when exposing the critical factors for the success of the organization's strategy, and how the consequences of a decision might affect the expected results, through their impact on the performance measures.

This study considers the use of BSC for evaluating IS/IT projects in a way that is integrated with MCDA methodology, using the BSC in the phase of problem structuring, which will require adaptations, given that:

- The relations of cause and effect are intrinsic to the BSC methodology, and incorporate a strong inter-dependence among its perspectives;
- The BSC does not incorporate the decision-makers' preferences as to the consequences of their actions; and
- The MCDA incorporates the decision-makers' preferences on the consequences of their actions, with the aim of achieving multiple objectives, very often conflicting ones, but this requires independence in the criteria when an additive aggregation method is used.

Cases using a BSC application

In order to create a conceptual foundation to draw up an adequate BSC model for the study proposed, some case studies that used BSC applications have been analyzed.

Balanced approach for the management of performance

The model by Kloot and Martin (2000) is targeted on local government management systems for assessing performance. The authors present a BSC model where the perspectives represent a link between the organization and its stakeholders (primary objectives) and the strategic choices of the organization (secondary objectives) for reaching the primary objectives and they consider substituting the perspective of Learning and Growth

with Innovation and Learning. They also suggest that the financial perspective target shareholders directly, instead of being targeted on stakeholders and that the focus on the customer be substituted by one on the community.

Dynamic multi-dimensional performance framework (DMP)

Maltz et al. (2003) developed an evaluation model for organizational performance that adds the BSC framework (Kaplan and Norton, 1997) and the framework for the dimensions of success from Shenhar and Dvir (apud Maltz et al., 2003). Maltz et al. indicate that one of the main disadvantages of the BSC method is the lack of focus on the dimension of human resources. The framework consists of five perspectives: those on finance, the market, processes, people and the future.

Model of project management based on four restrictions

The BSC Model by Norrie and Walker (2004) is within the context of IT project evaluation, with the focus on the role of leadership. They suggest the adoption of the BSC based on the methodology of the triple restriction (time, cost and quality) and extend it to incorporate a fourth restriction, the strategic dimension (Figure 3).

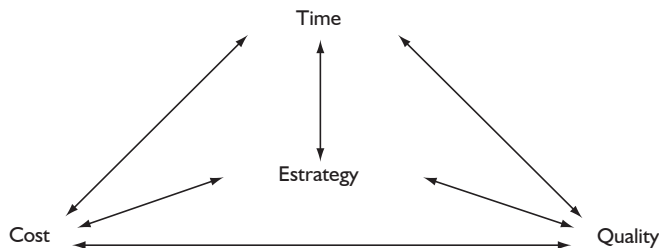


Figure 3 - Model of project management based on four restrictions (adapted from Norrie and Walker, 2004).

The authors propose the following changes in order to adapt the methodology to the context of project management:

- Drawing up measures of specific project results and comparing these results with the impact for the conduct of organizational strategies;
- Mapping the intersection of the project strategy with the organizational strategy and aligning them, by using the BSC as a leadership tool; and
- Measuring specifically the objectives and products related to the projects in order to then, appropriately, accommodate these measures so that they are related to the organizational strategy.

BSC for measuring the performance of the function/evaluation of IT projects

In the lines of research on IT governance, the studies by Martinsons et al. (1999), Milis and Mercken (2004), Valverde (2005) and Stewart (2007) stand out. The BSC Model for IS (Martinsons et al.,1999) is characterized by substituting the Financial perspective with

that of Business Value, and aims at operational efficiency, with the focus on the client, who is considered the IS/IT user.

The BSC Model for IT by Milis and Mercken (2004), directed towards the performance evaluation of IT organizations, keeps the original perspectives of the model by Kaplan and Norton (1997), save for substituting the perspective of Learning and Growth with that of Innovation and Learning.

Milis and Mercken (2004) made the important point that, when using the BSC to evaluate IT projects, it is necessary to incorporate a broad vision of the measures, namely, they are not restricted to the IT department, so that strategic alignment can be reached.

Stewart and Mohamed (2003) present the model 'Construct IT' BSC in order to assess the value added by IT to the management of construction projects.

Valverde (2005) proposes an IT governance model based on the balanced scorecard and qualityfunction deployment methodologies, and suggests using the following perspectives: Contribution to the company's business; operational Efficiency; User; Financial; and New technologies.

When an analysis is made of the contribution of the several models aimed at the IT field, it is observed that the various adaptations under BSC perspectives seek to reflect a better fit of the framework to the perception of how IT adds value to the organization.

Considerations on the integrating the BSC and MCDA methodologies

The set of BSC perspectives translates the strategy into a coherent series of objectives that reinforce each other. These objectives can be classified as primary or secondary, as per the terminology used by Kloot and Martin (2000), and they are related to the perspectives.

It is when defining the objectives of the decision that the main link between MCDA and BSC methodologies occurs.

The primary objectives are represented by the perspectives that are at the top of the BSC chain of cause and effect, which act as criteria, since they determine the results or the consequences of the model from which the projects must be evaluated, with there being a need to translate these objectives into relevant criteria for the decision-makers.

The secondary objectives are related to the perspectives that represent the means or processes through which it is intended to reach the desired objectives, and should not be used as criteria, because they cannot be translated as consequences of a decision alternative having been chosen.

Therefore, if the perspectives that represent the means to reach the objective were considered as criteria, they would incorporate a strong dependence on the criteria defined from the perspectives of the results.

Therefore, the BSC can be used in the phase of structuring the problem, and support the identification of the objectives to be reached and the factors that influence these objectives, and take the chain of cause and effect into consideration. This being so, the

use of MCDA conjugated with the BSC requires analysis of the perspectives that shape the consequences of the scorecard and those that are means to achieving the goals.

Construction of the model for prioritizing e-Gov projects

This paper proposes an adaptation to the Extended Platform Logic Model, by displacing the governance mechanism of Design Integration Architectures as per Figure 4. Since Integration Architectures serve the function of integrating the planning of IT with that of the business, which also involves technical architectures, some of the activities, which are related to these architectures, mention planning and prioritizing IT applications.

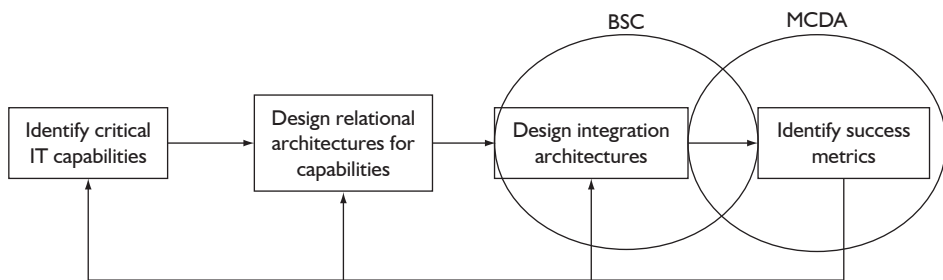


Figure 4 - Adapted Extended Platform Logic Model, using BSC and MCDA.

Thus, once the metrics of success for the IT area using the BSC are defined, the process of planning and prioritizing may well strengthen the strategy of the IT function, and consequently increase the probability of its success, and this will also allow the strategy to be revised, validated or adjusted to “market” demands, whenever new demands or resources crop up, thus giving feedback to the mechanism of the metrics of success.

Stages for constructing the model

The procedure used to construct the Model for Prioritizing e-Gov Projects consists of five stages, namely:

- 1) Identifying the perspectives of the BSC e-Gov in order to evaluate G2C projects.
 To promote the necessary adjustments to the BSC model to adjust it to the context of evaluating IT projects of public organizations, using as a basic reference, the IT competences identified in the previous mechanism.
- 2) Identifying the objectives to be achieved by the e-Gov projects, derived from the organization’s strategy and the IT strategy and drawing up the indicators.
 To define the objectives related to each perspective and to draw up indicators for the scorecard.
- 3) Identifying the perspectives that translate primary and secondary objectives.
 To validate the cause and effect relations that permeate all the perspectives and that correlate the indicators, thus identifying the perspectives as signposts to primary or secondary objectives.

4) Defining the criteria based on the primary objectives.

To use the objectives associated with the perspectives that translate the primary objectives, previously defined in the governance mechanism for success metrics, in order to derive the decision criteria. These objectives will be used as a basis to initiate dialogue, and they should be validated at the end of the stage. Should they not be validated, there is the possibility of returning to stage 1 (governance mechanism for success metrics) or to other mechanisms of the Extended Platform Logic Model, if necessary.

5) Drawing up the decision alternatives (identifying the e-Gov G2C projects) and aggregating the scores of each project in the multiple criteria.

To consider the perspectives of the BSC, with its associated objectives and indicators, aiming the viability identification of each project and the risks involved in implementing it.

In order to aggregate the scores of each project in the multiple criteria, the decision analyst will have to evaluate which MCDA method is more appropriate to the decision context, and to the decision-makers' preferences, by conducting the aggregation procedure that will result in prioritizing projects.

It is important to emphasize that stages 1 and 2 use BSC Methodology and are associated with the Governance mechanism for Success Metrics, and also have a point of interface with MCDA methodology, since identifying the objectives of the decision is part of how the problem is structured. Stages 3, 4 and 5 incorporate MCDA methodology and are associated with the governance mechanism for integrating architectures.

Construction of the Model

Identifying the objectives to be met by e-Gov projects, derived from the strategy of the organization and the IT strategies (or competences)

The improvement of e-Gov services for the citizens (or companies) is part of the strategy of the Government for:

- improving the effectiveness of public administration; and
- increasing customer satisfaction.

However, this must be done while consuming the minimum possible resources, which is the reason why the third objective was incorporated:

- Minimizing the costs of the G2C services.

Identifying the perspectives of the e-Gov BSC for evaluating G2C services

The BSC Model adopted in this research comprises four perspectives, as demonstrated in Figure 5.

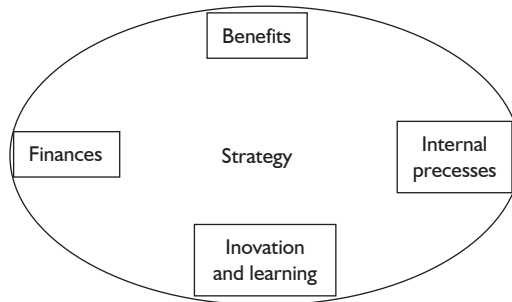


Figure 5 BSC e-Gov Model.

Identifying the perspectives that translate the secondary and primary objectives

The perspectives of the Benefits and Finances guide the primary objectives and the perspectives of the internal processes, and Innovation and Learning incorporate the secondary objectives.

Defining the criteria from the primary objectives

Table 1 exemplifies a BSC for evaluating e-Gov G2C projects, to be used in all the phases of the project life cycle: selection, implementation and evaluation. The BSC will be used in the context of performance measurement (selection, implementation and evaluation) and in the context of MCDA (selection). The decision criteria will be deduced, based on each perspective from the top of the hierarchy and their respective objectives.

The family of criteria defined by the Project Prioritizing Model for e-Gov G2C is as follows:

1) Perspective of the benefits:

Objective: To improve the effectiveness of public administration.

• Organizational Criteria

Strategic Impact

The impact is evaluated by considering the adjustment to the business strategy and to the IT strategy, derived from the business strategy. The impact on the strategy must be evaluated by taking the Strategic Planning of the organization and the IT function, as well as the emergent strategies, as the base.

Operational Impact

The aim of this criterion is to give value to projects that bring positive operational impact, especially related to incrementing the quality of the information available for analyzing the requirements of services and for the management of decision-making, and to the impact of making processes quick and flexible, these being evaluated from an internal point of view.

Objective: To increase customer satisfaction.

- **Criteria of customer satisfaction**

- Scope of Users**

- This criterion aims at identifying the impact in relation to the number of users who could be benefited by the availability of the e-service, as well as it measuring the importance of the group to which the customer belongs. Therefore, it is a criterion which is subjective and for which it was chosen not to draw up an index, it being used as a qualitative criterion.

- Volume of Service**

- Like any another service, Electronic Government services must be designed in accordance with the demand from and respect for the user (OECD, 2003).*

- The most common services keep a direct relation with the customer's expectations on the availability of electronic media. Although some services have an extensive list of clients who could be benefited (scope of users), this does not mean that the demand for the service will occur in the same ratio. Therefore it will also depend on the frequency with which this service is demanded.

- Ease of using the service (reducing the complexity of the service or the transaction)**

- This criterion aims to single out the alternatives of projects that incorporate greater profits in relation to simplifying the service, and differs from the Operational Impact since it is evaluated from a point of view external to the organization, which is that of the client.

- Simplifying the service will lead to the time attending to the client becoming shorter and will lower the transaction costs to clients, thus contributing to their being satisfied.

- Valuable projects are the ones that reduce bureaucracy, eliminate intermediation and promote greater transparency of the service offered.

2) Financial Perspective

- Objective:** To minimize the costs of the G2C services.

- **Financial Criterion**

- Costs of Implementation**

- In this criterion, the costs of developing the application, training, promotion, acquisition of software licenses, acquisition of digital certificates, etc, are evaluated (Table 1).

Application of the Model

The application of the Model for Prioritizing e-Gov Projects was targeted on meeting the needs of the Brazilian State Organizations for the Environment (*OEMAs*). The conduct of local state policies on the environment and water resources falls to the *OEMAs*, who aim to protect and conserve natural resources of the State. The *OEMAs* also mount research studies as applied to the activities of environmental control with a view to such resources being properly exploited.

Table 1 - BSC e-Gov G2C.

Objectives	Results Indicators	Tendencies Indicators	MCDA context
Perspectives of the benefits How to guarantee value for the client and the organization?			
<ul style="list-style-type: none"> Improve the effectiveness of public administration Increase customer satisfaction 	<ul style="list-style-type: none"> Attending to the management contract Satisfaction of e-Gov clients 	<ul style="list-style-type: none"> Average time for license Increment in the number of licensed enterprises E-Gov maturity Increment in the use of e-Gov services 	<p style="text-align: center;">Criterion</p> <ul style="list-style-type: none"> Strategic Impact Operational Impact Scope of Users Volume of service Ease of using the service
Financial Perspective How can we add value to the customer without adding to costs?			
<ul style="list-style-type: none"> Minimize the costs of e-Gov projects 	<ul style="list-style-type: none"> Reduce the Agency counterpart for e-Gov projects 	<ul style="list-style-type: none"> Increment partnership resources 	<p style="text-align: center;">Criterion</p> <ul style="list-style-type: none"> Cost of implementation
Perspective of the Internal Processes In order to meet the aims of the organization, which processes should have operational excellence?			
<ul style="list-style-type: none"> Improve the success of the Management of e-Gov projects Incorporate restructuring value into the projects 	<ul style="list-style-type: none"> Project success (product success + management success) 	<ul style="list-style-type: none"> % of meeting the costs, deadlines and quality of the project Increment in the structural value of the project Increasing the transparency of the product 	<p style="text-align: center;">Factors of Influence</p> <ul style="list-style-type: none"> Employee support (business area) to the development of the project
Perspective of Innovation and Learning How can we get ready to meet the current and future necessities of the e-Gov services?			
<ul style="list-style-type: none"> Make the IT area a strategic partner of the business area and strategy developer 	<ul style="list-style-type: none"> Extension and quality of SISP Employee satisfaction Employee retention Development of new competences 	<ul style="list-style-type: none"> Increment in the strategic partnerships Reduction of the backlog in training IT staff 	<p style="text-align: center;">Factors of Influence</p> <ul style="list-style-type: none"> Degree to which the team is qualified to develop projects

An *OEMA* undertakes its activities by managing the environmental resources concerned with the activities and the enterprises which use natural resources, whether these be considered effective or potentially polluting, or whether they can cause, under any circumstance, environmental damage.

The central issue is to identify and prioritize solutions for exploiting TICs in an *OEMA*, by the offer of electronic services to citizens and companies (e-Gov G2C initiatives). Examples of G2C applications include the availability on the web: governmental information for research, services and forms, form filling, information about public policies, job and business opportunities, registration and renewal of licenses, payment of taxes and duties, suggestions or complaints and information about voting (Wang and Liao, 2007).

Numerical application

The organization that served as the basis for the application of the model considered was chosen at the author’s convenience and will be simply identified as “Agency”. The implementation of the Model explicitly incorporated the preferences of only one decision

maker, the former-manager of an *OEMA*, who acted as IT Manager and Coordinator of Organizational Strategic Planning from 2003 to 2007.

Seven alternatives have been proposed, taking the current level of the e-Gov maturity of the Agency into consideration, and have been detailed to a satisfactory level for decision taking, and these alternatives are described in brief as:

- **A1 – Simplified Licensing (Digital Signature of Licenses and Authorizations)**

This involves the digital signature of simplified licenses, to speed up and to lessen bureaucracy in the process of granting licenses to enterprises with little and low potential for causing environmental damage, as long as these companies meet the restrictions related to the location and the type of their economic activities. This type of licensing will bring together the procedures of prior licensing, of licensing the plant and licensing the operation in a single process, and will generate a single license document at the end.

- **A2 – Dynamic Forms**

This system will have to make available forms for requesting services, simulating face-to-face client services and intuitively leading the user to choosing the service desired, in a way that fits the economic activity, and indicates the procedures for obtaining the service and the documentation required.

- **A3 – Annual Declaration of Industrial Solid Residues**

This system aims at helping the client to complete and deliver the declaration of industrial solid residues, compatible with the request to renew his/her operational license. The data from the previous declaration are at the user's disposal, and can be called up so that they may be updated.

- **A4 – Consulting Legal Processes**

The service for checking legal processes, on the web (or through a voice homepage), must not only offer monitoring the progress of the process, including being able to locate it within a predefined flow, but should also allow the client to identify if there are "requirements outstanding" (arising from faults in projects under analysis, a shortfall in the documentation required or a need for additional technical clarifications) and a description of such requirements.

- **A5 – Electronic Payment of Services**

The electronic payment system, which displays guides on how to pay debts to the environmental agency (license and authorization taxes, fines, environmental studies services), allows payment to be made on the homepage, thus settling the financial transaction.

- **A6 – On-line Complaints**

The users of this service will be able to legalize, follow up and complement the complaints process through the specific electronic service, on the Homepage.

- **A7 – Environmental Data Store**

This is the Data Warehouse with resources on Geographical Information Systems, showing, gradually, historical data with a time window of 5 to 10 years.

Evaluating the alternatives and weights of the criteria

The criteria of volume of the service and of cost of implementation were quantitative. The scales of verbal evaluation used in the qualitative criteria (Strategic Impact, Operational Impact, Ease of Using the Service) are presented in Tables 2 and 3.

The parameters used in the aggregation procedure using the PROMETHEE method are presented in Table 4. The result of performance evaluations of the alternatives for each criterion is presented in Table 5. The preference indices (Table 6) are used to calculate the negative and positive flow of the outranking relations (Table 7), from which the partial order of the alternatives is defined (PROMETHEE I Method) which admits incompatibilities, and the complete pre-order (PROMETHEE II Method) where the incompatibilities are eliminated, thus creating an order of priority, with the possibility of ties.

Table 2 - Evaluation Scale of the criteria: Impact for the Strategy, Operational Impact and Ease of using the Service.

Evaluation scale	
Insufficient	0.00
Weak	0.25
Regular	0.50
Great	0.75
Extreme	1.00

Table 3 - Evaluation Scale of the criterion Scope of Users.

Evaluation Scale	
Entrepreneurs of micro and small companies	0.4
Specific typology entrepreneurs (non-industrial)	0.5
Entrepreneurs of an industrial typology	0.6
Whole state population	0.7
Academic community / Non Governmental Organizations / Consultants / Government	0.8
Whole state enterprises	1.0

Table 4 - Parameters to be used in the aggregation procedure.

Criterion	Generalized Criterion	Weight
Impact for the Strategy	Usual criterion	0.25
Operational Impact	Usual criterion	0.10
Scope of Users	Usual criterion	0.20
Volume	Usual criterion	0.15
Ease of using the Service	Usual criterion	0.20
Cost of Implementation	Usual criterion	0.10

Table 5 - Performances Evaluation of alternatives for each criterion.

	Impact for the strategy	Operational impact	Scope of users	Volume	Ease of using the service	Cost of implementation
A1	0.75	0.75	0.40	0.22	1.00	0.04
A2	0.50	0.50	1.00	0.73	0.50	0.79
A3	0.75	0.75	0.60	0.04	0.75	0.43
A4	0.50	0.25	1.00	1.00	0.50	1.00
A5	0.00	0.75	1.00	0.56	0.50	0.08
A6	0.25	0.00	0.70	0.08	0.50	0.98
A7	1.00	0.50	0.80	0.00	0.75	0.00

Table 6 - Preference Indices.

Preference Indices							
	A1	A2	A3	A4	A5	A6	A7
A1	xxxxxxx	0.55	0.35	0.55	0.45	0.70	0.55
A2	0.45	xxxxxxx	0.45	0.10	0.50	0.70	0.45
A3	0.30	0.55	xxxxxxx	0.55	0.55	0.55	0.35
A4	0.45	0.25	0.45	xxxxxxx	0.50	0.80	0.45
A5	0.45	0.10	0.35	0.10	xxxxxxx	0.45	0.55
A6	0.30	0.10	0.45	0.00	0.35	xxxxxxx	0.25
A7	0.45	0.45	0.45	0.55	0.45	0.75	xxxxxxx

Table 7 – Outranking flows of alternatives.

Outranking Flow			
	Positive outranking flow	Negative outranking flow	Net flow
A1	3.1500	2.4000	0.7500
A2	2.6500	2.0000	0.6500
A3	2.8500	2.5000	0.3500
A4	2.9000	1.8500	1.0500
A5	2.0000	2.8000	-0.8000
A6	1.4500	3.9500	-2.5000
A7	3.1000	2.6000	0.5000

Exploiting outranking relations

As a result of the application of PROMETHEE I method, the partial order illustrated in Figure 6 is obtained, for the outranking relation, where the arrows indicate the direction of priority, while their absence indicates a condition of incomparability between the alternatives. It is emphasized that, by graphical simplification, since the results have presented the property of transitivity in the preference relations, the arrows for outranking alternatives are omitted if the knot can be reached by following the path through another knot where outranking occurs.

Table 8 demonstrates the results of the outranking relations for each alternative. The sensitivity of the model to variations in the weights of the criteria was tested for an interval of $\pm 20\%$, and its robustness has been proved.

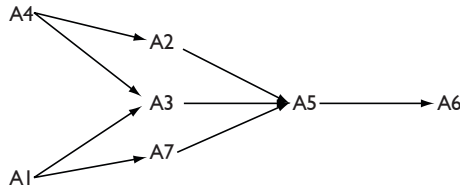


Figure 6 - Graphical Representation of the partial order generated by PROMETHEE I.

Table 8 - Classification of the projects.

PROMETHEE I	PROMETHEE II	Alternative	Description
1	1	A4	Processes Check
	2	A1	Simplified Licensing (Digital Signature of the Licenses and Authorizations)
2	3	A2	Dynamic Forms
	4	A7	Environmental Data Store
	5	A3	Annual Declaration of Industrial Solid Residues
3	6	A5	Electronic payment of services
4	7	A6	On-line Complaints

Discussion of Results

The use of the Promethee II produced a ranking of G2C e-Gov project alternatives that match the expectations of the decision. As to the decision, the use of a formal method of prioritizing e-Gov G2C projects resulted in a well-structured scenario of decision, and highlights the need to consider the organization from internal and external points of view.

The integrated use of BSC and MCDA in the proposed model for IT governance, has the advantage of strengthening the social structures that contribute to the good performance of the IT function, thus fostering cooperation and allowing an integrated strategy between IT and business to be established.

The integration of the activity related to performance measurement using the BSC, with the process of prioritizing projects, allows the alignment of the projects with the IT and business strategy, when deriving decision criteria from the objectives of the perspective(s) situated at the top of the hierarchy of the cause and effect relations of the metrics mechanism. Therefore, the IT strategy is strengthened, and exploiting the diverse objectives, not only the primary objectives, allows all the factors influencing the choice of an alternative to be considered. This means considering the interests of the different stakeholders of the process, thus allowing the viability and the risks involved in each project to be evaluated. This will also help to get the support of those who will be responsible for its implementation, thus making it more likely that projects will be successful.

On the other hand, the process of prioritizing, using a methodology of support to decision-making, will allow the strategy to be revised, validated or adjusted to “market” demands, whenever new demands or resources crop up, thus supplying feedback to the

governance mechanism for success metrics (using BSC) and suggestions for adjustments, when necessary.

A major contribution of this model is that it fits all the stages of a process of broad decision-making, in which the support to the decision is inserted, thus making it possible to analyze the results after the alternatives have been implemented, with the objective of calibrating the prioritizing model based on this feedback.

Conclusions

The study shows that the use of BSC and MCDA should not take place unless the perspectives that direct the primary objectives have been rigorously identified, and the decision criteria must only derive from these objectives.

The Model of Prioritizing e-Gov G2C Projects has filled a gap related to establishing formal methods for evaluating and prioritizing Electronic Government projects, thus contributing to the understanding of these processes and consequently, to the success of these initiatives.

It is emphasized that the model can be applied in public and private organizations, irrespective of the area of activity, with a minimum of adaptation. This adaptation can mention the perspectives of the BSC and its indicators, the decision criteria and the relative importance among the criteria. It is important to point out that new criteria may be added or excluded, according to the decision context and decision-makers' system of preferences.

As to suggestions for future studies, we recommend:

- Identifying the adequacy of the model to deal with viable alternatives that correspond to the highest levels of e-Gov maturity;
- Adapting the proposed model for use in a context of group decision, clearly incorporating the preferences of the several actors involved with the process of prioritizing e-Gov G2C Projects;
- Incorporating the treatment of the risks involved in each project in the model; and
- Detailing the development phase of action plans, thus incorporating restrictions on the problem, in such a way as to reconcile the budget and to provide for balancing the various needs of groups, whom the Agency has the mission to serve, by adding the use of PROMETHEE V to the model.

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References

- Almeida, A.T. (2002) Multicriteria Priorities Assignment For Information Technology Based On Organisational Aspects, *International Journal of Operations and Quantitative Management*, Vol. 8, No. 4, pp. 251-263.

- Almeida, A.T. and Costa, A.P.C.S. (2002) Priorities assignment of information systems based on PROMETHEE method, *Gestão & Produção*, Vol. 9, No. 2, pp. 251-263.
- Almeida, A.T. and COSTA, A.P.C.S. (Org.). (2003) *Aplicações com Métodos Multicritério de Apoio a Decisão*. Editora Universitária, Recife.
- Belton, V. and Stewart, T.J. (2002) *Multiple Criteria Decision Analysis*. Kluwer Academic Publishers, London.
- Costa, A.P.C.S. et al. (2002) Priorização do Portfólio de Projetos de Sistemas de Informação Baseado no Método TODIM de Apoio Multicritério a Decisão, *Revista de la Escuela de Perfeccionamiento en Investigación Operativa*, Argentina, Vol. 23, No. 1, pp. 106-119.
- Coughlan, J. et al. (2005) Understanding the business-IT relationship, *International Journal of Information Management*, Vol. 25, pp. 303-319.
- Esteves, J. and Joseph, R.C. (2007) A comprehensive framework for the assessment of eGovernment projects, *Government Information Quarterly*, Vol. 25, No. 1, pp. 118-132.
- Farbey, B. et al. (1999) Moving IS evaluation forward: learning themes and research issues, *Journal of Strategic Information Systems*, Vol. 8, No. 2, pp. 189-207.
- Gomes, L.F. et al. (2009) *Tomada de decisão gerencial: enfoque multicritério*. Editora Atlas, Rio de Janeiro.
- Henderson, J.C. and Venkatraman, H. (1993) Strategic alignment: Leveraging information technology for transforming organizations, *IBM Systems Journal*, Vol. 32, No.1, pp. 4-16.
- Hyvonen, J. (2007) Strategy, performance measurement techniques and information technology of the firm and their links to organizational performance, *Management Accounting Research*, Vol. 18, No. 3, pp. 343-366.
- Kaplan, R.S. and Norton, D.P. (1997) *A estratégia em ação: Balanced Scorecard*. Campus, Rio de Janeiro.
- Keeney, R.L. (2007) *Developing Objectives and Attributes*. Edwards W. et al. *Advances in Decision Analysis: from Foundations to Applications*. Cambridge University Press, New York, pp. 104-128.
- Kloot, L. and Martin, J. (2000) Strategic performance management: A balanced approach to performance management issues in local government, *Management Accounting Research*, Vol. 11, No. 2, pp. 231-251.
- Lee, J. and Kim, J. (2007) Grounded theory analysis of e-Government initiatives: Exploring perceptions of government authorities, *Government Information Quarterly*, Vol. 24, No. 1, pp. 135-147.
- Maltz, A.C. et al. (2003) Beyond the balanced scorecard: refining the search for organizational success measures, *Long Range Planning*, Vol. 36, No. 2, pp. 187-204.
- Martinsons, M. et al. (1999) The balanced scorecard: a foundation for the strategic management of information systems, *Decision Support Systems*, Vol. 25, No. 1, pp. 71-88.

- Milis, K. and Mercken, R. (2004) The use of the balanced scorecard for the evaluation of Information and communication technology projects, *International Journal of Project Management*, Vol. 22, No. 2, pp. 87–97.
- Newkirk, H.E. and Lederer, A.L. (2006) The effectiveness of strategic information systems planning under environmental uncertainty, *Information & Management*, Vol. 43, No. 4, pp. 481-501.
- Norrie, J. and Walker, D.H.T. (2004) A balanced scorecard approach to project management leadership, *Project Management Journal*, Vol. 35, No. 4, pp. 47.
- OECD. (2003) *The e-Government Imperative*. Organization for Economic Cooperation & Development, OECD e-Government Studies, Paris. OECD Publications.
- Schwarz, A. and Hirschheim, R. (2003) An extended platform logic perspective of IT governance: managing perceptions and activities of IT, *Journal of Strategic Information Systems*, Vol. 12, No. 2, pp.129-166.
- Stewart, R.A. and Mohamed, S. (2003) Evaluating the value IT adds to the process of project information management in construction, *Automation in Construction*, Vol. 12, No. 2, pp. 407– 417.
- Stewart, R.A. (2007) A framework for the life cycle management of information technology projects: Project IT, *International Journal of Project Management*, Vol. 26, No. 2, pp. 203-212.
- Valverde, D.N. (2005) *Modelo de Governança de Tecnologia da Informação, baseado no balanced scorecard e quality function deployment.!* (Mestrado em Engenharia de Produção), Universidade Federal de Pernambuco, Recife.
- Vincke, P. (1992). *Multicriteria decision-aid*. John Wiley & Sons, Chichester, West Sussex, England.
- Yildiz, M. (2007) E-Government research: Reviewing the literature, limitations, and ways forward, *Government Information Quarterly*, Vol. 24, No. 3, pp. 646–665.
- Wang, Y. and Liao, Y. (2007) Assessing eGovernment systems success: A validation of the DeLone and McLean model of information systems success, *Government Information Quarterly*, Vol. 25, No. 4, pp. 717-733.
- Ward, J. and Elvin, R. (1999) A new framework for managing IT- enabled business change, *Info Systems J.*, Vol. 9, No. 3, pp. 197-221.

Biography

Mônica Maria Leal Canedo holds a Msc from the Production Management Engineering department of the Federal University of Pernambuco. Working mainly in the Information Technology field, she was an Environmental Development Analyst at *Agência Estadual de Meio Ambiente e Recursos Hídricos - CPRH* (the Environmental Agency of the State of Pernambuco, Brazil), where she acted as an Information Systems Project Manager from 2004 to 2007. At present, she is an Analyst/Consultant at the Digital Government Relationships

Management Department of the *Agência Estadual de Tecnologia da Informação* – ATI (Information Technology Agency), Pernambuco, Brazil.

Adiel Teixeira de Almeida is currently a Professor of Management Engineering at the Federal University of Pernambuco. He obtained a PhD in Management Engineering from The University of Birmingham, UK (1994). He has authored various scientific papers, mainly in the following journals: IEEE Transaction on Reliability, European Journal of Operational Research, Annals of Operations Research, Computers and Operations Research, Journal of Decision Systems and Fire Technology. Has a Grantee in Productivity in Research from NRC - CNPq, since 1996. He worked at the *Companhia Hidro Elétrica do São Francisco* – CHESF (Power Electricity Company) in Brazil, as an Engineer from 1981 to 1986, and as a manager from 1986 to 1996, dealing with project management and IT planning and R&D projects.

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