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Abstract

This paper reports on an exploratory study based on publicly available accounts of ICT expenditures of the Secretaries of the State of São Paulo, Brazil and relates these data to their stages of ICT development and governance.

E-Government has been a priority for Administrations, with expectations of gains in services to citizens and performance of government processes as strong drivers for significant investments, focused managerial and political actions, leading to new services for corporations and citizens' live-events. These highly visible front-end interfaces require the support of effective and integrated back-office processes and informed management. Therefore e-government management has to be considered in the context of the agency's global ICT (Information and Communications Technology) activities.

Effective ICT governance contributes to performance and e-value generation, but requires political will and determination to be implemented and enacted.

The relationship between ICT use, growth stages and governance and ICT budget participation and growth, demonstrated in this paper, can be used both as indirect and robust measures for the effectiveness of ICT governance and as indications to managers of governance pre-condition for e-value generation in Government.

Keywords: e-Government, ICT Governance, ICT expenditures

1. Introduction

The State of São Paulo is Brazil's most populous (about 40 million), with 645 municipalities, being responsible for 33% of the GNP. The State Government has a total of 700,000 direct employees and is structured in 20,000 administrative units that report to 22 State Secretaries. From a total of US$ 18 billion expenditure in 2004, 0.92% were used for ICT.

The present 4-year plan (2004-2007) has allocated a total of US$ 2.1 billion for its e-government program alone, subdivided in programs for infrastructure, internal transactions, transactions with society and digital inclusion. Secretaries compete for these funds for their e-government projects.

Since 1995 the State has a centralized system for budgeting, finance, accounting allowing real-time control of expenditures, with special accounts for ICT expenditures that provided the information for this study.

Although the system records data in real-time, we chose to use the more stable yearly total ICT expenditures for the period (1998 to 2004).

The period 1995-2006 is characterized by administrative continuity (succession of governors from the same political party) and a continuous strong emphasis on the use of ICT.

Although a state supervisory board for the State's IT existed since 1967 (the Telecommunications board was created only in 1991), ICT became a strategic issue due to the large state modernization program started in 1995. Budget resources, complemented by international funds for modernization of the financial system, education, health, environment, police and social services, were used to (re)build a basic communications infrastructure and integrate common databases, and to create multi-service government offices that were perceived by citizens as a showcase for modern government.

All Secretaries have their web presence, with the larger Secretaries allowing their major service transaction (finance, police, education, social security) to be performed over the Internet.

This paper is part of a larger research project aiming at studying of the performance of ICT operations in Brazilian Government Institutions, using publicly available data. These procedures are mandated by law for all Brazilian Public Institutions and are being progressively implemented in all States. The State of São Paulo was selected for this pilot study because of its more advanced stage in this process and its strategic investments in e-government.

2.   Research Question and Literature Review

2.1   The Research Question and Hypotheses

What is the relationship between the strategic use of ICT, its stage of formalization and governance structure and ICT expenditures and their variation over time in Public Administration?

The hypotheses to be tested are the existence of positive relationships between ICT budget share share and its growth, governance maturity, systems integration and strategic use.

Justification for the research

The rationale for using these variables is that the resources an organization allocates to ICT and its variation over time follow the evolution of the function and its strategic importance to the organization, as indicated by many IT stage model researchers (Nolan, 1979, Galliers, 2003).

Direct measures of e-government performance are difficult to obtain. However, considering that the allocation of budget resources has a political component, in which decision makers make their (often subjective) evaluation of competing projects, the

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change over time of a Secretary's ICT budget can be taken as an indirect measure of its perceived value (as judged by the budget approving legislators).

The conjecture is that Secretaries with better ICT governance are also in a better position to elaborate and defend their projects proposals, manage budget and demonstrate results. ICT budget share and growth would then be influenced also by more effective governance.

Relating these data to the Secretaries' ICT stages of growth and Governance, could provide valuable insights for ICT resource allocation and management in Public Administration.

Effective ICT governance contributes to performance and e-value generation, but requires political will and determination to be implemented and enacted.

Given the relationships between ICT use, growth stages and governance and ICT budget participation and growth, to be demonstrated in this paper, can be used as both as indirect and robust measures for the effectiveness of ICT governance and as indications to managers of governance pre-conditions for e-value generation in Government.

Previous e-Government studies focus more on the more visible front-end interfaces (Moon, 2005), but these require the support of effective and integrated back-office processes and informed management. Therefore e-government management has to be considered in the context of the agency's global ICT (Information and Communications Technology) activities, thus justifying the use of total ICT expenditures in this study.

2.2   Literature Review

Weill and Ross's (Weill and Ross, 2005) research indicates the positive relationship between organizational performance (profitability and growth) and ICT governance performance, showing also that there is no single best ICT governance model. Our paper derives its conjecture of a relationship between ICT governance and growth from this research.

Traditional ICT management stage models relate ICT spending growth to the organization's progression in its ICT maturity stage (Nolan, 1979) and (Galliers and Sutherland, 2003), a hypothesis used also for our research.

Palvia et al (Palvia, 2002) demonstrate that the Key ICT management (and Governance) issues vary according to the stage of development of the Countries (Organizations) ICT operations. From this work we use the concept that the perception and management of ICT's strategic value is present in the more advanced stages of ICT use.

Moon et al. (Moon, 2005) present a stage model for e-Government, where the more advanced stages require also the effective integration of back-office systems and processes (and the supporting governance mechanisms). Their work pointed to the importance of considering the systems integration dimension.

Galliers and Sutherland (Galliers and Sutherland, 2003) propose a "revised stages of growth" model, with six stages:

1. ad hocracy;

2. starting the foundations;

3. centralized dictatorship;

4. democratic dialectic and cooperation;

5. entrepreneurial opportunity and

6. integrated harmonious relationship

Each stage is characterized by its strategy, structure, systems, staff, style, skills and super ordinate goals. The authors caution that no organization will find itself entirely within one stage and that stages can be skipped by effective management. This model will be used to identify the stage of development of the Secretaries ICT governance.

Sambamurthy and Zmud (Sambamurthy and Zmud, 1999) see IT governance arrangements being determined by contingent factors: the organizations overall *corporate governance*, *economies of scope* (of IT resources), determined by its diversification mode (growth strategy) and diversification breadth (its product (process) or market relatedness). The third determinant factor is the line managers' IT management experience (their *absorptive capacity*). These factors may by mutually reinforcement, conflict or domination, lead the organization to adopt a centralized, decentralized or federal mode of governance. The study's expert panel found that "Process relatedness" was more useful in discriminating the Secretaries ICTG operations.

McFarlan's "Strategic Grid Model" uses management's assessment of the role of IT for the business to classify IT governance approaches in one of four categories: support, factory, turn around and strategic. (Applegate et alia 2003, pp 33-34). Each category is characterized by its goals for IT and leadership and project management style. This model replaces a deterministic approach by management choice based on subjective evaluation and strategy. This model will be used to gauge the importance Secretaries attach to ICT in order to understand their governance efforts.

3.   Reference Models and Research Methodology

3.1   Reference Model

There is an established tradition of studying IT activities in organizations as evolutionary processes, with variations in the definition of the stages, the contingent factors and the conditions for transition between stages (Nolan, 1979, Palvia, 2002, Moon, 2005).

More recently, in addition to the rather normative evolution models, researchers have proposed the informed choice (by design) among alternative IT governance models, according to organizational and business dimensions. (McFarlan (Applegate, 2003), Sambamurthy and Zmud (Sambamurthy and Zmud, 2003), Weill and Ross (Weill and Ross, 2004)).

For this paper we have chosen three reference models, highlighting specific aspects of the problem:

1. Galliers's stage model, proposes taxonomy of a progression of the ICT function in an organization, identified by stages of growth, each having specific governance approaches, management goals and typical applications.

2. Sambamurthy and Zmud's contingency model, relating governance models to the contingent organizational variables.

3. McFarlan's Strategic Grid model, which adds another contingent variable: the strategic importance of IT, as perceived by the organization's management.

3.2 Research Methodology

Data Collection

The independent variables of the model are the classifications of the Secretaries according to the three reference models presented above, obtained from a panel of experts, familiar with the ICT situation of the Secretaries. The ensuing analysis related these variables to the IT expenditures data from the State accounting system in order to draw conclusions about observed regularities of the phenomenon.

The research also uses the accounting records of the Secretaries' general and ICT expenditures. These data are contained in the State's financial management and accounting system. Data completeness and reliability is assured by the system's registry function, the fact that payments are made only through the system and the auditability of the accounts by the State Accounts Courts.

The use of administrative records in research has both advantages and problems. On one hand there is the assurance of informant compliance, but on the other hand data cannot be designed to fit exactly the researchers' needs. For example, since the account plan does not distinguish between investments and expenses, we could only use figures for total expenditures. Although data could be treated at any level of detail, down to the individual contract/purchase transaction, we decided to use only the more robust total figures.

The system defines two ICT related accounts: *infrastructure* and *services*. The *ICT infrastructure* account is composed by the sub-accounts *equipment rental, supplies, parts, accessories and components, installation and maintenance, data communication services, ICT equipment.* The account *ICT services* records *outsourced services*.

Actual data classification may vary due to differing interpretations by agency accountants. It is also possible that these accounts do not capture all ICT-related expenses (for example, the secretary of education records its ICT training courses for teachers as personnel development expenses).

Only the largest Secretaries (Finance, Education, Police, Science and Technology, State Universities) have a significant number of internal ICT staff. All others rely on external (private or government-owned) vendors. This is due mainly to government restrictions on personnel hiring and on non-competitive salaries.

Therefore the ICT accounts described above can be used as a fair representation of IT expenditures, especially for the smaller Secretaries

One permanent goal of the Committee for Quality in Public Administration (the top-level ICT Governance body) was to convince agency executives to improve the classification of their IT expenditures.

The system records only expenditures funded by the State budget. Funds obtained by Secretaries from external sources are subject to other governance processes and have other recording procedures.

Model variables

The trade literature has developed indicators that are used to benchmark IT operations, of which "participation of IT expenditures in total revenues" (IT/TR) is commonly used, as, for example by Meirelles (Meirelles 2005) in his yearly survey of the use of ICT resources in Brazil, which is used by companies to benchmark their ICT expenses in relation to the industry.

Since "revenue" is not an adequate measure for the State's operational activities (due to non-operational funds transfers to municipalities, the Federal Government, etc), we substituted "Total Expenditures" (TE) for "Total Revenues" in our research.

The ratio (IT/TE) allows the comparison of organizations of different size and indicates the relative importance of ICT in each Secretary.

This variable and its evolution over time will be used as the dependent variables in our study of Secretaries' ICT governance and use, being understood as a proxy to the performance of its ICT services, as explained before.

There are variations in ICT expenditures due to special situations, like Secretaries' reorganizations, infrastructure renovations or even Secretaries' physical moves, not related directly to their service provision, which may distort the analysis in the short term.

Since the study of longer term variations in IT expenditures is one of the goals of our analysis, we chose to construct a more robust measure of variation: the inclination of the linear regression on the yearly IT/TE figures.

The forecast for 2005 according to this regression was used as a more robust measure for the comparison of the IT/TE variable between Secretaries.

This reference model has limitations since, for example, it does not consider the Secretaries' business specificities (variations in the strategic role of ICT, etc.) and more general organization decisions. The paper's use of only robust aggregate measures and broad categorizations are a response to this fact.

4.   ICT Governance in the State of São Paulo

4.1   ICT Governance History and Structure

The State of São Paulo has, since 1967, a federative ICT Governance structure, with a Board composed by representatives from the major players and subordinated to the secretary responsible for ICT (formerly the Secretary of Planning and now the Secretary of the Cabinet). A similar structure for the governance of the State Government Telecommunications resources was created in 1991.

In the past this IT board had the authority to approve Secretaries' ICT plans, service contract and computer acquisitions. It would assure that services went to the state-owned data processing company Prodesp, whenever possible. Over time the effectiveness and relevance of this board was reduced to a somewhat symbolic role.

An important change happened in 1995, with the institution of the Governor-sponsored modernization and e-government program that led to massive investments in business processes improvements and ICT infrastructure and applications. The program was managed by a special office subordinated to the Secretary of the Cabinet, with full authority over program funds.

This centralization allowed the implementation of some very large and revolutionary projects: a financial management and control system, a central reverse-auction purchasing system, a common (data and voice) communications infrastructure, a public telecenter network, integrating databases across Secretaries, and creating highly visible multi-service government offices that are perceived by citizens as a showcase for modern government.

This program was later formalized by decree as the Committee for Quality in Public Administration, a federative multi-layer structure that has the state-wide ICT governance as one of its functions, taking over the functions from the previous IT supervisory board. This arrangement demonstrated the Governor's perception that ICT should not be managed autonomously, but as a strategic resource for government modernization and improvement.

The committee's activities are published (in Portuguese only) on its website: http://www.cqgp.sp.gov.br (accessed on Jan 26, 2006).

The same decree instituted also the executive ICT groups in each Secretary, in charge of planning and managing its ICT activities, as shown in Figure 1.
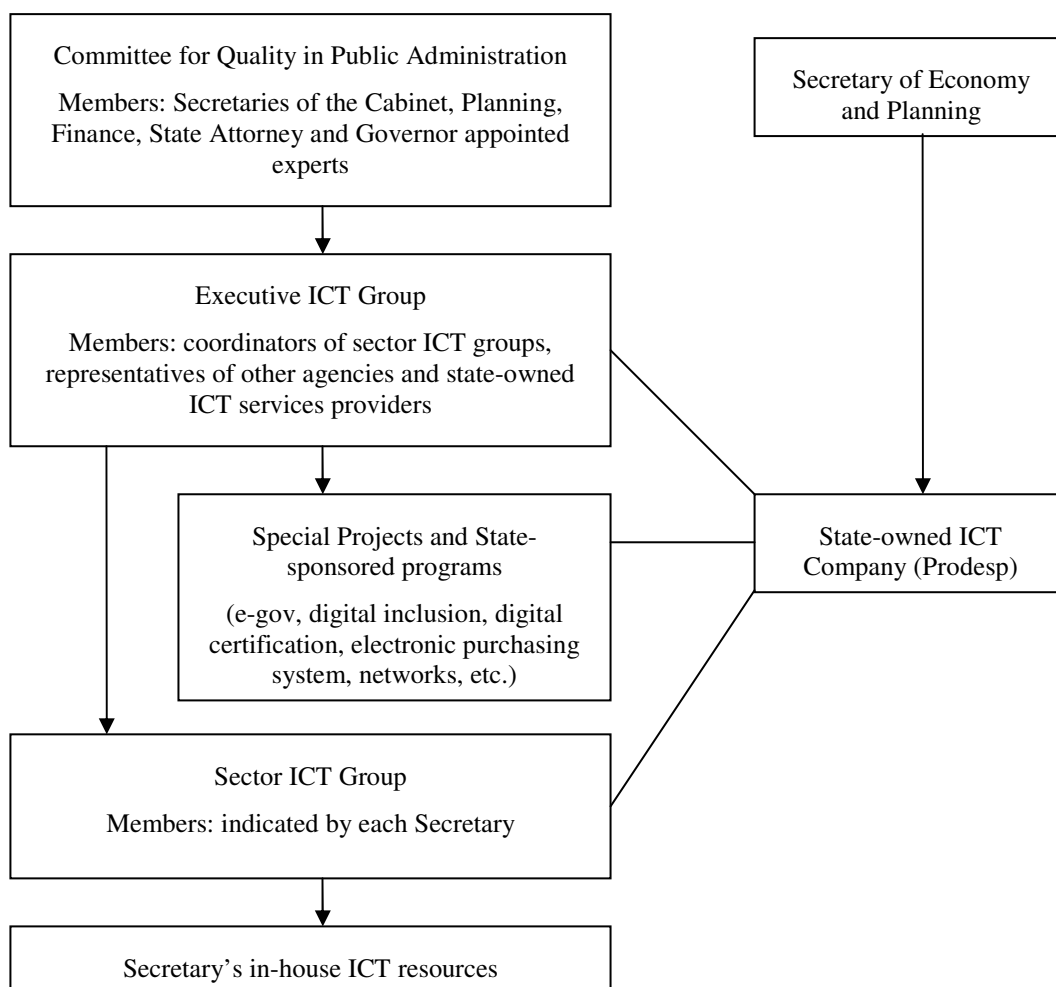

Figure 1: Formal structure of the São Paulo State Government ICT Governance

Secretaries that had already a formal ICT structure adapted easily. In many Secretaries, however, this group is only symbolic.

There are Secretaries, with limited internal staff, but responsible for very large subordinate organizations, like the state universities, research institutes, energy and

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transportation companies, hospitals, correctional institutions, etc. These organizations themselves are usually highly structured autonomous business units, which also includes their own ICT governance. Their representatives participate and strongly influence the Secretaries' executive ICT groups.

Secretaries have, over time, developed different IT Governance structures, ranging from completely decentralized operations, to "IT monarchies" (Davenport 1992). Some have their own in-house ICT groups, while others have outsourced governance and operations to outside vendors, usually the state-owned IT company Prodesp. In this case, due to its weak political power as outside vendor, Prodesp has not been able to promote process modernization and systems integration, responding only to individual requests for services, thus reinforcing the "anarchic" (Davenport 1992) status quo.

The level of process interdependence among the Secretaries' units and their reliance on ICT may indicate the need for stronger governance structures.

4.2   ICT Expenditure Data

Table 1 presents the consolidated data of Secretaries' total and ICT expenditures and the constructs

- *average annual change* (the slope of the linear regression calculated with the yearly data) and the

- *2005 estimated* participation of ICT expenditures in the total Secretaries' expenditures (based on the regression mentioned above).

Table 1: ICT expenditures and participation in total Secretaries' expenditures, ordered by IT/TE change. Source: adapted from São Paulo State Government, 2005

Unit	Total 2005 estimated (US$1,000)	2005 IT/TE estimated (%)	IT/TE estimated yearly change (%)
Secretary of Economy and Planning	4,911	7.70	0.89
Secretary of Finance	45,408	2.33	0.40
Secretary of Security (Police)	47,337	2.00	0.22
Secretary of the Cabinet	47,626	13.28	0.22
Secretary of Transportation	10,222	1.88	0.18
Secretary of Justice and Citizenship Protection	4,041	0.37	0.18
Secretary of Youth, Sports and Leisure	306	1.22	0.17
Secretary of Education	53,400	1.19	0.16
Secretary of Agriculture	3,298	1.10	0.15
State Attorney's Office	3,503	0.93	0.13
Secretary for the Environment	1,747	1.18	0.13
Secretary of Penitentiary Administration	4,235	0.96	0.11
Governor's office	12	0.63	0.07
Secretary of Culture	528	0.61	0.06
Secretary of Science, Technology, Economic Development and Tourism	24,287	1.01	0.04
Secretary of Housing	103	0.06	0.00
Secretary of Metropolitan Transportation	146	0.01	0.00
Secretary of Energy, Water Resources and Sanitation	850	0.15	-0.01
Secretary of Social Assistance and Development	1,396	0.46	-0.03
Secretary of Health	15,932	0.42	-0.07
Prosecutor's Office	3,681	1.42	-0.08
Secretary of Employment and Labor Relations	1,154	1.33	-0.29
State of São Paulo Government (Total)	289,110	0.99	0.06

Estimator robustness is limited by the small sample size, but should be sufficient for the exploratory use made in this study. Higher precision would require analyzing individual expenses at sub-secretary level and identifying special local arrangements, which is beyond the scope of this study.

4.3   Categorization of Secretaries' ICT Governance

The classification of the Secretaries' ICT governance and growth stages was made by a panel of experts, familiar with the State of São Paulo Government. In preparation for this task, the authors introduced the experts to the concepts of the Reference Models and discussed its utilization.

The codification used for each model's categories is presented in Table 2. Table 3 presents the results of the classification process.

Table 2: Codification scheme for Governance classification

Model	Category	Code
McFarlan's Strategic Grid	Support	1
	Factory	2
	Turnaround	3
	Strategic	4
Galliers' growth stages	Ad-hocracy	1
	Starting the foundations	2
	Centralized dictatorship	3
	Democratic dialectic and cooperation	4
	Entrepreneurial opportunity	5
	Integrated harmonious relationships	6
Sambamurthy and Zmud's contingencies	Corporate Governance	
	By function	1
	By product or division	2
	Process Relatedness	
	Low	1
	Share Databases	2
	Interdependent	3
	Line ICT management experience	
	Low	1
	High	2

Table 3: ICT Strategic Governance, Growth Stages and Contingent variables (ordered as in Table 1.)

Unit	ICT governance and growth stages						
	Strategic Grid		Growth Stages		Contingencies		
	before 2003	since 2003	before 2003	since 2003	Corp. govern	Process relatedn.	Line IT mgt exp
Secretary of Economy and Planning	2	4	3	4	1	3	2
Secretary of Finance	4	4	3	3	2	3	2
Secretary of Security (Police)	2	4	2	4	1	3	1
Secretary of the Cabinet	4	4	3	3	2	2	2
Secretary of Transportation	1	1	2	2	2	2	2
Secretary of Justice and Citizenship Protection	1	1	2	2	2	1	1
Secretary of Youth, Sports and Leisure	1	3	1	2	2	1	1
Secretary of Education	2	4	3	3	1	3	1
Secretary of Agriculture	1	3	2	2	2	2	2
State Attorney's Office	1	3	2	3	1	2	1
Secretary for the Environment	1	4	2	3	1	2	1
Secretary of Penitentiary Administration	2	4	3	3	1	2	1
Governor's office	1	1	1	1	1	1	1
Secretary of Culture	1	3	2	2	1	1	1
Secretary of Science, Technology, Economic Development and Tourism	2	2	3	3	2	1	2
Secretary of Housing	2	4	2	2	1	2	2
Secretary of Metropolitan Transportation	1	2	2	2	2	1	2
Secretary of Energy, Water Resources and Sanitation	1	1	2	2	2	1	2
Secretary of Social Assistance and Development	1	4	2	3	2	2	2
Secretary of Health	2	4	2	2	2	1	2
Prosecutor's Office	1	1	2	2	1	1	1
Secretary of Employment and Labor Relations	1	1	1	1	1	1	1

5. Data Analysis

The data correspond to a period with very low inflation, allowing a direct comparison of the monetary figures. The data, although being reliable, posed some difficulties to the researchers: They reflect only the expenditures funded by resources from the State budget. Some Secretaries have subordinate agencies and government-owned companies that generate their own revenue or receive funds from external sources. These resources are used for specific projects or services, frequently involving also external partners, and have their separate management and accounting processes, resulting in a higher degree of independence from corporate governance.

Since the basic conjecture of this research is that the Secretaries' ICT governance impacts its share of the State Budget, it becomes acceptable to restrict the analysis to the ICT expenditures funded by the State Budget.

Some Secretaries, with a small central structure, have, however, very advanced subordinates. This is the case of the Secretary of Science and Technology, which oversees the highly developed State Universities. The criterion for governance classification was to focus on the organization level spending the largest share of the Secretary's State ICT budget.

The Secretary of the Cabinet's high ICT expenditure is due to it being responsible for the management of major State projects: the e-government infrastructure, the multi-service government offices and the State's Public Telecentres Network.

The following analysis presents the preliminary results of our study. Given this stage of the project and the still small number of observations, the analysis will be of descriptive nature, highlighting the most important findings.

In general the Secretaries' ICT budget shares are significantly lower than those in the Brazilian private sector (5.3% average, according to Meirelles, 2005).

The data indicate a relationship between the IT/TE index and its growth over time and the advancement of the Secretaries' ICT governance stage, as demonstrated in Graph 1, Tables 4 and 5.
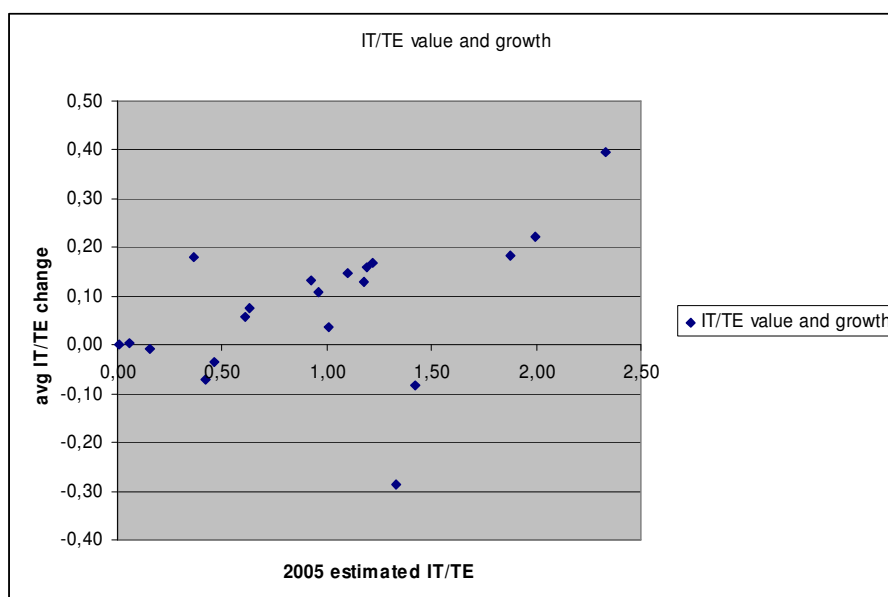
Graph 1: IT/TE 2005 estimated value and growth over the period 1998-2004 (Secretaries of Planning and Cabinet removed as outliers)

Table 4: Comparison of Secretaries' Governance status

Secretaries' IT/TE growth rate	Secretaries in McFarlan's categories: strategic or turnaround	Secretaries in Galliers's growth stages Centralized dictatorship or Democratic dialectic	Have higher Process Relatedness (Sambamurthy, Zmud))
Above median	9	7	9
Below median	5	3	3

Table 5: Comparison of ICT Governance evolution

Secretaries' IT/TE growth rate	Secretaries that advanced both in McFarlan's and Galliers's categories	Secretaries that advanced in McFarlan's but not in Galliers' categories
Above median	5	1
Below median	1	5

These results indicate that Secretaries with a higher ICT budget share have also a higher share increase, make a more strategic use of ICT, are in more advanced ICT management stages and have more integrated ICT applications.

These findings indicate the positive relationship between ICT expenditures, strategic value of applications and governance mechanisms, which lends support to the research hypotheses. Table 4 and 5 indicate that Secretaries with a superior ICT budget growth are more consistent in advancing their ICT governance stages.

Since the dependent variables (ICT's share in the Secretaries total budget and the variation of this share over time) are readily available and robust data, the research results allow inferences from these data to the more complex measures of ICT governance and maturity stages.

6. Conclusions

The research results lend support to the following conjectures:

1. a higher ICT budget share is related to higher budget share growth rates;

2. a higher ICT budget share growth is related to advances in the strategic value of ICT applications, the stage of ICT governance and business process relatedness;

3. the advances in ICT governance stages are related to business process relatedness, a characteristic of advanced stages of e-government (and the corresponding generation of e-value).

The relationship between ICT budget growth rate, a readily available and robust measure obtained from the State's accounting system and the advances in ICT applications and governance, allows one to consider using this variable as an indirect measure of the

formerly mentioned processes. The (possible causal) relationships identified in the study deserve further research.

These findings could have interesting implications for management and e-government public policy making, as, for example, the need for attention to governance issues as a precondition to effective resource utilization and strategic impact or the relationship between levels of systems integration and strategic impact of ICT (most visibly perceived in e-gov applications).

The results of this exploratory research should however be validated through replication in other sites and with larger sample sizes.

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