

E-PROCUREMENT IN BRAZIL'S STATE GOVERNMENTS

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ABSTRACT. After providing a brief overview of the governmental structure in Brazil, this paper will survey the level of e-procurement applications in Brazil's state governments. State governments in Brazil are responsible for 70% of Brazil's public sector budget and about 20% of the nation's annual procurement spends. Our findings are based on our survey of government websites, classified them by stages of development; and confirmed this survey with highly-qualified public sector managers.

INTRODUCTION

This chapter examines how Brazil's public sector is structuring its goods and service supply chain management (SCM) using information and communications technology (ITC) and electronic government (e-government) to recover its capacity for direct investment.

Widespread use of electronic procurement alone has not assured that all the potential for rationalizing current expenditures is being explored in Brazil. Discussions and solutions have largely been limited to that narrow scope. Brazilian researchers and technicians are pushing for the subject to be addressed more broadly and for e-government to contemplate the whole supply chain. The intention in this text is to outline alternative manners of broadening this scope in the Brazilian context and to underline its importance in rationalizing public spending.

This approach to the issue is important considering that, over the past 5 years, the direct investment capacity of Brazil's public sector has averaged a scant 3.0% of total budget. Direct government procurement totaled R\$247 billion in 2007 - R\$194.7 billion in current expenditures and R\$52.5 billion in capital expenditures - representing around 14.2% of total spending or 9.5% of GDP (BRAZIL, 2009). The topic addressed here comprises tools with the potential to improve these figures as well as to enhance management transparency and expedite activities. These gains can be made to occur at all stages of the logistics process.

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The intention here is to fill a gap, particularly in the Brazilian literature, because discussions of government procurement have been restricted to formal and legal concerns, with no integrated, overall managerial vision of the process as a whole. Some Brazilian authors, such as Fernandes (2002), have presented this idea of broadening the view of public procurement in order to rationalize public spending. According to Almeida & Lucena (2006), studies by international non-governmental organizations, such as Transparency International, claim that the public sector is inefficient, with corrupt practices contributing to losses of 3% to 10% of GDP, thus reducing national growth by up to 2% per year. Meanwhile, the general public regards the process of goods, services – and particularly civil works – procurement as lacking transparency, and traditional methods as the main source of inefficiency in public spending.

Implementation of “e-government procurement” – which, on this new view, can be termed “e-supply chain management” – has been considered in the literature as one of the most promising tools for improving the transparency and efficiency of public sector goods and service procurement and management. This new format of integrated management using the tools of e-government is taking shape and gaining strong adhesion in certain sectors of government in Brazil. These developments can be evaluated, taking 2005 as our point of reference, when public goods and service procurement at the federal, state and municipal levels totaled R\$114.2 billion (US\$ 57 billion) or 6% of GDP. Of that total, only 3.5% or R\$4 billion (US\$2 billion) was processed wholly through the Internet (Vieira, 2006). In 2007, the profile of central government had changed and, of R\$23.7 billion in goods and services, 69.4% was procured using electronic auction mechanisms (Brazil, 2008). The central government now uses good practices of e-supply chain management. Adhesion has been greater in some states than in others: in Amazonas, for instance, 80% of procurement follows the same procedures as in the federal government. In both cases, there now exists a culture of comprehensive, electronic management spanning a large part of the supply chain.

Improving supply chain management will not depend solely on introducing electronic systems. The concept of integrated management of materials and service procurement, referred to here as public sector supply chain management (PSSCM), extends from identifying the need for the good or service through to the end of the

asset's useful life or termination of the service contract. This concept is already being advanced by Brazilian experts, prominent among them Fernandes (2002), who argues that we have to abandon the old idea that each procurement is a unique process. We have to introduce the notion of comprehensive supply chain management (SCM) into the public sector.

New knowledge for this text was collected using the following two research techniques in combination: a literature review and a survey of internal and Internet documentation conducted in 249 leading public sector bodies at the federal, state and municipal levels of government in Brazil, for the purpose of discovering what new SCM concepts and processes are being used. The research focused on those government agencies that have advanced most in developing e-government systems. The components and concepts identified were evaluated by way of a questionnaire applied to key Brazilian government informants involved in PSSCM. This text will also discuss cost concerns in the public sector logistics chain using the case study method applied to the State of Amazonas in order to collect information.

This chapter will present a literature review to demonstrate how government in Brazil could contribute to public sector supply chain management and to show the need for an integrating approach to all the processes involved. It will then set out concepts of a method for evaluating the state of development in e-government, so as to inform the choice of agencies from which to extract the processes essential to SCM. Lastly, the study results will identify the processes presently making intensive use of e-government tools in Brazil and what impact these have had on rationalization of public spending, as well as offering an analysis of operating costs drawn from a case study. The chapter concludes by highlighting the evidence of improved current expenditure management using this new approach.

It is both feasible and necessary to combine integrated supply chain management with information and communications technology (ICT), and that combination has enormous financial potential that extends beyond the e-procurement element. There is evidence that other processes – including material and service standardization engineering and specification, vendor registration, strategic procurement and contract management – are also important in this connection. These will be examined below.

E-government and Supply Chain Management

This section examines the need for the public sector to apply e-commerce, combined with modern business logistics concepts, to managing its supply chain – and the feasibility of doing so. Information technology is an indispensable component to all organizational process innovation.

Notwithstanding the financial potential of e-procurement as an isolated system, this chapter will offer input to a discussion on a broader view of supply chain management (SCM). This is necessary, because even in cases of intensive use of e-procurement, as in Brazil, misuse and inefficiency have been observed, reported by the press and signaled in audits by oversight bodies; the main cause being a lack of important components of comprehensive SCM. Among the many arguments in favor of broadening this discussion of integrated public sector procurement systems is their potential for reducing public sector costs and enhancing the transparency of actions throughout the supply chain (Talero, 2001).

ENAP (2002) described how the great majority of Brazilian government agencies were concentrating their endeavors on one part of the expenditure cycle – the procurement process – and confirmed that there was a lack of effort directed to areas of supply where fundamental changes need to be made, both in the methods used to request, procure, use, stock and control consumer goods, and also in the timely reporting so necessary to decision making. This view is gradually gaining ground in sectors of government in Brazil, although still to a small degree.

This discussion needs to be expanded in academic circles. A brief review of the literature reveals that present studies of government spending are concentrated excessively on matters relating to limited aspects of procurement processes, leaving a lacuna as regards comprehensive SCM allied to use of e-government technology tools.

As evidence of this restrictive approach, consider recently published research, such as Eadie *et al*, (2007), which focuses on the difficulties and barriers facing vendor participation in electronic auctions in the highways services segment in Northern Ireland, Panayiotou *et al* (2004), who studied potentially problematical areas in introducing procurement systems to central government in Greece, and Croom & Jones (2005), whose literature review selected important issues relating to experiences in the adoption of procurement systems. Among the subjects most researched, authors

have concentrated on motivational aspects of why governments adopt procurement systems, examining their economic benefits and the cost reduction opportunities. An excellent source of reference are the studies by Piga & Thai (2006), whose book groups supply chain management issues into three areas: procurement partnerships, procurement regulations and ethics and the public contract as a government policy instrument. They report that other issues being addressed in conferences include procurement system reforms, e-procurement, transparency, public-private partnerships (PPP) and the discussion over centralizing or decentralizing procurement platforms. Batran *et al* (2004) examine PPPs as an element in public sector reform in Germany. The literature review by Croom & Brandon-Jones (2007) points to five major areas: changes in total procurement costs, changes in organizational characteristics when new procurement systems are introduced, alteration in structures of governance, system specifications and management of the implementation process. That analysis needs to be extended, given the potential for rationalizing the whole supply chain by using information and communication technology.

E-supply chain management can be implemented on a number of approaches, such as those presented by Lenk & Traunmuller (*apud* Jóia, 2001):

- The citizens' perspective – designed to offer public utility services to the taxpaying citizen so that they can exercise social oversight of the process;
- The process perspective – designed to rethink the *modus operandi* of SCM production processes in the various spheres of government, such as e-procurement processes, public asset management, contract management etc.
- The cooperation perspective – designed to integrate the various government bodies with each other and with private and non-governmental organizations so that the decision-making process can be made more agile without losing quality, while also avoiding the fragmentation and redundancies present today in relations among these various actors. In SCM such a perspective could be used for integrating and constructing systems for common use, such as price banks, unified goods and service registers etc.
- The knowledge management perspective – designed to enable the various spheres of government to generate and manage the

knowledge generated and accumulated by various government bodies on the diverse aspects of e-supply chain management, to use it in training and deploy it in appropriate databases.

In this connection, e-management can be said to offer the best toolset for structuring bureaucracy to control and prevent possible misconduct and to improve the efficiency of governments' internal and external processes. Improvement is possible throughout the PSSCM cycle, using instruments from all the perspectives described above.

Concepts for Evaluating Stages in e-government

The structuring of e-supply chain management to rationalize current spending – being examined here in the Brazilian context – will hinge on identifying benchmark government units to serve as the basis for our study.

In order to evaluate the state of development of e-government in PSSCM activities in Brazil, the relevant concepts must be discussed so as to understand the context. Following Andersen & Henriksen (2006), one first question when assessing the state of development of e-government is whether the activity being evaluated has e-government development potential, i.e. whether activities conducted directly with the clients can in fact be replaced by operations via Internet, given that there are public activities which should be carried out in direct contact with end-users.

Public procurement and supply chain management activities can largely be performed through the Internet – whether on a citizens rights approach (intended to offer public utility services to the taxpaying citizen), the process perspective (rethinking the *modus-operandi* of management and operation processes), the cooperation perspective (to integrate the various bodies of government and government with private and non-governmental bodies) or the knowledge management perspective (to enable the various spheres of government to create, manage and deploy in appropriate databases the knowledge generated and accumulated by the various agencies).

The stages of development therefore have to be traced so as to indicate the level of development of these activities from the perspectives listed above. The first approaches to evaluating stages in this connection were made by Layne & Lee (2001), who proposed four stages of e-government development: presence, transaction, vertical integration and horizontal integration. Their classification

considers variables such as the level of integration and the complexity of the service offered, combined with the level of technology involved. Following that study, other variations and applications arose, following the same basic approach to evaluating government service provision through the Internet. European Commission (2007) evaluates EU member-country services, including public procurement, for stage of development of Internet service provision. The methodology was adapted to evaluate PSSCM in Brazil using the following stages:

Stage 0 - No presence: the public agency responsible for procurement provides no information on purchasing and calls for tender via the Internet or on a website managed by the service provider. It performs SCM operations in the traditional manner, without using ICT tools.

Stage 1 - Information: at this stage, the public agency provides information on calls for tender via the Internet or on a website managed by the service provider or other government department. However, it posts only static publications, with no on-line operations.

Stage 2 - One-way interaction: at this stage, the public department engaged in procurement offers the possibility of downloading calls for tender to be printed for tender submission in non-electronic form.

Stage 3 - Two-way interaction: in this case, some forms - vendor registration, for example - can be completed on-line through the Internet. At this stage, the agency may use other units' e-auction tools. In our case, these can be e-tendering and also posting of procurement legislation.

Stage 4 - Transaction or transformation: at this stage, e-auctions can now be held and registration certificates issued. Auctions can thus be held with no paper procedures. In this case, digital signatures are used to eliminate paper documents. Stock requisition activities are also conducted on-line.

Stage 5 - Personalization: this is the most advanced stage, where transactions are on-line, paper-free and validated by other databases, and the public agency becomes proactive, i.e. it anticipates the necessary activities, such as being able to report supply levels or notify suppliers when certificates expire. At this stage, there is major interaction with external databases, corporate systems, suppliers and other public departments involved in public sector procurement.

These concepts of stages of e-government development serve to map out the most developed Brazilian government units, which were used as reference sources in examining e-supply chain management and its impact on rationalization of government current expenditure.

METHODOLOGY

In order to arrive at a structured set of ideas, exploratory research was conducted to identify supply chain management concepts current in Brazilian government units selected on criteria reflecting the explanatory power of the object under study. The topic investigated arose out of an initial examination of the literature, which pointed to the possibility that e-management of public sector supply chain components would improve management of public expenditure. Using those concepts, the study surveyed archives of paper and electronic documents, to identify how such systems are structured in the units most advanced in terms of e-government. Initially, the sources accessed in order to list functionalities making use of ICT were the Brazilian federal government's *comprasnet* purchasing system and *Siasg* integrated general services system.

The fifty-two important functionalities identified served as the basis for establishing the research questions on supply chain systems, so as to locate the public agencies in Brazil most developed in terms of PSSCM and select them as the study field for indicating the concepts, techniques and components of e-supply chain management and their impact on reform of current expenditure management. The most developed agencies were identified using a customized version of the stage methodology drawn from the studies by European Commission (2007), Layne & Lee (2001) and PNAFE (2005). Using a questionnaire, the survey revealed the existence of 52 functionalities on 249 procurement sites and internal documents of municipal, state and federal government departments, whose current spending represented 70% of overall government expenditure. These were classified into stages by number of functionalities implemented. The components and techniques in place among the set of public agencies classified as at the transformation and personalization stages were inventoried by consulting their systems via the Internet.

Another descriptive study was conducted using a 72-item questionnaire contemplating a set of techniques, concepts and components in use in Brazil extracted from the systems classified in the transformation and personalization stages. This was sent out to 600 key informants in the government management structure in

order to survey adherence to the processes identified as in use and their impact on management of public expenditure. The questionnaire was sent out by e-mail and the reply rate was 9% of interviewees, 70% of whom held a postgraduate degree and more than 10 years as public servants working at the strategic level. Another methodology employed was case studies using real data to identify the cost of public sector e-supply chain management, by way of the main macro-processes, using Amazonas State government as the research source.

In this connection, the research questions that guided our investigation and which were answered in the course of this study were:

- What functionalities present in existing supply chain management systems in Brazil are being implemented to improve the quality of public sector spending?
- What stage of development of e-supply chain management has been reached by the units of government with the greatest volumes of spending in Brazil?
- What impacts on government costs and expenditure have resulted from implementation of e-procurement and technical supply chain management systems in government?

RESULTS AND DISCUSSION

Identifying PSSCM Benchmark Government Units in Brazil

Taking the theoretical frame of reference given by Layne & Lee (2001), European Commission (2007) and PNAFE (2005), the e-government stage methodology was applied to a set of 52 activities in the various stages of the logistics chain at 249 government units in Brazil, representing 70% of current expenditure. These activities, subsystems, concepts and components were listed from a preliminary observation of central government supply chain management. At this stage some bibliographical references and government units' internal documents, such as Tridapalli (2008), were also consulted.

Given that list of references, the next step was to examine the government websites of the set of units mentioned above and their internal documents, from which it was concluded that 4% of the units studied are at the transformation stage, i.e. they offer some 30 services via the Internet. These are the most advanced in Brazil, but have not reached the personalization level, i.e. the level of internal and external integration is low and their activities are not proactive.

The state governments of São Paulo, Goiás, Mato Grosso do Sul, Minas Gerais, Pernambuco, Amazonas, and Bahia, the municipal governments of São Paulo and Curitiba and the federal government are all examples of units at this stage. These units served as sources for inventorying PSSCM components in Brazil. Units classified as at the transformation stage were those that carry out on-line transactions of supply chain activities, in both internal and external operations, in sufficient number to attain the goals of agility, transparency and economy in PSSCM operations. Here 30 important services were identified in the federal government system, which is the most developed in Brazil. Units at this stage are performing on-line operations in vendor registration, e-auction transactions, direct e-purchasing and electronic price quotation, on-line monitoring of the content of operations of both electronic and in-person auctions or other forms of tendering, management of price registration documentation with publicly-accessible information on all active documents and the prices registered, on-line material requisition, electronic budget commitment, on-line consultation on payments and a series of other services operated with the aid to the Internet.

In Brazil only a small group of such units are at the transformation stage in supply chain management, and 96% of the most representative units need to improve their e-government in supply chain management. There are no units at the personalization stage, although the federal government and the state governments of São Paulo and Minas Gerais come closest. This is clear evidence that a great deal of room exists for public authorities in Brazil to advance in improving their supply chain management process, even among the units at the transformation stage.

According to Andersen & Henriksen (2006), further research is needed to understand the reasons for this lack of progress through the stages of development of e-government, including case studies to explore in greater depth these critical issues in the under-use of e-procurement. Moe (2004), which examines cases of under-use of e-government in procurement in a number of European countries, advances some hypotheses. He indicates the causes as possibly high adoption costs in terms of investment in equipment and other IT tools, participants' low levels of technical readiness and also a lack of paradigm-changing attitudes among government managers.

The Research to Identify and Validate Essential PSSCM Components

The units under analysis in this study, which served as the basis for validating e-management components, were Brazilian government

departments at the federal, state and municipal levels, units of the legislative and judiciary, federal and state public attorney's offices and state and federal courts of audit involved in implementing e-procurement and e-supply chain management systems.

Drawing on the authors' research from 2006 to 2007, salient PSSCM sub-systems, techniques and components were identified in Brazilian government units at the transformation stage selected from among a set of 249 units. These concepts were validated by 53 key public sector supply managers in Brazil, who answered a survey questionnaire applied via the Internet with 72 questions relating to salient PSSCM issues, which were put by e-mail to a set of 600 key informants.

The practices being used in these Brazilian units, which will be described here, can constitute a minimum recommended model to other public management units in reforming their management of public expenditure. The initial conclusion from these studies is that, in the universe studied, there is evidence in public management that proper management of current public expenditure requires an integrated approach to the whole chain. There is potential for improvement gains to be obtained across the entire cycle and not just in the act of purchasing, which is the current focus of attention, particularly involving e-procurement.

Of the subsystems used and advocated by researchers and managers in the Brazilian context, those considered here as important are: material and service registration, materials standardization engineering, vendor registration, government e-procurement, strategic purchase planning, sustainable procurement management, total real property cost management, material and service criticality management, management of public procurement from small vendors, public service stock management, purchase follow-up, benchmark price bank management, strategic alliance management, financial and budget management, human resource management, approval of brands and products, management of stock warehousing and physical movement, technical management of relevant cost reduction, including vehicle fleet management, real property management, management of living and travel allowances, consumption management of electricity, water and telephone accounts and other relevant cost controls in each government unit, contract management, strategic management by supply chain indicators, management of official document recording and processing, legal management and legislation, management of price

registration documents, management of transparency and ethics, management of enablement for vendors, internal users and the general public, logistics distribution management, digital signature management, management of funds for small purchases, internal audit management and asset management (Tridapalli, 2008). Each of these sub-systems, such as public asset management (also known in Brazil as “patrimonial management”), deserves in-depth research in order to understand its management logic.

From the field studies involving 53 purchasing managers in Brazil and the Amazonas case study, concepts can be extracted or confirmed for scientific purposes. The first important figure is that 40% of the managers consulted were of the opinion that high priority should be given to supply chain systems, mainly management of procurement, contracts and stocks. They also stressed that use of ICT, allied to government supply chain and procurement management process redesign, yields cost reduction outcomes of the order of 13% to 37% in goods and service prices, depending on what stage implementation of such activities has reached. The most promising results appear early in introduction of this kind of modernization project, as proven in various studies in different contexts and in the specific situation of the case study carried out in Amazonas and presented in the research report, which confirmed this indicator (Amazonas, 2007).

Certain concepts, because of their importance, can now be regarded as a consensus in Brazil and these can and should be incorporated into public sector logistics processes. They include digital signatures, the concept of total real property cost, demand aggregation, integration with corporate systems and external systems, the methodology of goods and service registration and price banks, and principles such as transparency, competitiveness, agility and economy throughout the whole process. More than 80% of respondents to the inquiry made to the 53 managers indicated that these should be high priority concerns. Supply chain management needs more research, particularly in the Brazilian context, so that issues such as the reasons that influence suppliers to adhere to systems making intensive use of e-government can be explored more fully.

A number of authors have now identified capacity-building for public servants involved in PSSCM as fundamental to improving management, and that goes for internal users and outside suppliers as well. Opportunities for training managers and operators in

government procurement, supply chain process management, contract management and stock management must be created and incorporated into government structures. Management in this area calls for computer skills, management expertise and knowledge of the legislation. In the field study, 84% of the managers interviewed pointed to the importance of training activities.

One important point identified on analyzing the research data was autonomy in procurement management. Both the literature and experiences, such as Chile's, indicate that autonomy in purchasing must be accompanied by accountability. One of the major discussions in government procurement is how to obtain the best price by stimulating competition and eliminating corruption. In other situations centralization is more efficient in ensuring effective procurement processes for a price registration system, because it enables demand to be aggregated in order to operate a single process. A balance should thus be struck between centralization and decentralization. The study results indicate a tendency towards centralized management with decentralized operation.

Various studies and experiences have proven e-procurement systems to be highly efficient and there are results encouraging, but there remains the risk of fraud if the system is not protected by other subsystems, such as a reference price bank. In the field study, the managers indicated evidence that gains in procurement are possible not just by making more intensive use of e-procurement; other alternatives include a good supplier register, a register of materials and services with a reference price bank, contract management, stock management and warehouse management. One good option to improve management of this process is to set up procurement agencies or a central managing body to lay down procurement and supply chain management guidelines. Setting up such agencies gives the conditions necessary for a centralized procurement operation with demand aggregation, so as to stimulate competition and process rationalization around groups of products used transversely across the structure of government. Note also that, in certain cases of items of lesser value, decentralization should be considered, but with specific controls, such as a price bank against which to reference purchases. One has to be alert to the opportunities for corruption in the centralization of large-scale procurement: authors, such as Soreide (2006), have identified risks of manipulation by large suppliers in major purchases, even using e-procurement.

In order to give substance to the management model it is fundamentally important to integrate all the corporate systems with the supply chain management system. This is advocated by a number of authors, such as Fernandes (2002), who states that the supply chain has to be approached from a comprehensive management standpoint, and integrated with systems such as financial, asset and fleet management and others in government administration. Public sector supply chain management consists in coordinating the flows of materials and information from suppliers through to end users of the public service. This requires management of processes, such as demand management, client (user) management, material, service and information flow management, vendor management and order management. These management activities require resources, such as organizational structure, systems, leadership and attitudes, management methods and physical structure for the flows of materials, services and information. Such total management can be structured into systems, i.e. procurement, stock management, contract management, strategic performance management, relevant cost operational management, material, service standardization management, follow-up management, all this integrated with the other corporate systems, particularly the financial and budget systems, and the asset management and general protocol systems. During the field study, 84% of the managers indicated that high priority should be given to integration.

E-auctions have been proven to be effective, but doubts remain as to what factors contribute to their effective use. According to figures from the survey conducted in Brazil's states, in 2007 in 51% of the units surveyed the use rate was still very low. There are examples where e-procurement is used intensively, such as the federal government and Amazonas State government, which in 2008 reported rates of 70% and 80%, respectively.

One important issue identified in the field study of procurement managers in Brazil's state governments in 2006 was the need to use digital signatures in PSSCM processes so as to eliminate paper documents completely and thus make for more agile processes. Such use has been proven in some countries, such as Italy, and the technology is established and available for use without major difficulty. In Brazil there is evidence, pointed up in the same study, that the federal government is in the process of introducing digital signatures (Tridapalli, 2008).

There is unanimity in government procurement circles on the need for mechanisms to ensure greater process transparency, permit social oversight and combat corruption, because only then will the conditions be given for achieving optimal results. The study performed with key informants in Brazil indicates that government leaders have not given the issue the importance it deserves, with 60% of the respondents perceiving the importance given by public managers as average to low. Also 80% of the interviewees signaled a lack of transparency. Of the levels of government in Brazil (federal, state and municipal), the most discredited in this regard is the municipal level. The federal government is regarded as the most trustworthy, as a result of its introducing a larger number of electronic operations. On the other hand are Brazilian suppliers' expectations of taking part in these processes, because this is a highly attractive market. Some 74% of the study respondents signaled this trend.

It became clear in the course of the survey that there was a need, in the a model, for procedures relating to material and service standardization engineering in order to make procurement more agile and eliminate unnecessary stocks, in addition to a good materials and service register to permit appropriate purchasing and facilitate follow-up and technical stock management, including techniques for reducing idle stock levels and planning to improve response to demand.

All the functionalities discussed for a supply chain management system will produce optimal results only if managed on a strategic approach, setting clear goals aligned with the institution's overall strategy that are monitored by a set of indicators, such as proposed by Vaidya (2004), which can indicate action plans to achieve the proposed goals. According to Gaspareto (2003), among the models studied, the Balanced Scorecard has basic stages that can help structure performance evaluation in any environment where performance is to be evaluated and can thus be employed as a "backdrop" for structuring performance evaluation in a supply chain. This model is gaining wider acceptance.

In the field study, digital signatures, material and service standardization engineering and strategic management were validated as components with at least 80% approval from the interviewees. The managers interviewed indicated that restoring Brazilian public sector investment capacity depends largely on the PSSCM measures presented here.

Another important item of information added in this text is supply chain costs. This information was obtained by the Amazonas State case study in 2007, by applying the Activity-Based Costing (ABC) method to reduce the distortions caused by arbitrary assignment of overheads. This study identified procurement process costs and other supply chain process costs, concluding that current expenditure management cost R\$89.3 million in executing 12,150 processes, of which 1,110 were electronic material and service procurement tenderings, 490 civil works contract processes, 11,040 direct procurement processes and 84 purchases centralized in price registration documents in order to aggregate demand. In addition to procurement costs, management activities were performed to maintain current contracts and renew those that expired in 2007. Considering total supply chain cost and the number of processes, it can be concluded that the unit cost of each procurement process was R\$6,760.00, including purchase planning, process preparation, tendering, providing legal support to the processes, management, contracting and warehouse management, which represent 5.7% of current expenditure, including all stages of the logistics process. Note that this cost was calculated regarding only procurement as electronic, with the other processes still operating on the traditional system, because at the date of the study in 2007 the state government was at the final stage of implementation of the other stages of the logistics process. There is therefore room to reduce these operating costs by more intensive use of e-management.

All the sub-systems mentioned above can be disaggregated into functionalities that will make up the e-systems, particularly e-government practices operating from the various perspectives and/or organizational processes with direct impacts on reducing operating costs and unit procurement costs. Governments' definition and implementation of such sub-systems should be gradual and integrated with their internal and external processes, organized in a project management process making intensive use of ICT and process structuring tools.

The Impact of E-management on the Public Sector Supply Chain

PSSCM using the tools of e-government is an important process for improving the economic and financial performance of public administration, because by rationalizing current expenditures it frees up resources for investment, thus making for more efficient management.

Figures on public finances from Brazil's official statistics institute, IBGE (*Instituto Brasileiro de Geografia e Estatística*) show that in 2003 public sector supply chain-related expenditures represented 8.8% of total budget. At the municipal level, the figure was even more substantial (36.5%). In the states, the mean was 17.8%. Government investment capacity was 2.3% of total expenditure, while at the state and municipal levels it was 5.4% and 10.3%, respectively. Public power in Brazil has gradually been recovering its direct investment capacity, which by 2007 represented 3.02% of total budget (Brazil, 2009).

One way for governments to recover this investment capacity is by improving the quality of expenditure through proper management of the logistics process. A number of government units in Brazil have lost, or are losing, their investment capacity, as in the case of Rio Grande do Sul State, while others, such as Minas Gerais State, have recovered theirs by a "management drive" to rationalize expenditure, particularly operating costs. The processes mentioned here are not applied intensively in Brazil, despite their considerable financial appeal, demonstrating that enormous opportunities exist for boosting public sector investment capacity.

This financial potential has been identified in specific regions, such as Amazonas State, which - even with only partial implementation of e-SCM, without all the components mentioned above, i.e. contract management, stock management, standardization engineering - is already producing results (including real price reduction gains averaging 30%), which represented an economy of around R\$212 million in purchases effected in 2007, as announced in the government message (Amazonas, 2008). Another state where SCM includes functionalities integrated between stages of the logistics process is Pernambuco, which reported mean savings of 32.1% on an estimated purchasing volume of R\$1.2 billion from 2003 to 2007 (Pernambuco, 2007). Paraíba State, which embarked on implementation of its SCM system with partial functionalities in 2006, has already been able to demonstrate gains from its e-procurement system, with Paraíba (2009) reporting a purchase volume of R\$614 million from 2006 to 2008 and savings of 36.2% on that estimated volume. The federal government reported gains of R\$3.6 billion in 2007, even though not fully using all the potential of PSSCM (Brazil, 2008). São Paulo State reported savings of the order of R\$6.9 billion on purchases and R\$14.1 billion on contract management (São Paulo, 2007). There are thus several examples to demonstrate the system's feasibility and financial potential. These

results were possible thanks to the incorporation of fundamental principles, such as greater process transparency, integration, agility, use of ICT-based e-management, and economy, in addition to the implementation of a good number of stages of the logistics process. This evidence (mean savings of 30%) suggests that, taking 2007 as the base year, Brazilian government could increase its overall mean investment capacity from 3.02% to 6% of total expenditure, representing more than R\$52 billion a year, by e-management with the components mentioned here (Brazil, 2009).

At the outset, from a review of the literature, this chapter endeavored to demonstrate the need to use ICT in government supply chain management. From the results shown above, there is strong evidence that the intensive use of ICT is fundamental to improving the process. There is also evidence that in order to attain socio-economic goals in public spending management, it is not enough to act on part of the supply chain process, using e-procurement, but rather the whole cycle must be considered.

CONCLUSION

The main aim of this chapter has been to examine the impact of e-supply chain management, identifying the components where this could be introduced and demonstrating its importance to management of public sector expenditure and its potential economic results.

To begin with it was shown that simply adopting e-procurement is not sufficient to exploit fully the potential for management of public sector current spending, and that other opportunities for improvements exist if the approach is broadened to the other stages of the supply chain. The broader potential for results is as promising as for those from e-procurement.

Important instruments that can be incorporated into the logistics process include material and service standardization engineering, price banks, procurement process management, stock management, contract management, price registration system management, individualized management of consumption of significant public sector budget items, vendor management, audit management and warehouse management. All these should be addressed on an approach designed to integrate internally with the corporate systems and externally with vendors, society and other government bodies, making intensive use of information and communications technologies (ICT), process virtualization, proper levels of ethics,

trained staffs, engagement of small and medium-sized vendors, demand aggregation, strategic alliances, scheduled payments, encouragement for competition, follow-up activities, and all within a system of strategic management with management performance indicators.

The shared use of supply chain management (SCM) systems developed by central agencies with the components proposed here can help improve management and reduce operating costs, particularly for small and medium-sized units of government, because limited technical and financial resources and the lack of motivation on the part of government leaders contribute to low levels of development and thus to degradation of the quality of public spending.

In the opinion of procurement managers, the process still faces an acute crisis of credibility, concentrated more on the states and municipalities. Nonetheless vendors continue interested in participating in this segment of the market. In the case of Brazil, it has been demonstrated that there is a great deal of room for using these logistics process management tools. Applying the evaluation methodology by stages of e-government development in the supply chain shows that 96% of units have potential for improvement, because they have yet to reach the transformation stage, i.e. they are at the earlier presence and transaction stages, or in extreme cases, the “no presence” stage.

Advances in this field will call for firm commitment from government leaders and well-prepared technical staffs. As there is no margin for increasing the tax burden, due to strong public resistance, the only way for public authorities to boost investment capacity is to rationalize the use of current spending through e-management tools, which in the Brazilian case has been shown to be feasible.

This fills a knowledge gap in Brazil on salient aspects of this very important issue of reform of public expenditure management. Other substantial questions that remain for researchers to answer are: What is the real impact of comprehensive PSSCM use in terms of reducing current spending? What factors can influence participation by vendors, the general public and public servants in e-procurement and in e-supply chain management? How can shared management systems and partnered public sector procurement be implemented at the various levels of government?

It must be stressed that research in this field in Brazil is still tenuous, so much so that there are few publications addressing this subject in Brazilian and international journals. The suggestion here is thus that other researchers take interest in the issue.

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