Outsourcing of Software Development in Brazil and the United States

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ABSTRACT

Outsourcing of information technology by the federal government has been a growing reality since Law 200 of 1967, wherein the legislature sought to reduce the size of Brazil's governmental apparatus, which was then causing bureaucratic problems and hindering growth of the government sector. This article proposes to analyze the evolution of this mode of contracting by Brazilian public agencies, as well as their adherence to present-day software development practices. It also includes a qualitative study of the model for contracting and developing software and compares it to the U.S. Government model. The United States was chosen as a reference for this study because it is the major world consumer of individual IT and has political similarities to Brazil, such as a presidential, capitalist regime and comparable population size.

Key words: Brazilian Government. Contracting. Law. Law 8666, Outsourcing. Software Development. United States Government.

1. INTRODUCTION

The quest for administrative excellence often collides with needs that go beyond the corporation's primary competencies. Moreover, some managers

still believe in their ability to increase company profits by internally carrying out all the service stages necessary for the company's operation. However, in maintaining this stance they risk losing their business focus, suffering damage, and even moving towards insolvency (Cury, 2000; Oliveira, 2004). The evolution of information technology has been very dynamic with new technologies constantly being created, provoking a race among companies attempting to maintain their market position (Boehm 12-29).

The cost of accompanying this evolution is very high and it causes many organizations to delegate information technology activities to outsourcing companies in order to remain technologically up-to-date. Thus, the practice of outsourcing rather than developing projects in-house has become a tool for a competitive differential among businesses.

According to Barthélemy and DiRomualdo, the reasons companies opt to outsource have been well-documented and include cost reductions, better performance and access to broader labor markets (Barthélemy et al. 60-69; DiRomualdo et al. 67-80). Nevertheless, contracting out software development involves complex legal, economic, management and technological issues (Whang. 307-324; Lacity et al. 13-25) which should be meticulously assessed prior to taking an effective decision to opt for this

route. Delegating the creation of software to third parties has proven to be no trivial question, despite myths such as outsourcing always being the better choice because it means cuts in costs and personnel (Hernandes, 2007).

The move to outsourcing is also a reality among Brazilian government companies (Hazan 1). The quest to improve processes through information technology tools is a growing reality in public administration, which looks to IT as a tool to increase its capacity to meet the needs of the public. Nevertheless, this concern is not recent as can be seen in Decree 200 of 1967 that regulates the organization of the federal public administration. In this decree the legislature establishes guidelines for administrative reform and its third chapter contains provisions for decentralizing public administration:

> Art. 10. The execution of federal administration activities should be broadly decentralized [...]

> § 7° To better free themselves of the tasks of planning, coordination, supervision and control, and in order to impede uncontrolled growth of the administrative machinery, the administration will seek to unburden themselves of the material realization of executive tasks, having recourse whenever

possible to indirect execution via outsourcing if private enterprise is sufficiently developed and capable of performing executive duties. (Decree Law 200, Brazil, 1967),

Outsourcing is a reality among state-owned companies. But could there be a management system that makes full use of this tool and provides return value, thus generating gains for society? Do the laws that regulate contracting allow the software creation process to be complete, and make transparent and productive contracting possible? The aim of this article is an ethnological study which analyzes the knowledge, beliefs, laws, customs or habits acquired by people as members of society (Edward Tylor, 1871), analyzing the laws that regulate the software contracting process inside the Brazilian and American public administrations. Our proposal presents both pros and cons through practices recognized by the national and international markets. This article also intends to propose changes that can add value to the contacting process in the Brazilian public administration.

2. OUTSOURCING

Monitoring the evolution of information technology has not been an easy task, and in this context both private and public companies need tools that can aid them in meeting this challenge. Thus, contracting outsourced labor has become a tool often used by these companies (Barthélemy et al. 60-69; DiRomualdo et al. 67-80). According to Vazquez, there can be several levels of outsourcing, from writing software code up to outsourcing of the entire systems team (2004).

Other authors have identified features that justify this choice as a way for the contracting party to be relieved of responsibility for the final product (Hernandes, 2007). However, in his article, Pinheiro states that an organization which has not reached maturity in its acquisition process has the same potential for failure as those whose development still lacks consistent processes, and that the biggest problem detected in software acquisitions has to do with management practices inside the companies (Pinheiro, 2006).

Guerra also maintains that organizations must have maturity in their internal processes to manage software development contracts in order to achieve all the expected results. He defines maturity as the ability to manage software development and the maintenance process; in a mature organization the software process is carefully communicated to the existing team and to new personnel, and work activities are undertaken in line with planning, monitoring product quality and customer satisfaction (Guerra, et al. 232).

2.1 DIFFICULTIES

It is well known that characteristics inherent to the information sector can make it difficult for companies and government agencies at the time of acquiring or contracting software. Hernandez highlights four problems: (i) changes in requirements – since contracting delays within public administration cause the requirements found at the beginning of the process to undergo changes; (ii) labor turnover – the information technology market characteristically exchanges professionals among companies in the sector; (iii) loss of knowledge at the end of the contract period – contracts between public companies, often have a limited duration, requiring them to use knowledge management techniques in an attempt to ensure that the knowledge about the product developed remains in the contracting company; (iv) lack of knowledge about integration of work processes – many organization bid out software without broader knowledge of their own work processes and the correlations existing among them (Hernandes, 2007).

Outstanding among the problems presented is the change in requirements during the contracting and development process since, according to Hernandes, the scope of software is usually defined at the start of the project, but will rarely remain the same throughout (2007). According to Watts Humphrey, "Requirements in a system will not be totally known until users have used it" (1995). Peter Wegner further states that "it is not possible to completely specify an interactive system" (1997). However, there is the illusion in the market that it is possible to develop software without modifications and for that reason fixed scope contracts are signed which the client believes have predictable costs, timeframes and scope. The field of requirements engineering recognizes that requirements do not remain static through to the

conclusion of software projects. Many factors make them evolve from their conception to delivery (Kotonya, 1998). Also worth of note is Hadar Ziv's statement that "uncertainty is inherent and inevitable in development of software, processes and products" (1997).

3.   BRAZILIAN LAW

Even when they need training for more effective management, state-owned companies are ruled by norms. Contracting by Brazilian public agencies is regulated by various laws, decrees or normative instructions. Among these, the most noteworthy is Law 8666 of 1993, also known as the Law for Public Bids and Contracts, which establishes:

> Art. 1° - This law establishes general rules for administrative bidding and contracts for works, services, including publicity, purchasing, divestiture, and leasing within the scope of the authority of the federal, state, Federal District and municipal governments. (Brazil, 1993).

Upon first analysis of this law, one observes that the legislature sought to assure that public resources were well employed when contracting, purchasing, divesting or leasing property and services. Its text specifically refers to information technology in the following excerpts:

> Art. 24. The bidding process is indispensable […]

> XVI - […] for information technology services provided to domestic government entities, to organs or agencies that make up the public administration, created for this specific purpose;

> Art. 45. Judging of the proposals shall be objective, and the bidding committee or those responsible for the call for bids shall do so according to the type of bidding, the criteria previously established in the official convocation and in accordance with the factors referred to exclusively therein, and in such a way as to make it possible for bidders and the control agencies to monitor the process. […]

> § 4° When contracting information technology goods and services, the administration will observe the provisions of Article 3 of Law 8248 of October 23, 1991, taking into account the factors specified in paragraph 2 and is obliged to adopt the "best technique and price" bid type, while permitting the use of other types of bids in the cases listed in Executive Decree (Law 8666 Brazil, 1993).

The following analyzes the context at the time of the creation of the law and the present time.

3.1   THE CONTEXT OF LAW 8666 OF 1993

Information technology in the 1980s focused on sequential processes. Thus, computing systems followed the cascade development approach whose main feature was the requirement to close out the previous stage before beginning the next. This model dominated the way software was developed until the beginning of the 1990s. However, authors such as Frederich Brooks warned of problems generated when a sequential view of tasks is adopted (Brooks 10-19). Tom Gilb discouraged the use of the cascade model to create large software, believing that incremental development was more productive and presented fewer risks with greater possibilities of success (Gilb, 1999).

Nevertheless, the law of public bids and contracts determines that contracting software development contracts should contain characteristics similar to those of an engineering project, in which the planning stage is done with knowledge of all the requirements for project development. This feature can be identified in Law 8666/1993, wherein the legislature determines in Section III – Works and Services that:

> Art. 7° - Bidding for works and services delivery will obey the provisions of this article and specifically the following sequence:
> I - Basic project;
> II - Executive project;
> III - Execution of works and services;

> § 1° - The execution of each stage will be preceded by the conclusion and approval of work related to earlier stages by the designated authority, except for the executive project

which can be developed concomitantly with the execution of the works and services if also authorized by the administration (Law 8666, Brazil, 1993).

The need to obtain all software characteristics while still in the planning stage is evidenced in the definition of the basic project in the law itself:

> Basic Project – set of necessary and sufficient elements with an adequate level of precision to characterize the work, service, or complex of works and services subject of the bid, elaborated on the bases of indications in the preliminary technical studies that assure technical viability and the adequate treatment of the environmental impact of the undertaking, and which makes it possible to evaluate the cost of the work, definition of methods and timeframes for execution; it must contain the following elements:

> [...] f) detailed budget of the global cost of the work, based in units of services and provisions which have themselves been evaluated; (Law 8666, Brazil, 1993).

Item f of the law reveals the legislature's belief that a project to be bid out can have total knowledge of all the customer's needs while still in the planning stage. This belief reveals the gaps in the legislature's knowledge of the information technology area. According to Frederich Brooks in No Silver Bullet: Essence and Accidents of Software Engineering, the idea that projects contain the total software specifications prior to the start of implementation is impossible (Brooks 10-19).

3.2   ADAPTATION OF THE LAW

Data from the Standish Group in 1995 which used a database of 8,380 software projects showed that only 16% of these projects were delivered within the agreed-upon timeframe and cost, and with all the specified functionalities; 32% were canceled prior to completion, and 52% were delivered with higher costs and longer timeframes or with a lack of the functionalities specified at the time of project initiation. According to the same study, in cases where projects respected the time

and cost limits, aspects of low development quality were observed, resulting in high numbers for corrective maintenance. As a result of this analysis, the study identified that the main reason for the faults discovered was the use of the Classic Model of development. In its final conclusions, the study recommended that software be developed in an incremental manner (Standish Group, 1995).

In attempting to regulate Brazilian legislation related to bidding for information and automation services, the President of the Republic, through the Office of the Chief of Staff, published Decree 7174 of May 12, 2010, which regulated contracting procedures for information technology by Brazilian government agencies, despite the fact that this decree seeks to regulate the provisions of Law 8248 of October 23, 1991, revokes Decree 1070 of March 2, 1994 and alters Decree 3555 of August 8, 2000. Upon first analysis, one observes that this decree contains greater detailing of themes dealing with hardware acquisition in detriment to software acquisition, as well as requiring the cascade approach to development, and requires a survey of all project characteristics while still in the planning phase; these remained obligatory under this decree as can be seen in the following article:

> Art. 2° Acquisition of goods and services for information technology and automation must be preceded by contract planning, including the basic project or terms of reference containing the specifications for the object to be contracted [...] (Decree 7174, Brazil, 2010).

The Brazilian legislature's distance from the realities of software development can be observed, because since 2001 with the advent of the Agile Manifesto, there has been a veritable revolution in the way software solutions are created, using the following methodological pillars: individuals and interactions over processes and tools; working software over comprehensive documentation; customer collaboration over contract negotiation, and responding to change over following a plan.

4.   UNITED STATES LAW

The legislature's main justification at the time it required that complete planning for services be accomplished prior to their start up was to assure

transparency in public entities' bidding processes. But, wouldn't it be possible to have guarantees of frankness and transparency for government agencies and state-owned companies simultaneous with the application of good practices in software creation? The U.S. Government signaled this concern by publishing the Clinger-Cohen Act proposed by Representative William Clinger and Senator William Cohen in February 1996. It revoked the 1965 Brooks Act, which had amended the Federal Property and Administrative Services Act of 1949.

In February of 1996, the United States Congress approved the Clinger-Cohen Act with the objective of reforming and improving the manner in which federal agencies acquire and manage IT resources. The central point for implementation of these reforms was the need to establish IT leadership inside each government agency. This law decentralized authority and responsibility for acquiring information technology resources; it unified the laws for information technology management reform and the Federal Acquisition Reform Act. The Clinger-Cohen Act of 1996 created the position of Chief Information Officer (CIO) in an attempt to give more attention to results that might be achieved by IT investment, at a time when the idea of making large-scale IT investments was relatively new. The Clinger-Cohen Act emphasized rigor and structure in the way some agencies should select and manage IT projects. Under this law, the CIO became responsible for establishing the visibility and management needed to fulfill the law's specific provisions; the position had the following basic attributions: help to control risks in developing systems, better administer technology expenditures, and achieve real and measurable improvements in agency performance.

Through the Clinger-Cohen Act, the U.S. Government presented the guidelines for software development, e.g. planning, control of investments to maximize value, risk assessment/management in information technology procurement, and contracting large information technology systems in a modular manner as prescribed in the law:

> [...] Use modular contracting to the extent possible when acquiring larger systems for information technology [...] (Clinger-Cohen Act, USA, 1996).

Section 4.1 as follows, explains the temporal context of the American law; while Section 4.2 takes up the issue of modularization again.

4.1   CONTEXT OF THE CLINGER-COHEN ACT

Before analyzing the content of the Clinger-Cohen Act of 1996, the context at the time of its enactment must be understood: Marc Andreessen in his article Why Software is Eating the World (Andreessen, 2011), says that in 2013 software would begin to eat the U.S. federal agency contracts, and that federal budget reductions would provoke significant cuts in work positions. According to Rockwell Collins, budget pressures and the capacity of resources directly affect contracting by the U.S. Government, and sums up the present day budget pressures as, "uncertainty without precedent for all the companies that support the Department of Defense". Budget pressures obliged companies to seek cost reductions through firing workers or by using intelligent software solutions, causing the consumption described by Marc Andreessen to be considered in all government contracting, especially for information technology.

Despite the fact that Collins' article alleges the non-existence in earlier years of budget pressure on companies that work for the U.S. Department of Defense, budgetary discipline and expenditures on information technology are not new to other companies around the world. As Augustine says, the reality is that for a long time project managers have had to deal with budget reductions for their projects, as well as reduction in their teams (Augustine 70-74). In turn, Earl claims that outsourcing of information technology was born of the need to cut costs and to reduce personnel due to growing expenditures on the information technology sector (Earl, 1998), while Wang also lists among the motives that lead organizations to outsource their information technology area is lower production costs (Wang 24-50).

4.2   ADAPTATION OF THE LAW AND MODULARIZATION

To aid government and state-owned companies in complying with the Clinger-Cohen Act, the White House published Contracting Guidance to Support Modular Development which

sought to orient CIOs in applying this law, seeking greater benefits for government and warning of the risks existing at the time of contracting software. As can be seen, there is a concern on the part of the U.S. Government to assure that resources applied to solutions can effectively return value to taxpayers.

> ...responsible development needs complete detailing of requirements prior to the commencement of work. While this is an apparently reasonable hypothesis, practice and experience in the private sector have shown that large, complex implementations of IT frequently stumble over costs and delays in their timetables, since a meticulous process of collecting requirements often takes year to conclude. [...] Government increases its investment risks in these situations because: (1) IT solutions might no longer be necessary or seen as priorities after requirements are surveyed; (2) elevated resources are allocated for outdated solutions without any return on investment, or (3) government-owned companies can experience budget cuts before the final delivery of software (CGSMD, 2012).

In a deeper analysis of the guidance, we identified characteristics recognized as agile in the area of information technology:

> Assuring customer satisfaction though early and continuous delivery of valuable software: deliver working software frequently (weeks instead of months); use working software as the main measure of project progress; even late changes to the project scope are welcome; constant cooperation between the business people and the developers; projects arise though motivated individuals, and there must be a relationship of

trust; software design should value technical excellence; simplicity; rapid adaptation to change; individual changes, and interaction over processes and tools; working software over extensive documentation; collaboration with customers over negotiating contracts; responding to changes over following a plan (Agile Manifesto, 2001).

The stance the U. S. Government takes is adherent to the market according to Charette who in his article compares agile methods with the traditional weighty methodologies and demonstrates that projects using the agile model achieve better results in terms of timeframe, cost and quality (Charette, 2001).

5.   COMPARISON OF THE LAWS

Upon first analysis of the U.S. Clinger-Cohen Act of 1996 and the Brazilian law for Public Bids and Contracts No. 8666 of 1993, we find in both the need for budgetary discipline and fulfillment of the federal government's strategic plans in both countries, which are little different from existing budgetary guidelines in all governments. However, the major difference found is in the concern of the U.S. Congress in determining that large information technology projects should be delivered in the modular manner, believing that this practice allows for fewer project risks and makes possible a greater, more immediate return on investments made in the solution. According to Contracting Guidance to Support Modular Development:

> small, quick deliveries by the information technology area allow taxpayers to receive a working product before the end of the project, and if needs changes, these can be made without loss of time or resources in developing

new solutions, moreover, this approach permits, "the IT area always to be included in new market solutions." (CGSMD, 2012)

Returning to Law 8666/1993 one finds no reference to prohibit modular development by Brazilian companies. Nevertheless, the need for a complete survey of the solution before the start of creation, and the obligation to begin one stage only after having terminated the prior stage, make contracting solutions by modules very difficult. Moreover there is a lack of regulation to encourage this practice inside the Brazilian government.

Can we then conclude that the U.S. Congress better adheres to modern software development practices recognized worldwide, allowing American government agencies to take better advantage of resources invested in developing software solutions? Did the Clinger-Cohen Act manage to meet the need for good management of government resources, i.e., that the thing being purchased is right for the right reasons? How does one know?

In 2006, Tom Davis, President of the Committee on Oversight and Government Reform, said, "Since the passage of the Clinger-Cohen Act the government has begun to take a holistic approach toward information technology, using it to resolve business problems and achieve performance improvements. We have a long route to travel, but the giant that is the federal government is well on the road to the twenty-first century."

According to Andrues, "The Clinger-Cohen Act and the laws and regulations that succeeded it are all part of an elementary impulse to impose limits, to demand organizational results and establish a basis to account for expenditures." The imposition of structure, nonetheless, is only one part of what will be necessary to make the Clinger-Cohen Act the change agent that it was projected to be. What is even more necessary is good news, and the story tellers should be the federal CIOs. They should cultivate an environment in which results can be proven, exalted and put on display. They should create conditions for achieving definitive improvements through information technology.

6.   CONCLUSION

The law must be honest, just and created for the common good of citizens and not for the benefit of private parties,compatible to the nature and the customs of the time; necessary, usable, and clear, without obfuscation that raises questions" (Santo Isidoro de Sevilha).

The law is the result of social reality. It emanates from society through its instruments and institutions destined to formulate the law, reflecting society's objectives, as well as its beliefs and values, the complex of its ethical and final concepts (Herkenhoff, 1993).

Thus, one cannot analyze laws without delving deeper into the social environment, including family, school, clubs, churches, work, and others. It should be understood that laws, usage, traditions and customs must be understood as flexible and dependent upon the time, beliefs or locations which differ among states, countries and continents. Something could be considered absurd in a given epoch or place, while in another it might be right or accepted. A law cannot be analyzed without understanding beforehand the time or location in which it was promulgated, or the truths in which it is based. A law is related to the context of its creation, taking into consideration social structures such as family, society, culture and belief systems.

In proposing to analyze the differences between the laws ruling software bidding in Brazil and the United States, we come across this reality and once can identify the evolution of the software creation process in public agencies in these two countries. One observes that laws evolve to meet the different ways of creating solution in information technology. They experience regulations that are more concerned with hardware, others more up-to-date and focused on software. Presently one can observe greater concern by the legislatures, especially the U.S. Congress, to assure that the software delivered meet the needs required and that it also provide a greater return for society.

During the work, it was perceived that the pillars of success for a software creation project – timeframe, cost and quality – are improved when agile methodology is applied, lacking only the fourth pillar, scope, which as defined by this methodology, should be flexible and seek to meet the customers' needs. Despite agile methodology still being in its early phase in 2001, it had already demonstrated consistent results as described by Charette when he compared agile

and traditional methodologies and showed that projects using this methodology obtained better results in meeting deadlines, cost and quality standards. This same study shows that the number of projects and teams using agile methodology grew in the IT environment (Charette, 2001). The major characteristics of agile methodologies are acceptance of change to requirements during the software creation process. He believes that in this way it is really possible to deliver to customers the products they need, without sacrificing the process and tools, documentation, contract negotiation or planning. Simply put, the agile methods consider the importance of these to be secondary compared to the individuals and interaction with working software, with customer collaboration and with rapid response to changes and alterations (Agile Manifesto, 2001).

Thus, contrary to the determinations of Brazilian law, the software project scope must be flexible in order to guarantee that the other pillars can be in place within the customers' expectations, assuring defined costs, timeframe and quality. But for this to happen it will be necessary to revise Law 8666 of 1993 in which the concept of the basic project needs to become more flexible. Moreover, following the example of the U.S. Congress, it is suggested that the Ministry of Science and Technology publish a guide for software contracting guide for the Brazilian government's public and state-owned companies, that software be created in modular form and adhere to agile development methodologies, since it is currently believed that the agile approach could be the big tool that will enable the Brazilian government to attain its objectives.

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