A managerial framework for an Electronic Government Procurement Project: Complex software projects management fundamentals

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Abstract

An Electronic Government Procurement (e-GP) project, as most of complex software systems development and implantation, requires sophisticated and strong managerial concepts and skills. So, an effective and consistent managerial framework is needed. Traditional project management models, that propose a series of good practices and tools, must be extended, modified and improved to face, as an example, Electronic Government (e-Government) applications. These additional capabilities are very important in the environment of e-GP projects.

This paper describes a specific managerial framework adopted to face an e-GP project, at an argentine province level, with Inter American Development Bank supervision and finance support. The proposal includes a scheme where Software Engineering Institute's (SEI) Capability Maturity Model Integration (CMMI) is complemented with Project Management Institute (PMI) points of view included at Project Management Body of Knowledge 3rd Edition (PMBOK)

This paper could be useful for software engineers oriented to e-GP applications development and implantation, others e-Government applications and also, in general terms, in the field of complex e-Business projects.

Keywords: e-GP, Electronic Government Procurement projects, e-Government, Capability Maturity Model Integration, Software Project Management
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1. Introduction

According to a generalized point of view, e-Government applications development and implantation are very risky projects. Governmental environments, especially in Latin America, imply important challenges for project managers. [1]

There are many different software engineering and project management models that propose a series of both good practices and efficient tools that can improve project management capabilities.

This paper describes the experience combining SEI' s CMMI [2] and PMI [3] recommendations in the context of an e-GP project. This management scheme was

developed to have an effective software project management methodological framework. The scheme was developed to complement SEI recommendations in a very complex project were change management, communication (both internal and external) management, motivation management, return on investment management [4] [5] and scope management are very important project components. As a paper key idea, we are suggesting that, when a software project has a very complex implantation environment and when a fully distributed web system (both core application and workflow tools) must be develop and implanted, SEI' s CMMI is good but not enough as a managerial reference framework.

We explain how we designed and implemented (first stages) the methodological framework, how the practices proposed both by SEI and PMI were tailored to the project's needs and available resources, and we also summarize the benefits obtained and to be obtained using the proposed scheme.

This paper's issues could be useful for development and implantation teams oriented to implant not trivial e-Government application in very complex environments as governmental areas usually are.

2. Sources of concepts and tools
2.1. The CMMI

According to the Carnegie Mellon University [6] Software Engineering Institute, CMMI is a common-sense application of software or business process management and quality improvement concepts to software development and maintenance.
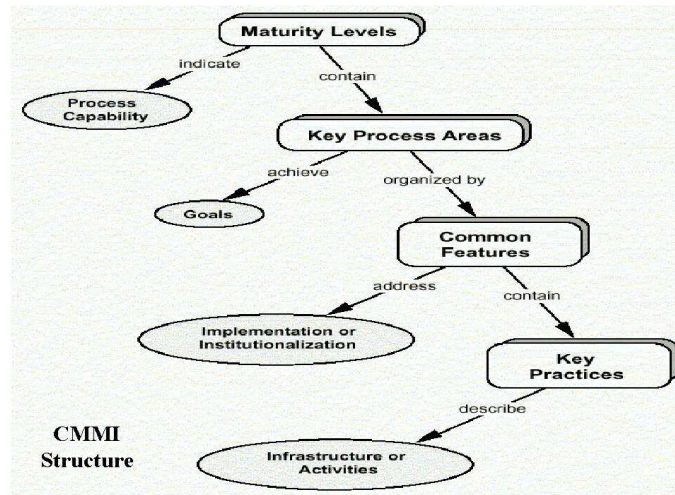
It is a community-developed guide for evolving towards a culture of engineering excellence, model for organizational improvement. The underlying structure for reliable and consistent software process assessments and software capability evaluations.
The Capability Maturity Model Integration for Software (CMMI) is a framework that describes the key elements of an effective software process. There are CMMI concepts and tools for no software processes as well, such as Business Process Management (BPM) [3].

The CMMI describes an evolutionary improvement path from an ad hoc, immature process to a mature, disciplined process. The CMMI covers practices for planning (partially), engineering, and managing (partially) software development and maintenance. When followed, these key practices improve the ability of organizations to meet goals for cost, schedule, functionality, and product quality. The CMMI establishes a yardstick against which it is possible to judge, in a repeatable way, the maturity of an organization's software process and compare it to the state of the practice of the industry. The CMMI can also be used by an organization to plan improvements to its software process. It also reflects the needs of individuals performing software process, improvement, software process assessments, or software capability evaluations; is documented; and is publicly available.

The CMMI has two representations:

a. The staged representation groups in 5 maturity levels.
b. The continuous representation groups in 4 process categories:
-   Project management
-   Process management
-   Engineering
-   Support

The CMMI defines 25 process areas and more than 500 defined practices. Process areas define several specific goals and a cluster of related practices performed collectively to achieve those goals. They are the major building blocks in establishing the process capability of an organization.

Each process area has been defined to reside at one the 5 maturity levels in the staged representation. To reach a given maturity level, the organization has to satisfy the goals associated with all the process areas at that level and below.
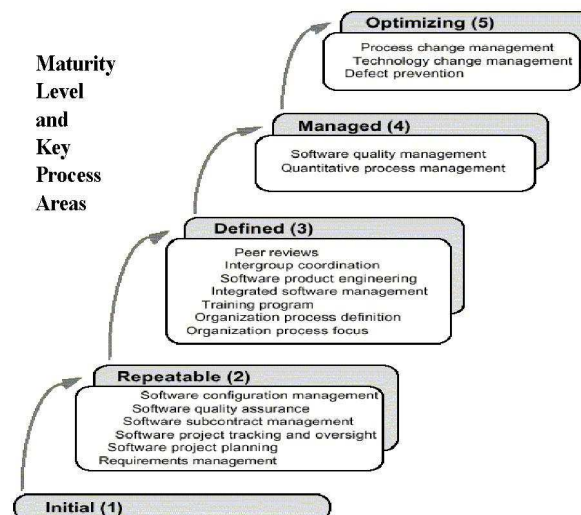
In the continuous representation, the process areas are organized in 4 groups. In a formal appraisal, a capability level from 0 to 5 is assigned to each process area, thus defining the capability profile of the organization.

2.2. The Project Management Institute

Project Management Institute (PMI) [8] is the world's foremost advocate for the project management profession. A vital and forward-thinking organization, PMI is comprised of 247 chartered chapters, 16 new potential chapters, 30 Specific Interests Groups (SIGs) and two colleges. PMI sets industry standards, conducts research and provides education, certification and professional exchange opportunities designed to strengthen and further establish the profession. PMI advances the careers of practitioners, while enhancing overall business and government performance, through documentation of return on investment.

According to PMI, project management is a strategic competency. PMI point of view has successfully been applied in high profile projects around the world.

2.3. Guide to the Project Management Body of Knowledge, (PMBOK Guide); Third Edition

This reference guide was recently adopted by the American National Standards Institute (ANSI) as the standard for the exploding field of Project Management. It is accepted as a global standard. This new edition updates and expands the knowledge base and practices applicable to most projects most of the time. It serves both career professionals in project management, as well as managers of all types who need these tools to manage the proliferation of project teams in both corporate and government organizations.

The Project Management Body of Knowledge is a project management model developed by PMI that summarizes the knowledge available, around the world, in the project management discipline. The PMBOK documents a set of good practices that have been generally accepted to be effective in this discipline. The model defines 39 processes organized in 5 groups:

a. Initiation: includes 1 process to create the project.
b. Planning: defines 21 processes to elaborate the project plan.
c. Execution: defines 7 processes to execute the tasks included in the project plan, including quality assurance and subcontractor contract administration.
d. Control: defines 8 processes to control the project's performance, report results, and manage changes in the scope, budget and schedule.
e. Closing: includes 2 processes for closing out the contract with the subcontractor and finishing the project.

Each one of the 39 processes proposed in the PMBOK is defined as a set of inputs, tools and the outputs to be produced by the process. Not all processes should be applied always to all projects.
The project manager must determine which ones are appropriate for each project.

The PMBOK provides an excellent reference model to be used as the bases to develop a software project methodology.

3. The problem
3.1. E-Procurement general considerations

E Procurement approach is very important in E Government environments. We can say that E Government has three chapters [9][10][11][12][13][14][15]:

- Administration to business (A2B)
- Administration to citizen (A2C)
- Administration to administration (A2A)

All the E Government forms described above are used in a governmental E Procurement project.

E Government and, specifically, governmental E Procurement, has the potential to have an even deeper effect on the public sector than E Business on private sector.

Inserted into an E Government context, an E Procurement network typically uses sophisticated technology that provides a secure marketplace, sales platform and transaction tracking system available only for selected buyers and suppliers.

As a component of an E Procurement system, Electronic Reverse Auctions (E Auctions) are an innovative procurement technique that use secured Internet-based technology. The sense of competition is heightened as suppliers compete in real time by bidding lower as the auction unfolds.

E Auctions offer efficient, open and transparent negotiations as part of a full E Procurement process. This means that the time needed to carry out competitive negotiations is reduced as the price of the first offer is already market price or is very close to it.

E Auctions may either be structured around the lowest price or the most economically advantageous tender, and value for money efficiencies can be high. Using this approach, efficiency improvements in public sector contracts of 20–25% are not uncommon [1].

E Auctions are being increasingly used in public sectors as standard practice, both in prime contracts and in securing value in the supply chain. Suppliers are also realizing the benefits of online bidding because of transparency and increased market awareness.

In this paper, as a complex software project example, we present the use of the concept of Software Reuse in the context of E Procurement that includes a powerful E Auctions module.

3.2. The implantation environment

As a typical immature organization, the governmental environment of implantation was recently suffering from a series of common problems related to project management:

a. Projects were being delivered late and over budget.
b. Many project management activities were implemented in an ad-hoc way.
c. Subcontractor management was considerably ineffective.
d. There were not project performance metrics in place.
e. Projects with scope management problems
f. Projects with change management problems
g. Project with team / environment communications problems

As a partial conclusion, considering the implantation environment situation, we can say that CMMI has not all the concepts and tools needed to face all these project common problems.

4. How to face the problem?

Following an Inter American Development Bank suggestion, the provincial government (the implementation environment) decided to implement a scheme to solve the problems mentioned above. Thus, we (hired by government) started to develop a software project management methodology with the following main objectives:

a. Define and document the software project management process.
b. Establish and implement metrics to measure project performance.
c. Incorporate widely accepted international practices into the project management process.
d. Control the subcontractor's project performance in project segments where there is an outsourcing contract.
e. Implement the methodology using a pilot project.
f. Continuously improve the effectiveness of the software project management activities.

Although the province government is not currently seeking a CMMI evaluation, it might want to get it in the future. Therefore, the developed methodology was oriented to satisfy the goals of the project management process areas at levels 2 and 3 of the CMMI. This was a specific project goal.

Performed studies have clearly showed that CMMI is an important framework to be considered. Additionally, the project needs fundamentals and tools like communication management, scope management, changes management and team communication management that there are not included into CMMI scheme. PMI's PMBOK contains such fundamentals and tools and present them in a very useful way, regarding the project needs.

5. The solution definition

We extract practices from both the CMMI and the PMBOK to be included in our framework. We considered:

a. All the 72 practices defined in the 8 projects management process areas of the CMMI.

b. All the 39 processes proposed by the PMBOK.

One of the problems we faced was to determine how to adapt the different practices to the specific province government's project management environment and available resources. Some of these practices proposed in both models required considerable adaptation before they could be adopted in our specific project.

The practices from the CMMI and the PMBOK were included in our scheme according with the following mechanism:
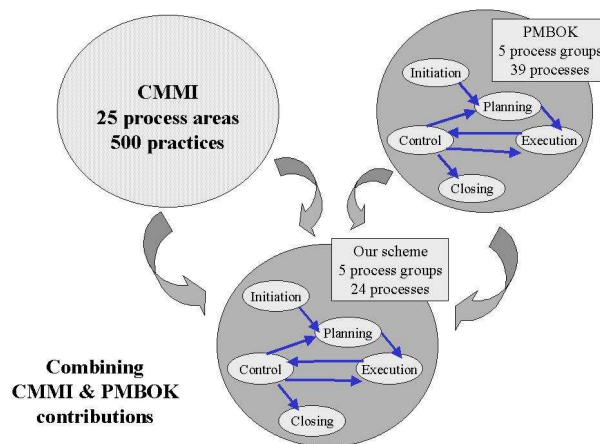
The process we followed to develop our scheme was:

-   First step: define and document the organizational project management policies that drive all activities associated with software projects.
-   Second step **(I)**: begin an iterative process in which each one of the 39 PMBOK processes is analyzed to determine its suitability and determine how it can be included in our methodology. In this step, several PMBOK processes were eliminated and in other cases several processes were combined into a single simplified process.
-   Third step: analyze, adapt and incorporate CMMI related practices.
-   Fourth step: define the tasks as well as the tools and templates needed to execute the process.
-   Fifth step: review the draft process definition
-   Sixth step: accept (or not) the process definition (by a technical committee whose observations and suggestions produce modifications to the process definition).
-   Seventh step **(II)**: incorporate (once approved) the process definition into the main document. Steps second to seventh are repeated until all the PMBOK processes are considered).
-   Last step: the technical committee made an overall review of the entire 100-page document and the 28 templates and guidelines that accompany it. Once approved, the methodology was released and team training began.

In actual terms we implement a sort of "do until" loop since **(I)** to **(II).** The "loop" must be executed "until" technical committee finds that the obtained scheme is adapted to the

specific project managerial needs. All PMBOK processes must be considered during "loop execution".

Some processes are optional depending on the project characteristics, such as size, organizational culture, etc. For example, if there is no outsourcing as part of the project, all the processes related to subcontracting need not be executed. Detailed risk control is required only for large projects.

Approved projects enter the planning phase whose main product is the project plan and, in the case of projects with outsourcing, the request for proposal (RFP).

The execution phase consists of carrying out the project plan and building the project products.

For projects with outsourcing, this phase includes supplier selection and contract management.

The control processes are performed in parallel with the execution processes. Their objective is to control the project schedule, product quality and manage the changes to the project. Additionally, for large projects only, risk control is needed. Finally, closing processes are executed to finalize the contract (if any) and finish the project.

In fact, there are a total of 24 processes in our scheme, but only 15 of them are mandatory in all projects.

6. The Implementation

A document, containing the complete project definition, following our newly documented methodology, was presented to Inter American Development Bank and it was fully accepted.

We implemented a pilot project; we selected a 5-month project to test and refine our methodology. During the execution of the pilot, the project team met several times to review observations and improving suggestions made by its members to the different components of the methodology.

Results from the pilot project were satisfactory. The pilot lasted 5 months and it produced more than 30 additional points that were incorporated into the final scheme version.
Since the release of the final version, the scheme has been deployed across the all project stakeholders and participants. All potential project service providers are accepted the final scheme version.

7. Conclusions

As the result of our initiative, we obtained a documented and implemented software project management methodology customized to the e-GP project's needs and working environment. This methodology is now the cornerstone of the future e-Government

projects. Our point of view could be extended to any software project with strong managerial needs.

Competitive advantage, obtained both by the province government and by project team, from the implementation of this methodology, includes the following aspects:

a. Improved "ex ante" project budgeting
b. Improved cost estimation process.
c. Support for project scope management
d. Support for change management
e. Support for communication management
f. Improved risk management capabilities
g. Better supplier selection and evaluation process.
h. Improved use of software metrics to control the project's performance.

In fact, our methodology is a simplification of the model contained in the PMBOK with some of the CMMI project management practices incorporated into it.

We used these two models to develop a project management process composed of 24 sub processes or activities, and for each one the inputs, outputs, tasks and tools are defined in detail.

Our experience shows that the project management practices proposed by the CMMI and the PMBOK are compatible and frequently are also complementary. Hence, they can be combined straightforwardly to develop a software project management methodology.

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