

# TOWARDS A GLOBAL SOFTWARE DEVELOPMENT MATURITY MODEL

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**Keywords:** Global Software Development, Distributed Software Development, Maturity Models Structure

**Abstract:** Build softwares have always been a challenge. To shape and to implement a computational viable solution involves a lot of technical and social questions (referring to the interaction between stakeholders). This complexity increases, significantly, when dispersed global teams are used. The necessity to have a set of processes better to organize the development strategy appears as one of the main challenges to be explored. The objective of this article is to present a proposal of structure for a maturity model for global software development. The study is based on an ample theoretical revision on the structures of the main maturity and government models of information technology. The empirical base of this study will involve a multinational organization of software development with branch offices in Brazil, Russia and India.

## 1 INTRODUCTION

To work with teams globally distributed has been an activity more frequent during the software development. While the time-to market tends to be less using this type of strategy, the necessity to develop products with quality and speed tends to be a counterbalance in the scale of this type of work (Delmonte, 2003). These changes are causing a great impact in such a way in the market, as well as in the types of software products that are being created. In this direction, the global software development (GSD) has attracted a great number of researches in some knowledge domains. Because of the great technical and social complexity, the searches on models that facilitate the development of software with teams geographically distributed tend to increase. There are a lot of efforts that has been done by researchers and the management with the intention to understand the factors that allow multinationals organizations to get success crossing physical and cultural borders of its countries.

In this context, this article has the objective to present the structure of a preliminary model of maturity for global software development, in order to organize and to establish processes that facilitate the adoption of this strategy. The model structure was the result of an ample analysis of the main maturity models structure from information technology. Amongst them, have the SW-CMM, the CMMI, the SPICE, the ITIL and the CobiT. This

structure is a part of a study in the search for a maturity model for GSD. It will compose a preliminary model, with it, cases studies will be conducted in organizations with software development units in Brazil, India and Russia.

This article is composed as: section 2 presents the theoretical base; section 3 describes the research method; section 4 presents analyses and comments on the structure of the studied maturity models structure, section 5 shows the structure of the preliminary maturity GSD model elaborated and the section 6 presents the final considerations and research limitations.

## 2 THEORETICAL BASE

### 2.1 Maturity Models

#### 2.2.1 SW-CMM

The SW-CMM (Software Capability Maturity Model) is a product for organizations that develop software. Made by the Software Engineer Institute (SEI) (Paulk, 1995), this model aims to supply subsidies for a better engineering and quality control of software products. The structure of CMM consists of six components, which, are delimited by a set of key process areas, in them, there are a common

features that need to be address by a key practice to reach a generic or common goal.

It is composed of five incremental maturity levels by which an organization establishes and improves its software development process. Except for level 1, each maturity level consists of several key process areas that an organization have overcome to achieve a maturity level.

### 2.2.2 CMMI

The CMMI (Capability Maturity Model Integrated) is an evolution of model SW-CMM (Kulpa, 2003). The main change is at the definition level, being able to improve areas that the SW-CMM did not attend. In accordance to (Kulpa, 2003) it is a framework that can be used from diverse representations, composition by a series of other models. The CMMI can be applied in to an organization process or many. These forms are called continuous and staged, respectively.

The CMMI model structure is composed by common process areas, objectives (generic and specific), elements (common features) and practices (generic and specific). It has the same levels of SW-CMM, in essence, with the differentiation that the CMMI-continuous has a level 0 (incomplete), that informs that the organization does not implement any type of process or politics for a key area.

### 2.2.3 SPICE

In accordance to (Rocha, 2001), the SPICE (Software Process Improvement and Capability determination) was the project of future norm ISO/IEC 15504 for evaluation of software processes. SPICE model approaches the concept of evolution in the capacities level of an organizational process. When the processes are being implemented, the organization can reach new levels of model usability, thus exceeding, for new levels. The levels of model SPICE are classified as: Level 0: Incomplete; Level 1: Executable; Level 2: Managed; Level 3: Established; Level 4: Predictable; Level 5: Optimized. The structure of the model is composed by maturity levels that are similar to the SW-CMM model.

### 2.2.4 ITIL

The ITIL (Information Technology Infrastructure Library) is a framework of better practical developed in the end of the 80's for the Standard British for IT Service Management. It is a set of documents whose objective is to implement a service of IT assets management (ITIL, 2004). This framework can be customized, and defines how the services will be

carried through inside of the organization for the IT area.

Its structure is not connected to a set of processes or practical, but to better organize the processes and procedures that the organization must implement. The levels of the ITIL are identified as, Level 0: Non-existent, Level 1: Initial, Level 2: Repeatable, Level 3: Defined, Level 4: Managed, Level 5: Optimised.

### 2.2.5 CobiT

Currently being kept by the ISACA (Information Systems Audit and Association Control), the CobiT (Objectives Control will be Information and related Technology), is a reference model that it structuralizes the processes and procedures in the sector of information technology. Figure 1 presents the elements of the CobiT. Composed of domains, processes and activities, that must be lined up with the processes, the resources and the IT criteria (Ridley, 2004).

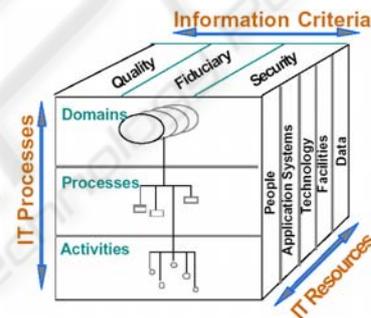


Figure 1: CobiT model structure

As long the objectives of the processes are being reached, and the usability of the model is increased, the organization advances in maturity levels. This evolution is represented by a scale of 0 the 5 which represent the levels of maturity of the model. In the same way as the ITIL, the maturity levels evaluate the degree of usability and integration that the guidelines prescribe for the organization. The CobiT defines has some guidelines in each process dimension that can be customized by the organization, facilitating its implementation.

## 3 RESEARCH METHOD

The research is organized in 2 stages (A and B). Each stage has 3 dependent phases. The Figure 2 presents the relationship between the stages and phases.

**Stage A:**

- Phase 1: Consists in a theoretical revision on the maturity models structures;
- Phase 2: Does a detailed analysis on the models structure;
- Phase 3: Presents the GSD preliminary maturity model structure.

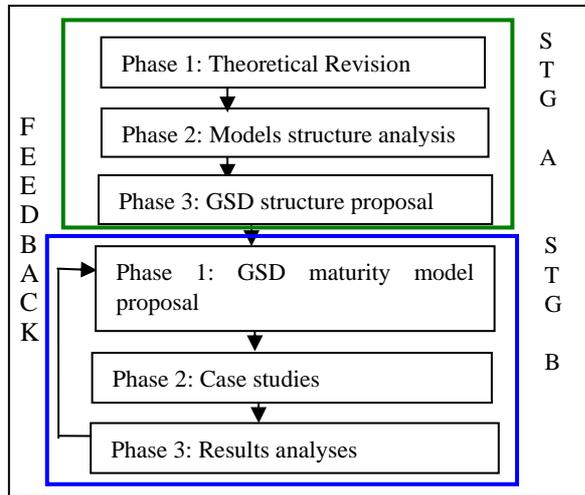


Figure 2: Research Phases

**Stage B:**

- Phase 1: Has the objective to propose a GSD maturity model.
- Phase 2: Looks to lead case studies in some organizations that use the GSD strategy.
- Phase 3: aims to elaborate improvements and to provide feedback for a new version for the model structure.

**4 MATURITY MODELS STRUCTURE ANALYSIS**

Some properties were identified as common in the models structures, as:

- a) The models structures are iterative, or either, a time is necessary until reaching definitive level of qualification or maturity;
- b) The maturity levels are composed by a set of processes or documents that satisfy it;
- c) The maturity levels serve to have an impression, at some moment, on the usability of the model in the organization. Its evolution is always referring itself exactly and not to other variable.
- d) The processes that compose the maturity levels aim to reach objectives or to establish politics and standards;

e) In the structures that use key processes areas, there is a checklist to validate if the objectives of each process or norm had been reached;

f) Maturity models are not restricted to processes definitions and guidelines. They have other components such as people and tools;

g) The model structures affects and changes the processes management, people and the organization assets.

The SW-CMM has one of the simplest structures used of the models presented here. Moreover, it was created to look for the necessities of organizations that develop software. However, as presented for (Nolan, 1999), it has limitations on its generic definition. It also didn't specify the relationship between the software development and the IT governance, did by ITIL and CobiT. In this aspect, using these models structures could complement this lack, can be a solution, in terms of GSD.

Between the ITIL and the CobiT, there is an alignment into the business needs, the resources and the IT processes. The ITIL encloses the governance, but does not represent the involved elements, leaving this to the organization. The SW-CMM does not possess flexibility to reach the maturity in definitive areas without reaching all items of the current level. The GSD maturity model can not have this limitation, because it may be interesting for the organization not reach certain maturity in definitive process for political or strategy questions.

**5 TOWARD A GSD MATURITY MODEL**

Based on the maturity models structure analysis, it was defined that the basic format that composes the preliminary GSD maturity model, based on the SW-CMM and the CobiT.

The SW-CMM presents an adequate structure of organization and relations between the components. The aggregated components of the SW-CMM are:

- Structure format;
- Elements Composition, guided by a maturity level.

The CobiT did not limit to organize in processes areas, moreover, it explores in a bigger depth, the use of guidelines to drive the processes that can be implemented and institutionalized. So, from this model, the structure will aggregate the following components:

- Orientation of implementation based on guidelines;
- Relations at the domain level, which means there will exist domains inside the model that could be composed by processes.

Based on these components, it was possible to compose the structure represented on Figure 3.

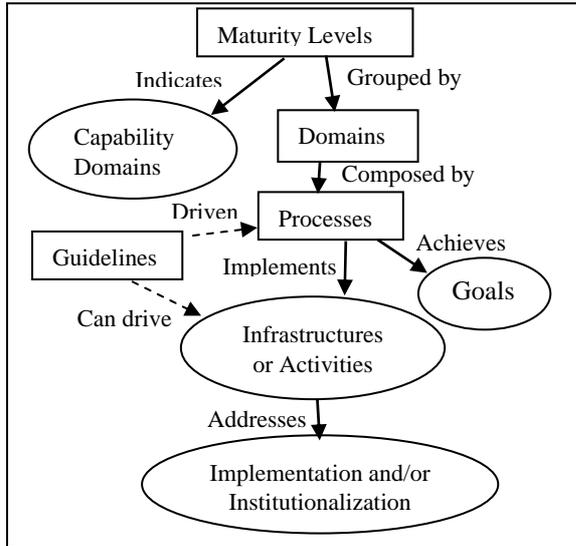


Figure 3: Preliminary GSD model structure

The *maturity levels* are grouped in domains. They represent the capacity for each domain or set of domains.

The *domain capability* delimits the target that must be done in each level of maturity.

The *domains*, which grouped, compose a maturity level, are related to the dimensions that are worked in global development projects (Evaristo, 2003). Domains like **trust; levels of dispersion; synchronization; stakeholders involved; culture; type of Projects** and **development process** can be considered as part of GSD organizations.

The *processes* will compose the domains. Each process has an objective that it must be reached so that it attends a domain. The domains can be composed for one or more processes and must inform, as it is possible to reach definitive objective. For example, the organization can have 2 processes to make the synchronization in the global development projects. The *guidelines* are used to drive the way the processes should be implemented. They supply subsidies to support the processes. In the same way, they can guide as an activity or infrastructure must be used to implement a process.

The *activities and/or infrastructures* aim to allow the processes reach the objectives that they must reach. A set of activities will compose one or more processes.

The *Implementation and Institutionalization* aim to characterize the way as the organization is leading its domains.

## 6 FINAL CONSIDERATIONS

The studies in this area offer excellent chances of research. In accordance to (Ridley, 2004), the research GSD area will approximately have a growth of 65% up to 2006, presenting great changes in the economic politician scene in countries that will adopt this type of practical.

The ample theoretical revision did not identify analyses on the maturity models structure, and as they could compose a generic model for GSD. In this direction, this research looked to explore this space. A study on the main software development maturity models and technological management was carried through, composing a structure that will serve as base for a GSD maturity model.

Future works will evaluate this study and use cases studies to validate the implemented model. It's necessary also, apply the model in organizations that develop software globally to investigate its effectiveness.

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