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# Amazonas State's Participation in Global Software Development Projects

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## Abstract

*Economics and technology have strongly restructured software development setting. In the last years the movement toward globally distributed software development has gathered a fast pace, which can be verified through the geographic distribution of such projects among several organizations, both big and small. This paper presents a proposal of including Amazonas State - Brazil, so far known only for housing the greatest piece of the world's greatest rain forest, as a participant agent in global software development projects, offering an alternative source of sustainability to Amazonas State's economical development.*

## 1. Introduction

Widely known for housing some of the world's richest natural resources, Amazonas State – Brazil - has carried out several actions in order to promote alternatives to the development of its cities with limited opportunity for access of progress, by sending economic growth to outside the state's capital - Manaus, based upon on regional capabilities, with consequent employment and income generation, not to mention of course the industrial model already established in Manaus, through its Trade Zone.

Amazonas State's growth needs to consider the changes that are modifying the way the countries are relating to each other all over the world. This growth must follow these changes that the world has been presenting in the recent decades, mainly due to globalization processes.

Besides building economical, social, political and cultural changes between countries relationships, globalization is having a deep impact in industries' manufacturing, once it interferes on the way products are conceived, designed, constructed, tested, and delivered to costumers [9].

Due to fast globalization of enterprises, software development had also to adapt itself to this reality. In times where corporations are becoming more distributed and mutually cooperating all over the world, software development in internationally distributed projects, where software is developed in several geographically far locations, is one great challenge today.

Global Software Development (GSD) takes place when two (or more) development teams are separated by national boundary while collaborating on common projects [3]. GSD is strongly characterized by physical and temporal dispersion of its participants. The main goal of enterprises that adopt global software development is to seek capitalization through the several attractions that this scenario provides: the possibility to participate in new markets, gain advantages due to mergers and fusions, acquisitions and different taxes, proximity to markets and clients, minimize costs and use of geographically dispersed resources, besides possible improvement of time-to-market by using time zone differences in follow-the-sun development [11], [6], [7].

In addition to the potential benefits generated by GSD, there is also a wide range of challenges faced by developing software in a distributed fashion. Several studies have been reported in recent years to show the solutions to the problems caused by physical and temporal distance between the involved GSD projects teams, such as sense of team and collaboration between participants, trust, a common language, time zone difference related issues, and requirements gathering [13], [15], [5].

GSD presents as a great alternative to sustain economic development of various cities of Amazonas State. The purpose of this paper is to present a set of good practices, established through a proposal of inclusion of Amazon State as a participant agent in global software development projects. These recommendations are intended to provide a series of actions for entities that wish to include Amazonas State cities in the GSD universe, and for that, must meet a minimum set of requirements, considering the main problems raised



by community experiences presented in the literature on this subject.

This paper is organized as follows: section 2 describes the theoretical background. Section 3 presents the proposal of participation of Amazonas State in GSD projects. Finally, section 4 concludes this paper with considerations, limitations and next steps on the research.

## 2. Global software development

Technology and software development enterprises are constantly adapting their activities, increasingly distributing activities around the world, through collaboration initiatives both internally in corporation and externally with partners, subsidiaries and third party service providers.

It is a common practice to find software development teams dispersed in a country or across multiple continents [10], [18]. Overcoming time and distance, several organizations have geographically distributed software development [8].

### 2.1. Motivational factors

One of the most obvious reasons for enterprises to embark on a challenging and risky endeavor such as GSD is the potential it has to reduce development costs [7]. The possibility of moving part of the development activities to areas with low-cost labor force is, with no doubt a great motivating factor for companies, which can perform the same activity for a fraction of its original cost.

The demand for software continues to increase at a faster pace than the supply capability. Historically, the demand for software has outpaced the supply of people who perform them [11].

Another motivating factor is the need to have access to new markets while maintaining the quality of service. Many companies prefer to be close to client improving software sale, design and maintenance services, in addition to know more about this client and local conditions that surround him.

The increasingly global market competitiveness has generated a sense of urgency in delivery of new products. Aiming to alleviate such pressure, it becomes even more necessary to reduce *the time-to-market*, cited by [6] and defined as the length of time it takes from a product conception until the product is available for use or sale. For software industry this reduction is notably important, mainly in areas such as mobile telephony and electronic commerce systems.

Through *follow-the-sun* development it is possible to have developers working in different time zones and, consequently, increase the number of hours worked per day, which can substantially reduce development cycle.

The interaction between different distributed development teams suggests the increase of innovation and sharing best practices among participants.

### 2.2. Main challenges

There is no doubt about the benefits of GSD, but there is a series of new problems. Erran Carmel [5] grouped the main problems of distributed software development, namely: geographic dispersion, poor communication, lack of coordination, lack of sense of team and cultural differences.

In fact, several reports can be obtained from literature about the problems in GSD that can be linked to the items grouped by Carmel: cultural aspects [2], lack of trust among team members [1], linguistic challenges in oral and written collaboration [14], project coordination and tracking challenges [19], adoption of development methodologies [16], and temporal and geographical dispersion [6].

GSD challenges human ability of transparent communication and imposes standardization procedures, the search for guaranteed quality levels, and the management, monitoring and control of activities.

## 3. The proposal

Including a new producer region in the Global Software Development requires observation in some basic aspects; therefore, this proposal's goal is to define the requirements to introduce the Amazonas State – Brazil - in the GSD context.

This approach considers three fundamentals elements such as the identification of actors involved in the scenario, the relationship between them and their effective participation and contribution in the process.

### 3.1. Proposal overview

As the main actor in proposal the entrepreneur is a person who works to get a successful opportunity.

According Souza [17] the undertaking is a “creative destruction”, perception and exploration for new opportunities by using available resources in a innovate manner. Likewise, entrepreneur is someone who destroys the economic order by introducing new products and services, new organization ways, or by exploration new resources and materials. The entrepreneur can create a new enterprise to organize his new undertake.

Two components determine the potential to an enterprise entry in the global software development market.

In this research the enterprise has two elements such as competency and business strategy as shown in Figure 1.

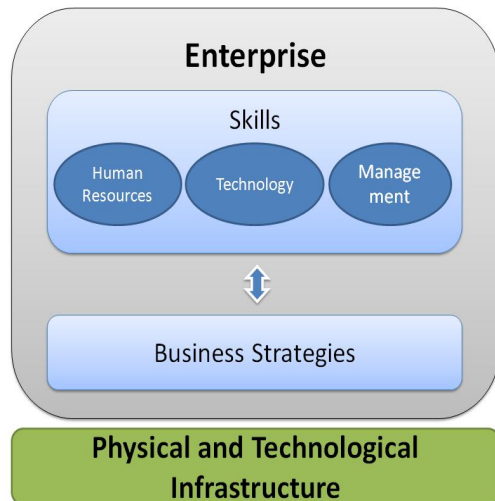


Figure 1. Enterprise's competences and business strategy

Enterprise performs organizational competences to develop its activities. Developing its competences is required when it does not exist.

The business strategy is defined according to its own competency and it is influenced by global market conditions. The strategy can be responsible for changing enterprise competences and it also shows the necessity for new competences in front of the global market needs.

Following some new competences are presented:

*Human Resources:* it considers people as elements in the enterprise. A strong relationship between human resources and business strategy is observed but to reach this strategy a high qualification level is required on the human resources.

Furthermore, other important aspects are required such as the definition of professional profile for each people working in the enterprise, the correct qualification program, and training in languages, etc.

*Technology:* it involves services, products and process provides from the enterprise to the global market. Technology includes tools for communication, implementation strategy for exchanging between team geographically distant, and definition and institutionalization for a development process.

*Management:* it is responsible for synchronization among activities and process in the enterprise. This competency allows planning and executing the strategy needed to the enterprise's entrance in the global market. Moreover, it provides mechanisms to facilitate the coordination and project control allowing information sharing and correct responsibility distribution.

The management area also includes areas such as technologic management, and financial administration.

### 3.2. Physical and technological infrastructure

The infrastructure required on implanting the GSD is not present in the Amazonas State where the most part of the cities does not have physical and technological structure to support this kind of development.

Some factors such as means of transportation, supplement of electrical energy, and both communication, physical and mobile; these aspects are important in considering a GSD implementation, and a good communication is the main requirement.

Geographical and temporal distances are reduced with a physical and technological infrastructure and it allows to approximate teams geographically distant.

In the same way, alternatives to enable the communication need physical and technological infrastructure as a requirement to solve GSD problems.

Kobitzsch, Rombach and Feldman [12] affirm that an essential component to GSD is the advanced communication, requiring a specification plan to define the physical and technological infrastructure.

About the technological infrastructure some aspects are related, such as:

*Software requirements:* it is related a complete software definition including version, licence questions, compatibility among systems operation, project management tools, CASE tools and others.

*Hardware requirements:* it involves a hardware specification including computers, servers, networks devices and resources for a distributed environment.

*Telecommunications requirements:* it considers remote communication resources to communication between teams of project, reliable internet connection and high performance network.

According to Kobitzsch, Rombach and Feldman [12] the enterprise has the option for its own internet link through the dedicated satellite links.

About complex technological infrastructure other questions are involved such as:

*Alternative supplements of electric energy:* it is concerning the instable electric energy which causes damage to technologic devices and data. Furthermore, in building electric power supply is required take into consideration supplements to it.

*Hardware environment:* servers and networks devices.

Moreover other questions are important, such as:

- Comfortable physical environment;
- Table and chair ergonomically correct;
- Property assurance; and
- Adequated environment.

### 3.3. Human resources training

The capacity concerning to human resources is one of the most relevant aspects within an enterprise;

and it requires a set of action related to technical qualification to face the global software development market. From this observation some actions as follow presented:

**Training in Global Software Development:** it considers the need for information about distributed software development, and the reason for this training is to prepare the professional within the GSD scenario. Because of the enterprise seeks for the internationalization of its activities, one of the major challenges is to develop software in a distributed manner.

The goal in this training is to prepare the professional within the involved scenario showing his importance in collaborating to develop his enterprise and region.

*Training in the enterprise's goals:* this training is directly concerning to the services offered from the enterprise to the global market. It includes different technologies, systems operation platform, mobile technology and other. Likewise, each training need to be associated to the main activity in the enterprise such as analyze and specification, validation, and maintenance.

*Language training:* as GSD involves different region on the planet, training in other languages is required as a manner to decrease problems caused by geographical and temporal differences. Thus GSD participants need to have the same communication protocol which is provided mainly by a common language.

Concerning this aspect, Lutz [12] says that English is the most important language in the world and the most spook in international communications. Consequently several global enterprises have the English language as standard in communication. But other languages are observed according with necessity and relevance for the enterprise involved.

*Participation in real projects and case studies:* it is concerning the needs for participation in real scenarios of GSD implementation.

In considering this action the University of Amazonas State in Brazil – UEA - provides a recent course called Technology in Analyze and Development of Systems – TADS - this qualification is part of a program named “*Ensino Presencial Mediado*”.

On implementing the TADS the UEA took into consideration the needs for sustainable development within the Amazon region because it seeks to increase the region without damage the environment.

TADS provides training in systems technology development based on distance education technologies and works in twelve cities in the Amazonas State. TADS' students not only learn computing subjects facing distances but also learn to develop systems within a scenario which considers teams geographically distant, and this context shows

the necessity for a strategy involving TADS teams in real systems projects.

An alternative to support and increase TADS course is to involve the technical team in simulation of a real project which can provide an experience to participate in the life cycle of project. It can minimize the risks; identify failures; find opportunities to increase and make corrective adjustments in the project.

Besides, it can show problems related to GSD and contribute to define the best solutions for each case present in the experiment.

## 4. Conclusion

The Amazonas State needs to create alternatives to increase the regional development by a sustainable manner, considering the preservation of Amazon forest.

Making part in the Technology Information market through the Global Software Development is an opportunity for this region. However to improve this market investments from the public and private initiatives are required.

The approach proposed is in phase of definition and requires further research in important points such as requirement validation in physical infrastructure and team of professional working in the Amazonas State cities.

The stage of this research indicate the Amazonas State scenario on the GSD Market and present some actions and activities required to allow the Amazon Region making part in the international market of global software development.

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*Danny De Souza Lopes*

It is a great honour to have had your collaboration.  
Many thanks for your never-ending support!

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