Analyzing Human Resource Management Practices within the GSD Context

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ABSTRACT

The development of software across different countries (and time zones) differs substantially from software development in one single country or region. The management of processes and people, who work in globally distributed teams, requires a high level of coordination and collaboration which needs to be based on established human resource management practices. The People Capability Maturity Model (People-CMM) provides a complete framework that enables quality in human resource management to be improved. However, today, the adoption of the People-CMM within organizations using Global Software Development (GSD) is not an easy task. This paper uses an empirical study to analyze the implementation of the People-CMM within the GSD context. Results confirm that cultural and communication problems are the main challenges in the implementation of the People-CMM adoption within GSD scenarios.

KEYWORDS

People-CMM, Global Software Development, Distributed Software Development, Competency

INTRODUCTION

The Information and Communication Technology (ICT) industry is becoming more global regarding ownership and market scope (Aramo-Immonen et al. 2011). As a consequence, the software industry has become one of the main streams of development all over the world and is acknowledged as an important engine for economic growth (Nicholson and Sahay 2008). However, in spite of its economic importance, the failure rates associated with software projects are still high (Stamelos 2010). The personnel working in software development teams have been recognized as one of the most decisive resource for the success of projects but, also, the source of deficiencies (McConnell 2003). Recent research has stated that human resources are the key input in software development (Aravinda Rajah et al. 2011), while others suggest that the human potential is the most important resource (Galenic 2010). Moreover, qualified software engineers pertaining to software development teams are key factors in the software development process (Pressman 2005). According to López-Fernández et al. (2010), human resources are gaining importance in a very dynamic and competitive environment. The importance of personnel in software engineering was confirmed more than a decade ago, when the Software Engineering Institute (SEI) developed a separate model for human resource management: the people management capability maturity model (People-CMM) (Curtis et al. 2009). Likewise Pressman (2004) described the importance of human capital management through the statements of two vice presidents from software companies. The first stated that the most important element for software development is not the tool, but the people. The second declared that the most important ingredient in any project is smart people. They emphasized that the selection of good staff is the most important task for any organization and, especially, for those involved in software development, since success is directly linked to people's abilities.

Recent research (e.g., Feldt et al. 2010) suggests that human factors have been largely overlooked or not been based on empirical studies. Nonetheless, there are several studies devoted to different areas of human issues in software engineering including people assignment to specific roles (André Ampuero et al. 2010), skills identification (Colomo-Palacios et al. 2010) and professional development (Soto-Acosta et al. 2010), among others.

Global Software Development (GSD) is the new paradigm that enables such innovations (Colomo-Palacios et al. 2010). GSD teams are made up of people from different cultures and countries, joined with the aim of developing software. This way of working introduces complexity in an already complex process, and is something managers must address. The purpose of this article is to shed light on human resource management by studying which practices as defined in the People-CMM are more important in GSD scenarios. The People-CMM provides complete information regarding human resource management within the software industry. However, to the best of authors' knowledge,

no studies have analyzed the practical implications of the People-CMM adoption within the global software development context. This article aims to address this gap in the literature. The remainder of the article is organized as follows. Section 2 outlines the relevant literature in the area of GSD, analyzing the main issues related to human resource management. Section 3 includes an explanation of the main features of People-CMM. Section 4 describes the study and the results, and the article ends with a discussion on research findings, conclusions and future lines of research.

GLOBAL SOFTWARE DEVELOPMENT: THE IMPORTANCE OF PERSONNEL

Worldwide globalization has brought significant changes to nearly all industries and, in particular, to software development (Smite et al. 2010). Software development has rapidly evolved in comparison to other industries, and has adopted several globalization characteristics. As a result, a new field called GSD has emerged to cover specific aspects of global distributed software development (Oshri et al. 2007). GSD involves the development of software applications through interactions of people, organizations and technology across nations with different backgrounds, languages, and working styles (Herbsleb and Mockus 2003). This business strategy, which allows the development of high quality software in low-wage countries at low cost (Khan et al. 2011), has also been called offshore software development (e.g. Khan et al. 2011), Global Software Work (e.g. D'Mello and Sahay 2007), 24-h development teams (e.g. Sooraj and Mohapatra 2008), follow the sun and round the clock (e.g. Carmel and Agarwal 2001) or GSD. GSD is a particular kind of Distributed Software Development (DSD) in which teams are distributed beyond the limits of a nation (Herbsleb and Moitra 2001). GSD teams can be considered as a specification of virtual teams (Martins et al. 2004) and their creation is encouraged by relationships between customers of outsourcing software development organizations and developers (Heeks et al. 2001). However, Milewski et al. (2008) posed the GSD paradox, since several researchers and practitioners state that some GSD teams are highly productive, while others asseverate that GSD teams perform sub-optimally.

The benefits from GSD include, but are not limited to: greater availability of human resources and multi-skilled workforce (e.g. Milewski et al. 2008), lower costs (e.g. Smite et al. 2010) and shorter time-to-market cycles (e.g. Sooraj and Mohapatra 2008). However, GSD faces many challenges including communication, coordination, control, efficiency, lack of trust, higher conflict rates, issues regarding the protection of intellectual property and socio-cultural distance, among others. An extensive review of the challenges faced by GSD can be found in the work of Mishra and Mishra (2011). These challenges are rooted in the complexity of managing GSD teams and their intrinsic nature. Managing GSD teams is not an easy task because of the additional problems and

complexities that have to be taken into account. Moreover, the management of software companies in such environments is problematic (Erra and Scanniello 2010). Personnel issues have been posed as the main challenge in many GSD studies (e.g., García-Crespo et al. 2010). Nevertheless, the fact is that the development of software by geographically distributed projects teams is here to stay; so researchers and practitioners must respond to this global trend (Prikladnicki 2012), including a shift in the way people are managed.

PEOPLE CMM

The People-CMM employs the process maturity framework of the Capability Maturity Model for Software (more recently called CMMI-DEV) as a foundation for a model of best practices for human resource management. Although the People-CMM (Curtis, et al. 2009) was originally developed to face problems within software industry, today its focus has expanded to all organizations.

People-CMM introduces a set of practices in stages (maturity levels) to create a succession of changes in the organization's culture. In this sense, the People-CMM consists of five maturity levels or evolutionary stages (1 Initial; 2 Managed; 3 Defined; 4 Predictable; 5 Optimizing), through which an organization's workforce practices and processes evolve. Each maturity level contains a set of process areas (PAs). Organizations at level 1 present an incoherent policy on many human resource issues. The workforce practices implemented at the Managed Level (Level 2) focus on activities at the unit level: staffing, managing performance, and making adjustments to compensation as a repeatable practice. Organizations at this level perform basic workforce practices but there is inconsistency in how these practices are performed across units and little synergy across the organization exists. Maturity Level 3 enables organizations to develop the capability to manage its workforce as a strategic asset. Thus, the primary objective is to help an organization gain competitive advantage by developing various competencies which must be combined to accomplish business activities. At the Predictable Level, organizations are able to manage, exploit and assess the capability created by its framework of workforce competencies. The effect of workforce practices on these capabilities is monitored and corrective actions are taken if necessary. All practices are based on the management of practices in a quantitative way. Finally, at the Optimizing Level (Level 5), the organization is focused on continual improvement by adopting new human resource management practices and technologies. Organizations must pursue the alignment between workers, teams and organizational units as well as the alignment of all of them with business objectives. The People-CMM process areas and their distribution among levels are presented in Figure 1:

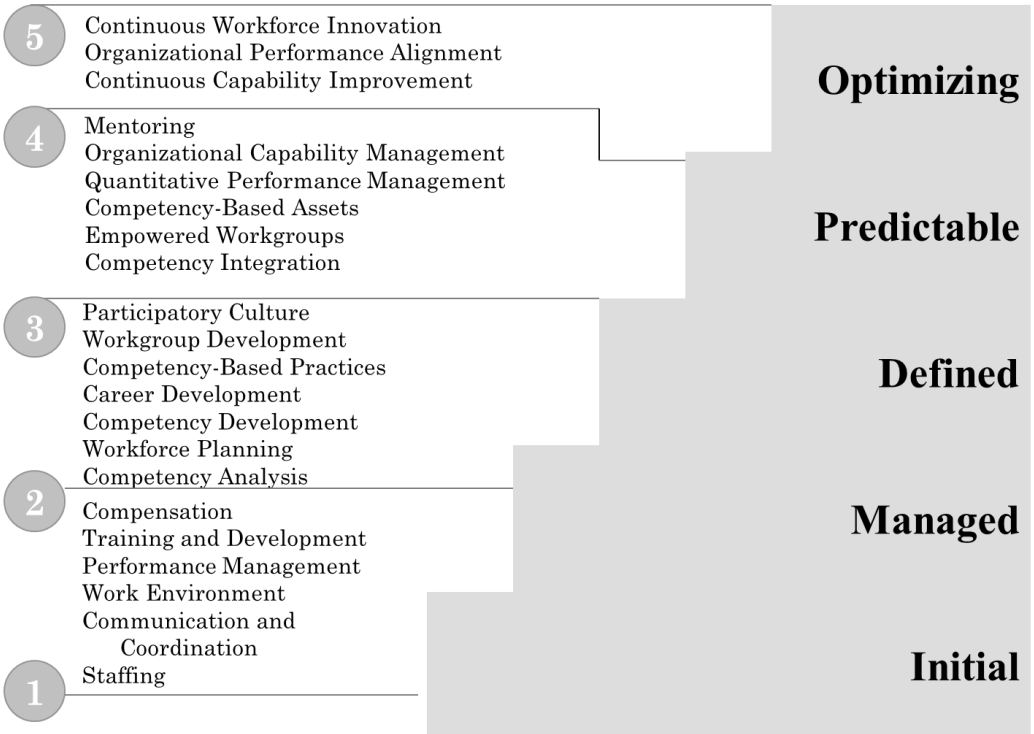

Figure 1. Process Areas of the People-CMM

Although the People-CMM's process areas reside at a single maturity level, the model links them across maturity levels by common areas of concern. These links are named process area threads. The process area threads are as follows:

- Developing individual capability. The focus of this thread is to develop individual competencies to perform the work and, thus, contribute to organizational goals.
- Building workgroups and culture. The aim of this thread is to increase the coordination and interaction between workers and teams.
- Motivating and managing performance. In this case, attention is given to the measurement and development of individual performance, along with the alignment of that performance with organizational objectives.
- Shaping the workforce. The fourth thread focuses on the assessment of practices, individual competencies and organizational needs in order to address eventual gaps.

These threads allow organizations to follow a non-staged path for improvement. However, People-CMM suggests adopting the staged approach.

Taking into account the importance of People-CMM, our work is motivated to identify key issues regarding the implementation of the People-CMM within the GSD context. In fact, the People-CMM is one of the few methods to achieve quality in human resource management within organizations. However, its application in distributed environments is not easy as it was designed to be implemented in a single organization. Reported challenges in GSD, as discussed previously, create a lot of constraints regarding the implementation of the People-CMM. To respond to these challenges, this article studies the human resources practices implemented by People-CMM, and has two objectives. The first is to identify which process areas are affected within GSD scenarios and to what extent, while the second is to discover which practices in these process areas must be revised in order to adapt to this approach and what the main adaptations needed are.

THE STUDY METHOD

Methodology

A qualitative study is conducted using Delphi and Focus Group tools. This qualitative approach is very useful when the purpose is to explore an area of interest, obtain an overview of a complex area or discover differences, rather than similarities. Moreover, according to Myers (1997), when the focus of information systems research shifts from technological to managerial and organizational issues, qualitative research methods become increasingly useful. Our work is directed to respond to four research questions:

1. When applying the People-CMM, which process areas are affected within GSD scenarios?
2. To what extent are these process areas affected?
3. Which process areas from the People-CMM affected by GSD could be readapted?
4. What are the issues related to these process areas?

To answer these questions, two different qualitative methods were used. The first three questions were performed by a Delphi study (Step 1). The last one was conducted via a Focus Group study (Step 2). All the questions were based on the People-CMM, levels 2 to 4, while level 5 was not analyzed in this study.

Delphi method was designed by Dalkey and Helmer (1951) in the 1950s for military purposes and, from the 1960s onwards it was also used in organizational spheres. The Delphi method presents three main features (Landeta 2006): anonymous response;

iteration and controlled feedback; and statistical group response. Although this method was developed many years ago, it continues to be used, since it is a valid instrument for forecasting and supporting decision making (Landeta 2006). The Focus Group method involves assembling small groups of peers to discuss particular topics (Baddoo and Hall 2002). The discussion within these groups, although directed by a researcher, is largely free-flowing (Hall, Beecham and Rainer, 2002). The use of discussion groups in software engineering and IS development research has been extensively treated in the literature (e.g. Baddoo and Hall 2002; García-Crespo et al. 2010). However, and in spite of its usefulness, Delphi method presents limitations. The work of Yousuf (2007) discusses its strengths and weaknesses based on a review of the literature. This author lists some of the common problems of the method, including: limitation of perspectives due to a poor expert selection process, poor use of the technique in terms of summarizing and presenting group response, artificial consensus, tendency to eliminate extreme positions and time consuming to cite the most important ones. The threats to Validity section illustrates how the study setup deals with Delphi caveats.

Planning

To achieve the objective of Step 1 (the Delphi Study), eleven software project managers were selected on the basis of their experience within GSD projects and their knowledge of the People-CMM. Subjects were selected from those who answered positively to a personal invitation sent by the authors among Spaniard and French IT companies. Four participants were female (36%) and seven were male (64%). The average age of the sample was 40.4 years old. The sample for the focus group, which was recruited among project managers that answered positively to a personal invitation, consisted of four subjects, three men and one woman. The average age of the sample was 43.3. All participants have an experience of at least 2 years in managing GSD projects.

Data collection

The Delphi study consisted of questions one to three and was performed via video conference. In the first round, an initial record was obtained based on responses from the individuals. This record was later presented to subjects, in the second round, who had to agree on a group response. Questions two and three were answered using a 1-4 Likert Scale, with values representing: (1= Low, 2= Medium, 3=High; 4=Very High) for question two; and (1= Easy adaptation, 2= Not so difficult adaptation, 3=Difficult adaptation; 4=Very Difficult adaptation) for question three.

The Focus group (step 2) was designed to be assisted by three researchers (one in each location). Participants were connected via videoconference and assisted on-site by the researcher. The virtual meeting lasted approximately 30 minutes. After an initial brainstorming phase, in which subjects discussed their experience and thoughts, they discussed the adaptation of the People-CMM process areas practices identified in Step 1.

Threats to validity

There are two threats to validity: internal and external. With respect to internal validity, the threat is the fact that the respondents may not have a comparable level of knowledge or expertise. Given that respondents were in both cases chosen because of their expertise and experience, authors expect that the respondents have a comparable level of knowledge and expertise.

In terms of external validity, there are two kinds of threats. The first is the small number of respondents in both steps, which does not allow the authors to make generalizations. The second is the fact that the sample was not taken at random. Nevertheless, the sampling method is acceptable for the exploratory purposes this study is pursuing.

Apart from that, Delphi studies are affected by their own threats to validity that arise from pressures for convergence of predictions. However, participants possess significant knowledge and common interest in the topic and this helps increase the content validity. Furthermore, the use of successive rounds helps to improve concurrent validity.

RESULTS

Table 1 shows results from the Delphi study (step 1) in which questions one to three were answered, while Figure 2 represents the distribution of both scores regarding the People-CMM process areas according to the defined scale (1= Low, 2= Medium, 3=High; 4=Very High). Table 1 presents four columns; the first contains the maturity level of the process area, the second includes the name of the process area, the third contains the level of repercussion of GSD in this process area and finally the fourth column presents the level of adaptation required to adapt the process area to a GSD scenario.

The consensus of the first step (Delphi) is described by Kendall's coefficient of concordance (W). The coefficient measures the degree of association among k sets of rankings. Schmidt (1997) proposed that strong consensus exists for $W >= 0.7$; moderate consensus for $W = 0.5$; and weak consensus for $W < 0.3$. In our study, two Kendall's coefficients of concordance were obtained. The former reflected the consensus among panelists about the repercussion of GSD on the People-CMM process areas and the latter illustrated the consensus with respect to the adaptation of such practices. Regarding the repercussion of GSD on the People-CMM process areas, there was moderate to high consensus among panelists, $W= 0.633$ ($n = 10$, $P < 0.01$). In contrast, lesser consensus was reached with regard to GSD adaptation, $W=0.596$ ($n = 10$, $P < 0.01$). However, these results provide an acceptable level of agreement among subjects regarding both questions.

Table 1. Delphi results

Level	Process Area	GSD Repercussion	GSD Adaptation
2	Staffing	2= Medium	2= Not so difficult adaptation
2	Communication and Coordination	4=Very High	3=Difficult adaptation
2	Work Environment	2= Medium	2= Not so difficult adaptation
2	Performance Management	3=High	3=Difficult adaptation
2	Training and Development	2= Medium	2= Not so difficult adaptation
2	Compensation	2= Medium	2= Not so difficult adaptation
3	Competency Analysis	3=High	3=Difficult adaptation
3	Workforce Planning	3=High	3=Difficult adaptation
3	Competency Development	3=High	3=Difficult adaptation
3	Career Development	3=High	3=Difficult adaptation
3	Competency-Based Practices	3=High	3=Difficult adaptation
3	Workgroup Development	3=High	3=Difficult adaptation
3	Participatory Culture	4=Very High	4=Very Difficult adaptation
4	Competency Integration	3=High	3=Difficult adaptation
4	Empowered Workgroups	4=Very High	4=Very Difficult adaptation
4	Competency-Based Assets	3=High	3=Difficult adaptation
4	Quantitative Performance Management	3=High	3=Difficult adaptation

4	Organizational Capability Management	3=High	3=Difficult adaptation
4	Mentoring	2=Medium	1= Easy adaptation

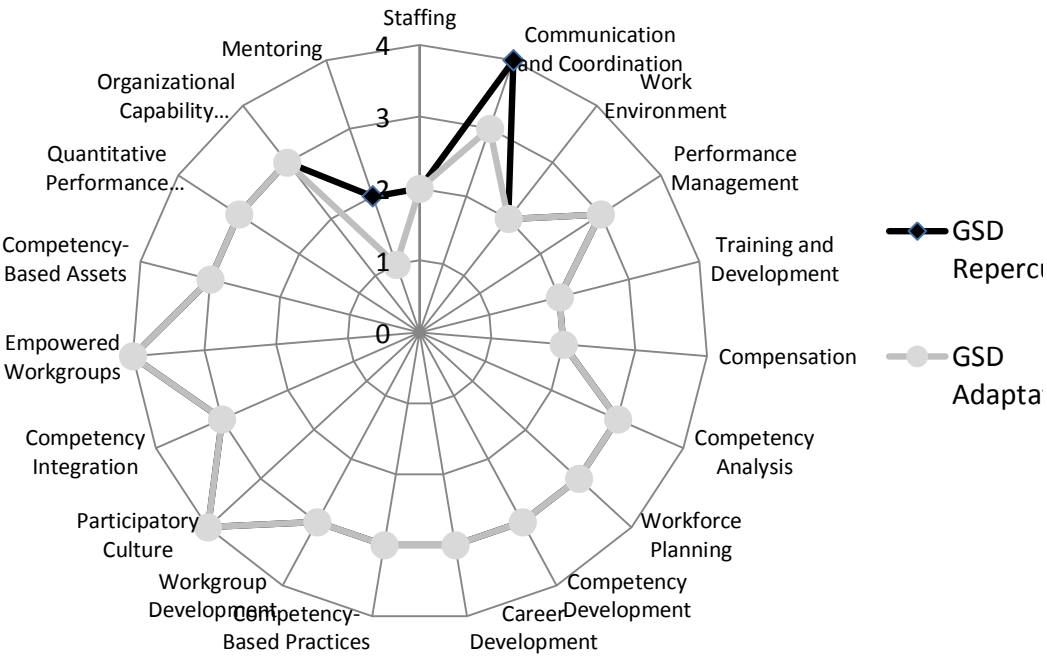

Figure 2. Delphi results distribution among process areas

GSD repercussion

As shown in Table 1 and Figure 2, experts consider that fourteen out of the nineteen variables are highly or very highly affected within GSD environments. In fact, more than 70% of the processes are affected within GSD to a high extent, with three of them (*Communication and Coordination, Participatory Culture and Empowered Workgroups*) being affected at the highest level. In contrast, GSD affects moderately (medium level) to a lower number of variables (five, 26%), with not any variable presenting a reduced level of repercussion.

Furthermore, results indicate that the highest level of repercussion of GSD occurs in the top maturity levels (level 3 and 4). In contrast, level 2, the lowest analyzed maturity level, presents more process areas with a medium level of repercussion of GSD as is the case for the variables *work Environment, Training and Development or Compensation.* This result is intuitive because process complexity increases with each maturity level, and complex processes more likely to be affected within GSD settings.

These preliminary results indicate that many processes are affected within GSD, with the level of repercussion being from medium to high. These findings confirm previous literature and suggest that the high-demanding GSD scenarios affect a large number of relevant process areas which have a substantial contribution to maturity. In fact, as mentioned above, experts consider that the most affected process areas within GSD projects are: *Communication and Coordination, Participatory Culture and Empowered Workgroups*. Thus, communication and coordination between teams is more demanding and complex within GSD settings. Frequently, it is necessary to coordinate personnel and teams which are in different geographic zones, with distinct time zones and which speak even different languages. Therefore, distance, temporal and culture barriers make communication and coordination difficult which, in turn, affects projects management's efficiency (e.g., Noll et al. 2011). The *Participative Culture* is influenced within GSD indirectly through communication. In this sense, a scarce or bad quality communication reduces the participation of people and teams involved in the project. Moreover, a GSD project with reduced communication and participation makes difficult for workgroups to reach a high degree of autonomy and responsibility, which favors centralized project management, a practice incompatible with the high maturity level needed for the creation and maintenance of *autonomous teams*.

Regarding the eleven process areas with a high level of repercussion, they correspond to high maturity levels (level 3 and 4). In this sense, as mentioned earlier, it is more likely that complex processes are more affected within GSD settings. Actually, processes such as *Quantitative Performance Management* or *Competency Integration*, both at level 4 of maturity, require complex activities, which are even more complex in distributed environments.

Finally, the majority of processes with a medium level of repercussion of GSD correspond to the lowest level of maturity (level 2). Therefore, from the experts' point of view, less "mature" processes such as *Compensation* or *Training and Development* present lower levels of influence within GSD work environments. The only exception comes from the *mentoring* process which, despite pertaining to a high maturity level (level 4), is considered to receive a medium level of repercussion within GSD settings.

GSD adaptation

Results indicate that those processes pertaining to lowest maturity level (level 2) are considered easier to adapt to GSD settings. The only exception is the *mentoring* process which despite pertaining to a high maturity level (level 4), is easy to adapt to GSD scenarios. In fact, it has a higher level of adaptation than variables receiving a medium level of repercussion from GSD activities. In contrast, *Participatory Culture* and *Empowered Workgroups*, two of the three process areas which receive the highest level of repercussion within GSD environments, are difficult to adapt to GSD. Processes presenting a high level of repercussion of GSD are difficult to adapt to GSD scenarios as this is the case for *competency integration*, *competency-based assets* or *quantitative performance management*. Thus, the more a process is affected within the GSD context, the more difficult it is to adapt to GSD.

The aim of Step 2 is to identify the main issues related to these process areas. To achieve this objective, a focus group was gathered. Subjects identified a set of challenges and issues related to the People-CMM process areas as well as valuable comments about the difficulty of implementing the People-CMM within the GSD scenario. The analysis of the focus group was carried out using software for qualitative data analysis (NVIVO 9.0, International QSR Pty Ltd). NVIVO is used to organize, classify and analyze information, but also to explore and study trends. Moreover, it permits to establish connections between contents as well as extract conclusions from the primary data. More specifically, the procedure of using NVIVO consisted of the steps as follows:

1. First, a qualitative analysis was conducted by one member of the research group.

2. Then, another researcher conducted again the analysis without any information from the first analysis.

3. Finally, a third researcher, not belonging to the research group, compared the previous analyses and determined differences and communalities.

Table 2 lists the direct transcripts of the issues raised during the group session.

Table 2. Focus group excerpts

Level	Process Area	Excerpts
2	Staffing	"No matter if you are a centralized organization or a distributed one you need to recruit candidates based on defined criteria such as qualifications and job descriptions" "The main issue here is to ensure that the process can be managed and controlled overseas" "Organizations in other countries have a different working pace. In many cases, they take months to select a candidate" "Sometimes culture differences make things more difficult in personnel selection and process observance"
2	Communication and Coordination	"Communication and coordination activities are a nightmare when you work in a follow the sun approach" "English language command is not good enough in many cases" "It is mandatory to write everything" "Quality of Life and Work Life Balance are fairy tales in many countries" "Technology helps to solve distance problems, but not cultural or time-zone problems" "The use of time in meetings is ineffective in many countries" "Culture-shock is an everyday matter within GSD projects, which is usually caused by interpersonal communication"
2	Work Environment	"Work conditions are quite different across countries regarding GSD: Laws, regulations, safety procedures… even dress codes" "Aspects like noise level and distractions are dissimilar" "Crowding is a big problem in many countries" "Working condition standards cannot be generalized, especially from developed countries"
2	Performance Management	"Performance appraisal is a myth in many organizations" "Reward procedures are not easy to understand in many cases" "There are organizations that conduct performance appraisal procedures but the process does not include an evaluation of the

		plan itself. It's like a black box"
2	Training and Development	"Resources for training are not always easy to get" "In many organizations, organizational training policies are not documented" "Personnel is not motivated to participate in training activities"
2	Compensation	"Compensation procedures seem to be irrational in many cases" "Equity is not easy to achieve in compensation. It's not a formal process in almost all cases"
3	Competency Analysis	"An integration of the competencies needed to face organizational business activities is difficult because in many organizations there are no documented objectives" "Future workforce competency requirements are not easy to identify in customer service driven environments, where competency requirements depend on other organization" "Competency analysis depends on other process areas, although the problems that appear in those are may be presented here"
3	Workforce Planning	"A formal planning is sometimes nonexistent. Organizations just hire personnel when a contract is signed and there is no concern about future business needs" "There are cases in which offshore partners present a long tail of partners through which they obtain personnel… In such cases, it is hard to spread the use of the People-CMM, since they just hire on-demand and do not renew contracts once the project is over" "The length of the workforce planning cycles is normally a project timeframe"
3	Competency Development	"This process area presents challenges from other process areas: Competency Analysis and Training and Development" "Competency Communities could be implemented, but these communities run better between offshore partners and contractors than within offshore organizations" "Although in many cases high levels of CMM are achieved by some organizations, there are no real practices to track knowledge acquisitions in personnel in the context of offshore projects"

3	Career Development	"Technical career paths are very limited" "Part-time or temporary workers have not career development schemas" "Career paths are not documented in many cases and sometimes there are no competencies description for each position" "There is no connection between business objectives and career paths. Normally they are inherited from the past have not been updated for years"
3	Competency-Based Practices	"There is no participation of the offshore contractor in the work performance feedback" "Recognition and rewards are not connected with competency developments"
3	Workgroup Development	"The low continuity of personnel is a barrier for the development of workgroups" "Workgroup disbanded processes are not managed at all" "The isolation of workgroups is a reality in many cases" "Workgroup performance is rarely assessed and managed" "Workgroups formation in many cases follow a random strategy"
3	Participatory Culture	"Coordination challenges lead to a low participatory culture" "Decision are not easily taken in offshore sites" "Culture differences across countries make it even harder to establish a common participatory culture" "There is a inferiority complex in offshore countries which stops participatory culture"
4	Competency Integration	"As an integrated process of previous competency-based processes it presents all the problems commented earlier… but in this case, combined"
4	Empowered Workgroups	"Workgroup empowerment would be a key process area because it confers all the autonomy needed by teams, no matter if they are in-house or offshore" "The relative independence, that workgroup empowerment brings to software teams, offers a framework for the

		development of outsourcing and offshore teams. In practice, this process area is not observed… Sadly"
4	Competency-Based Assets	"The lack of trust is the main barrier for this process area" "Knowledge does not flow between GSD participants. In many cases, workers hide information due to lack of trust" "Confidence among partners in alliances is not easy to achieve. Taking into account that knowledge must flow, a lack of trust leads to low or insufficient development of the resulting artifacts"
4	Quantitative Performance Management	"This process area has all the problems presented in Performance Management (Level 2) together with many of the challenges detected in all competency-related areas"
4	Organizational Capability Management	"It is hard to get a uniform process performance baseline in corporations with a low tradition of performance management" "There is a clear problem of trust in data available in many cases. It's about confidence" "Evaluation of training is not easy, because training presents all the problems described earlier" "There are cases in which the process performance baseline is built based on a handful of successful projects… and these projects do not reflect the real situation. It is not a process-oriented practice, but a sales-oriented solution"
4	Mentoring	"eMentoring is ready to be applied all over the world. All you need is a telephone or an internet connection" "eMentoring is comparable to traditional mentoring" "Technology is changing the mentoring process. Distance is no longer a problem"

As presented in Table 2, comments on the 19 analyzed process areas are many and diverse. In many cases, difficulties inherent to GSD projects are indicated. Below, key points regarding the various processes are explained.

Staffing. Experts pointed out that, although differences in the speed with which recruit and selection processes are performed exist, and these processes can be complex, in the

end, GSD projects demand for the selection of appropriate candidates for both in-house and offshore workgroups.

Communication. Subjects mentioned that communication and coordination between offshore workgroups is difficult. Communication is constrained by various factors such as geographic and time distance as well as culture differences, for instance, regarding language and/or different perceptions of time and work.

Work environment. Participants mentioned that the regulation of work conditions is quite different across countries regarding. In many cases, laws, regulations and safety procedures with regard to work conditions differ between partners. In any case, they pointed out that it is possible to establish work conditions standards for offshore localizations.

Performance management. Experts explained that this process is absent or it is applied inadequately in many organizations. These circumstances do not favor the implementation of a performance measurement procedure potentially applicable to all locations participating in the GSD project. Organizations do not seem to dedicate resources to the *Training and Development* process, and *compensation* is described as a little formal process that does not reinforce equality.

Competency Related Processes. Subjects agree in the fact that in many organizations, competency analysis is not within the objectives of human resource management and that a hypothetic integration of the needed competencies to face business activities is difficult or unviable. Moreover, they argued that human resources' required competencies are difficult to identify, especially, within projects conducted in various locations. These difficulties affect the development of others processes such as *Competency Development*, *Competency-Based Practices* and *Competency Integration.* Without implementing competency analysis processes, the development of competencies and practices based on competencies is difficult. For the case of competency development, although organizations present a high level of maturity in this process, no practices that search the acquisition of knowledge for the personnel working in the offshore project are implemented. Moreover, although it is possible to implement competency "communalities" between various locations, they are difficult to incorporate in the offshore team. Regarding practices based on competencies, rewards and work recognition are more likely to be in-house than offshore, since work recognition and rewards are not related to competency development. Therefore, difficulties in *competency analysis* and associated processes such as *Competency Development*, *Competency-Based Practices* and *Competency Integration* constitute processes not always easy to apply in-house, but their extension to an offshore location represents an even more complex objective.

Workforce Planning. Participants mentioned that formal planning is sometimes nonexistent. Organizations only hire personnel when a contract is signed and there is no concern about future business needs. Moreover, in many cases, offshore partners have

other partners which provide them personnel and thus, the planning process is responsibility of another company. As a consequence, it is hard to spread the use of People-CMM in processes related to workforce planning.

Career Development. Experts mentioned that technical career development is more limited in offshore activities than in-house. Furthermore, part-time or temporary workers are often hired, but organizations do not offer them career development paths. There is no connection between business objectives and career paths. Likewise, related to career development is *Workgroup development*. Subjects argue that the rotation and low continuity of personnel is a barrier for the development of workgroups. However, reasons linked to organizational culture are responsible for the reduced development of workgroups. For instance, in many companies, team performance is rarely evaluated or managed or its management follows random strategies.

Participatory Culture. Subjects indicated that the degree of participation is very linked to culture differences. For instance, difficulties in coordination lead to a poor participatory culture, and culture differences across countries make it even harder to establish a common participatory culture. Also, offshore countries present a kind of "inferiority complex" which stops participatory culture.

Empowered Workgroups. Experts argue this process confers independency and autonomy to teams. However, these processes are absent or difficult to apply in offshore locations.

High Maturity Processes. For processes such as *Competency-Based Assets*, *Quantitative Performance Management* and *Organizational Capability Management*, their generalization or application to offshore settings is enormously complicated. *Competency-Based Assets* process is linked to confidence, since the absence of confidence prevents information and knowledge sharing. Regarding *Organizational Capability Management*, it is hard to get a uniform process performance baseline in corporations with a low tradition of performance management, which is even more complicated in offshore locations. For the case of *Quantitative Performance Management*, difficulties are similar to those related to the organizational capability management. With an almost nonexistent tradition of performance management, it is difficult to establish parameters to measure quantitative performance in offshore settings.

Mentoring. Despite representing a process of high maturity, subjects considered it easy to implement as well as applicable to any offshore location. They asserted that the technology helps the establishing of mentoring relationships. The only requirements are a motivated mentor and a willing mentee.

Results from the *focus group* are consistent with those from the Delphi study. Processes with less level of repercussion of GSD, less adaptation difficulties to GSD and, at low levels of maturity, such as *staffing or work environment* are processes which present very few differences and have easy adaptation to offshore scenarios. In contrast, processes

with a high level of repercussion and difficult to adapt to GSD are processes which present substantial differences between in-house and offshore locations. This is the case for the processes: *Communication and Coordination*, *Participatory Culture* and *Empowered Workgroups*. In sum, experts were not very optimistic about the implementation of high level process areas to offshore settings.

DISCUSSION

The research analyzed the level of repercussion of GSD as well as degree of adaptation of GSD to 19 process areas, with different maturity levels, pertaining to the People-CMM. Findings from the Delphi study indicate that most of the processes (73.6%) are affected within GSD to a high or very high extent. Three of them (*Communication and Coordination, Participatory Culture and Empowered Workgroups*) are affected at the highest level. Moreover, results indicate that the highest level of repercussion of GSD occurs at the top maturity levels (level 3 and 4). Therefore, the more complex a process is, and more maturity level it demands, the more likely it is to be affected within GSD.

These Results are consistent with those obtained for the adaptation of processes to GSD: processes pertaining to high maturity levels are difficult to adapt to GSD. This is the case for the processes: *Communication and Coordination, Participatory Culture and Empowered Workgroups*. The only exception is the *mentoring* process which, despite pertaining to a high maturity level (level 4), is considered to receive a medium level of repercussion of GSD and it is easy to adapt.

Regarding the *Communication & Coordination* process, there are many studies in the literature that point to it as one of the GSD's main challenges (e.g., Sooraj and Mohapatra 2008). Thus, although technology enables communication, clear understanding during communications is still a major problem in GSD. Issues such as: pronunciation, poor command of the English language and cultural differences are far from being solved with technology (e.g., Thomas and Bostrom 2010; Yang et al. 2008).

Through the Focus Group, this research also analyzed the opinions of experts regarding the challenges to implement People-CMM's processes in GSD environments. Results from the second study confirm those obtained in the first study. Complex processes or those from high maturity levels are more difficult to implement than process from lower maturity levels. The only exception is again the *mentoring* process which, despite pertaining to a high maturity level (level 4), is easy to implement in GSD scenarios. In sum, both studies confirm results about difficulties and challenges of GSD environments: more complex processes are the most affected within GSD and are the most difficult to adapt.

Reports on the use of *mentoring* techniques within GSD teams are abundant (e.g. Casey and Richardson 2009; Oshri et al. 2007). In all cases, the use of technology is crucial. Although Evans and Volery (2001) suggested in their study that e-Mentoring is mature enough to be implemented in corporations, GSD scenarios include features that make the use of this tool more complicated than in normal settings. Experts from our study are optimistic and suggest that the implementation of *mentoring* in GSD environments is easy. It is likely that our participants may have focused almost exclusively on practical issues related to technology available today which favors the implementation of mentoring. However, establishing a relationship between a mentor and a mentee, which among other aspects, include a difference in status, can be influenced by cultural factors which our experts may not have considered. For instance, it is easier to establish a mentoring relationship in less egalitarian and hierarchical firms. These circumstances are found frequently in GSD contexts (Casado-Lumbreras et al. 2011).

The process area *Participatory Culture* is associated with coordination challenges, mainly due to culture differences. Culture can be seen as an external factor that impacts communication practices and encompasses the national, organisational and team culture as well as the individual culture and personality (Tanner 2009). Furthermore, an inferiority complex was reported from the *Participatory Culture* process area. This phenomenon has been already reported in the management literature, when analyzing traditional offshoring regions like Eastern Europe and India (Berchtold et al. 2010). In the case of GSD, this problem leads to lesser participation of offshore personnel in projects and corporative decisions. A possible solution to this problem is to increase personnel and corporation self-esteem.

With regard to *Empowered Workgroups*, the importance of their process area resides in the independence that it brings. In fact, experts agree with the fact that the creation and maintenance of *Empowered Workgroups* require a decentralized management which is not often found in GSD projects.

It is noteworthy that cultural issues, cultural diversity and cross-cultural management were found to be significant issues in GSD teams. However, according to Smite et al. (2010), as software development goes global, there is a desire to minimize the geographical, temporal and cultural distance – rather than to address these issues squarely. Much of the existing research focusing on cultural issues within GSD (Siakas and Balstrup 2006; Tanner 2009) advocates these issues. For instance, Tanner (2009) stated that the cultural heritage as well as the level of ignorance regarding other cultures impact the effectiveness of GSD practices. She also observed that communication practices should be employed in accordance with the cultural background of participants.

All the above discussion leads us to make several reflections. Having analyzed the implementation of nineteen process areas within GSD, following the People-CMM, the question to ask is: to what extent this framework can offer "solutions"? With this respect,

Ramasubbu and Balan (2007) conducted a research consisting of 42 finished projects from a service software firm of high maturity (level 5). Their results confirmed that the implementation of GSD practices in high maturity levels have a significant effect on productivity as well as a "difficult to establish secondary effect" on quality. In this sense, while models such as the CMMI were established for in-house environments, they can also be useful in GSD environments, especially in processes highly affected within the GSD context such as *Communication and Coordination* and *Participatory Culture.* Experts seem to agree that reaching high maturity levels will favor the management of GSD projects and to achieve that objective, frameworks of reference are helpful.

CONCLUSION AND FUTURE RESEARCH

This study investigated the applicability of different process areas from the People-CMM within the GSD context. Using a qualitative methodology, it investigated the repercussions that GSD causes in People-CMM practices and their adaptation to this context. Results show that communication and culture issues are dominant in human resource management and must be addressed to implement the People-CMM within GSD. Results also show that some process areas are more affected than others, namely *Empowered Workgroups, Participatory Culture* and *Communication and Coordination*. According to the experts, the first two are very hard to adapt to GSD, while the latter seems to be more adaptable. Literature has reported that the three global distances (temporal, distance and cultural) make it difficult to manage GSD projects; and the same issues make it more difficult to implement human resource management improvement initiatives.

GSD has emerged and remains as a viable and attractive approach for software development to the burgeoning software needs. However, it is also full of challenges. People management is one of the important challenges that need improvement with regard to software development and GSD. The management of human resources is crucial for GSD projects, where managers have to deal with cross-cultural and cross-continental environments. Following the lead of this study, future research should be directed at analyzing the implementation of People-CMM within specific countries and regions. Researchers should also explore the effects of People-CMM on project outcomes (such as personal and team productivity, and relationship stability). Moreover, cost-benefit analyses for setting up People-CMM would be of significant interest to company executives and decision makers.

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