

GLOBAL OFFSHORE SOFTWARE DEVELOPMENT: TWO APPROACHES TO ESTABLISHING CREDIBILITY AND QUALITY STANDARDS

*Rachna Kumar, Professor, Marshall Goldsmith School of Management, Alliant International Univ., CA
Rene Naert, Assoc Professor, Marshall Goldsmith School of Management, Alliant International Univ., CA*

INTRODUCTION

The global landscape for software development has changed considerably in the last few years. Pressures to cut costs have mounted and organizations are increasingly considering outsourcing software development to overseas offshore locations. “Offshoring” refers to the practice of organizations transitioning part of their business operations in one country to lower cost overseas destinations. The basic idea entails utilizing equivalent skill levels at lower wages in other countries in the global arena. Experts assess the global offshore market to be close to a \$300 billion opportunity and the size of offshored IST services and business processes is regarded to have almost tripled since 2001 (Chakrabarty, Gandhi, & Kaka, 2006).

Within the global software development offshoring context, it becomes important to establish credibility and quality assurances before committing to any work transition plans. However, the opportunity cost of transitioning work in small chunks or waiting till credibility is established and evidence for quality assurance mounts is substantial. In fact, larger organizations on both ends of the offshoring relationship, the source country and the destination country, find it somewhat easier to transition work due to the volumes of work involved and due to the buffer they can afford in operational costs. But smaller and medium organizations at both ends of the offshoring relationship find it very hard to establish or ensure credibility and quality assurance in such situations. One of the ways in which the credibility of an offshore software development organization can be established is by assessing their adherence to established and disciplined approaches to software development such as ISO9000 (International Standards Organization) or CMM (Capability Maturity Model).

This research has investigated two different approaches to establishing credibility and quality assurance in global offshore software development situations. We have concluded that these approaches apply to very different settings: the CMM model is most appropriately suited for larger, established software development organizations in the destination country, where the destination country itself is somewhat advanced on the learning curve of the global software development landscape (such as India, China, or Russia); the MoproSoft model is most appropriately suited for small and medium sized, newer software development companies in the destination country, especially where the destination country itself is striving to get a foothold on the global software development landscape (such as Mexico or Brazil). More specifically, this research aims to understand and recommend approaches which could be utilized by software development organizations in global offshore contexts either to establish their own credibility or to ensure the credibility of potential vendors.

Methodology and Research Study

The authors completed a mentoring project with one small mentee organization, consisting of 11 employees, which undertook a software improvement program to improve their assessment from Level 1 of CMMI model to Level 3 of the CMMI model. The motivation for this company to go through this process was that with a Level 2 or above assessment CMMI designation, they would qualify to sub-contract with larger corporations on several lucrative defense projects. The project also involved a mentor organization, which employed over 200 employees and operated at a higher level of CMMI assessment. The authors observed the improvement process and CMMI assessment for this company as

a longitudinal study over the period of 2 years. During the study, several project and process related investments were required and an investment exceeding US\$200K was made (Kumar and Naert, 2003).

In parallel, one of the authors implemented a project to transfer information systems development skills from US to Mexico. (Kumar and Kelly 2005). Over the duration of two years during this transfer of software skills project, the author interviewed and observed several small scale and micro software development organizations in Mexico in their growth phase. International competitiveness, global credibility and quality assurance were among the major challenges faced by this industry segment. The author investigated the establishment and articulation of the Prosoft and Moprosoft models for software development by the Ministry of Economy in Mexico as a means to answer the credibility and quality challenges faced by them. Subsequent investigations in other growing economies, poised to make a claim in the global offshore software development trend, gave more evidence of the challenges faced and the appropriateness of the Moprosoft model (Kumar & Naert, 2007).

Background and Context for CMMI model and MoproSoft as Quality Process Improvement Programs:

The Total Quality movement was perhaps the first internationally recognized attempt to incorporate an all inclusive description of an organization's culture, attitude and institutionalized processes of an operation. Organizations that subscribed to the TQM methodology earned a reputation that provided its customers with an assurance that the products and services produced were dependable and of an independently certifiable quality. TQM recognized that product quality is achieved at every level of a process, and the output from quality processes is a quality product or service (Visitacion, 2003). However, the implementation of TQM type processes, and the requisite supporting resources, was cost prohibitive for many small organizations (Oktaba, 2006). The search for a more practical, economical software development standard's model saw the emergence of the International Standard Organization (ISO).

The ISO 9000:2000 was developed as an alternative method to TQM in providing a set of international standards for the specific assessment of software production systems. The ISO 9000:2000 standards focus on the specifications and levels of quality where contracts between two or more parties require the demonstration of the vendor's capability. It was the second of three international standards for quality systems that can be used for external assurance purposes, and enjoys global wide acceptance. ISO 9000:2000, although embraced by the international community, was also considered an expensive proposition for most small companies with limited resources. In parallel, a systematic approach engineered to provide a standard specifically for software process improvements was the Capability Maturity Model (CMM). The CMM was created in large part to provide a metric management capability for software organizations. The CMM was developed by measuring, and analyzing, activities of highly functioning software organizations; that is, those organizations that consistently delivered software systems to their clients on time and within budget (Kulpa and Johnson, 2003). In Latin America however, specifically in Mexico, several software development companies were small or medium sized, and found the costs of implementing and adopting the CMMI model prohibitive and time consuming. The Prosoft initiative was implemented and eventually institutionalized to cover basic CMMI features and later enhanced to include organizational features and operational processes. This initiative was blessed and encouraged by the International Trade Division of the Economic Commission for Latin America and the Caribbean. The enhanced process model became known as Moprosoft, which stands for Modelo de Procesos para la industria del Software, and is based on many of the best practices embedded in the CMMI, ISO 9000:2000 and several other process models (Oktaba, 2006). Moprosoft intends to increase the rate of growth of the use of software processes in the Mexican Software industry, and helps in establishing a suitable software development business model that could be easily diffused to small and medium software companies. The processes an organization goes through in order to adopt

one of the disciplined approaches to software development, requires a professional state of readiness and organizational commitment, which is both costly and requires a large time commitment. The challenges are far greater for small businesses, not only because of their limited resources, but also because of the lack of experience, understanding, and capability regarding the efficient introduction of the internationally accepted models such as TQM, CMMI, ISO 9000:2000 or Moprosoft (Kumar and Naert, 2007; Wilkie et al., 2004).

CMMI: Globally Accepted Software Process Credibility and Quality Standard

The basic advantage of the CMMI is that it provides a single, integrated framework for improving processes throughout an organization, enhancing the quality and efficiency of the organization as a whole (Ahern et al., 2004). It has rapidly become a preferred means of improving organizational processes in industry and government. The multitude of companies that have since adopted this method has led to an even greater interest within the software industry. The CMMI provides the “what to do,” but not the “how to do it” (Kulpa and Johnson, 2003). Although CMMI has been implemented in a multitude of organizations in over eighty diverse countries, it is still not considered the best choice for organizations that are resource constrained. In addition, in the offshoring context, CMMI has been shown to present several more complexities and significant challenges when implemented with the backdrop of language and cultural issues (Kumar and Naert, 2005).

The software development activities, according to Kulpa & Johnson (2003), are represented as 316 key practices in the CMMI. The practices were grouped into 18 Key Process Areas (KPA) that focus on the best practices found among the organizations that were reviewed. The KPAs concentrate on such items as managing requirements, managing changes, creating project plans, tracking estimates against actual and analyzing the variance, implementing quality assurance activities, instituting peer reviews, and training personnel in the related processes. In an effort to influence the establishment of universal standards for software organizations, the Software Engineering Institute (SEI) in conjunction with the U.S. Department of Defense (DOD), developed the Capability Maturity Model Integration (CMMI). The CMMI was an expanded version of the CMM. And, with the advent of the SEI’s involvement in the process, coupled with the ubiquitous nature of information system’s technology, a global transformation in process standards and control was primed to explode.

The Moprosoft Advantage for Small Settings

Since the Moprosoft method is built around the known best practices of other models, there are several similarities to the CMMI. However, these unique set of process structures differ from the CMMI in several areas, for instance Moprosoft actually creates a set of specific sub processes that allow small settings to accelerate their process improvement initiative in a series of smaller, and less expensive, increments. Though the model is relatively new, it is proving to very efficient (Oktaba, 2006). The model is easy to apply and does not disturb the productivity of the regularly scheduled business activities of the organizations. The Mexican software industry is positioning itself to become the ideal model for software development in the Spanish speaking countries of Latin America (ECLAC, 2005). Therefore, the need to implement internationally accepted process improvement methods in the software businesses in Mexico is essential. These methods would provide a streamlined path to help realize this grand vision of the Mexican Department of Economics. Several companies looked into the practices of CMMI, and as they learned through the experience of others, the lack of resources and budget can be a major obstacle to the obtainment of a recognizable standards process (Almeraz, 2006). The CMMI provides an organization with a very specific set of maturity models, and a systematic approach for the measurement of the processes (SEI, 2006). Their corporate culture and small settings environment demanded something a little more specific, cost efficient, and crafted uniquely in the Spanish language for the Latin American experience. Moprosoft focuses on the three areas that are considered to be the

essential core of every business: Top management (Strategic Level), Mid-level Management (Tactical Level), and the Operations level (Oktaba, 2006). In the Top management category, the model focuses on practices that are related to the management of the business. It also provides a set of processes that can be used to provide the necessary metrics for executive decision making. The second category addresses practices that include resource management, process and project management, that are in line with the strategic business goals. The third category focuses on the practices of software development and maintenance projects. In this category, the operations category, there are projects that include the administration of specific project processes, and internationally acceptable software maintenance methods (Oktaba, 2006).

The Process Documentation Pattern (PDP) of Moprosoft, which includes general process definition, the practices sections and the tailoring guidelines, provide a clear, easy to adopt set of principles. The PDP is similar in nature to the KPA's of the CMMI. The PDP, however, eliminates much of the complexity and confusion generally associated with other SIPs. The general process definition focuses on the roles of responsibility, inputs, outputs, internal products, and bibliographical references. The practices section includes recommended training practices, exceptional situation management, the use of lessons learned, and other items that lend themselves to the efficient implementation of new processes. Moprosoft includes a method of assessment that serves as a guide to further improvement of the processes. The assessment method is called Evalprosoft, and it allows for each capacity level to be evaluated independently (Oktaba, 2006). Evalprosoft provides the process metrics that may indeed position Moprosoft as the right tool for small settings in Latin America. Small settings can easily begin the task of implementing an internationally recognized software improvement process initiative by deploying the Moprosoft methodology. Moprosoft introduces a unique concept that allows small businesses to achieve their process improvement initiatives without the resource complications associated with the CMMI (Oktaba, 2006). This, however, does not intimate that both are mutually exclusive, on the contrary, both methods can be perfectly combined to increase a company's maturity level at a much faster, and less expensive, pace.

Conclusions for Offshore Software Development Organizations

Small organizations, or small units within large organizations, are generally referred to as "small settings" in the CMMI model. They are classified as a "small business" if they have fewer than 100 people; a "small organization" if it is within a large organization with fewer than 50 people; or, a "project" if there are fewer than 20 people involved. There is a large gap existing in the definition between what is considered a small setting in the United States and of those in several other parts of the World, especially Latin America. A small setting in Latin America, for example, is closer in definition to what is categorized as a *very* small setting in the United States (Mondragon, 2005). The differences in infrastructure are also considerable, but there are some similarities in how the businesses operate. For example, the software process improvement initiatives, as previously discussed, are limited by the budget, time, and organizational resources that a company is willing to commit. In the United States these resources are considered a requisite investment in the company's ability to increase their competitive advantage by producing quality services and gaining the recognition as a world class operation (Mondragon, 2005).

If the software industry is in its infancy in a nation, there is an urgent need for these small organizations to gain the advantages of having a certifiable software improvement assessment as per a formal and structured model. Even if the organizations commit to adopting CMMI and investing the funds and resources, a downside risk exists that the successful completion of a CMMI program might not yield any significant deliverables or results for a period of 1 to 3 years (Kumar and Kelly, 2005). A more economical, and time efficient system, such as Moprosoft will be more easily implemented into small business settings, and is of great interest to business and governmental leaders throughout such nations,

more specifically so in Latin America (Oktaba, 2005). Our study also indicates that there is double advantage for the companies which adopt the Moprosoft model: The Moprosoft method in itself will improve the software processes in the organization, and the Moprosoft method will prepare the organization to be competent to do well in a CMMI appraisal (Bustos, 2005). This integrated guidance feature makes the selection of the Moprosoft model a wise economical choice for small settings that is also very effective and efficient. In conclusion, Moprosoft could hold great promise for the small setting software development organizations as well as medium/large sized organizations within the United States seeking to incrementally achieve a CMMI designation. In the context of offshore software development, it allows small software development organizations as well as organizations in nations which want to be desirable offshore destinations, to provide credibility and quality assurance.

REFERENCES

- [1] Ahern, D. M, Clouse, R. and Turner, R. (2004). CMMI Distilled: A Practical Introduction to Integrated Process Improvement, 2nd Edition. Boston: Pearson Education Inc.
- [2] Almeraz, E. (2006). Lecciones aprendidas y estrategias de Implantacion de CMMI en Mexico. Retrieved November 14th, 2006, from <http://www.software.net.mx/NR/rdonlyres/BBE8566F-CA03-45F2-8C2E-985F830FA9E2/1366/ElizabethAlmeraz.pdf>.
- [3] Goldenson, D., Rout, T., Tuffley, A. (2006). Measuring Performance Results in Small Settings: How do you do it and what matters most?. In Suzanne Garcia, Caroline Graettinger, Keith Kost (Ed.), Proceedings of the First International Research Workshop for Process Improvement in Small Settings. (18-21)., Pittsburgh, Pennsylvania.
- [4] Herbslep, J. (1997). Software Quality and the Capability Maturity Model. Communication of the ACM. 40(5), 30-40, Retrieved July 16, 2006, www.sei.cmu.edu/cmmi/background/conops.html
- [5] Kelly, G. (2006). Barriers to Adoption of the CMMI Process Model in Small Settings. In Suzanne Garcia, Caroline Graettinger, Keith Kost (Ed.), Proceedings of the First International Research Workshop for Process Improvement in Small Settings. (18-21)., Pittsburgh, Pennsylvania.
- [6] Kulpa, M. K. and Johnson, K. A (2003). Introduction to Process Improvement and the CMMI. Retrieved June 7, 2006, from <http://erp.ittoolbox.com/documents/document.asp>.
- [7] Kumar, R. and Naert, R. (2005, June). Overview of CMMI Model and Certification Process. Organizer and presenter, Workshop for Software Professionals being held under our certification
- [8] Kumar, R., and Naert, R., and (2007, April). A Readiness Approach to Profiling a Nation as an Attractive Destination for Software Development Offshoring: The Case of Iran. Proceedings of Thirty Sixth Annual Meeting of the Western Decision Sciences Institute, Denver.
- [9] Kumar, R. and Kelly, L (2005). Culture Issues in the Implementation Efficacy of Remote Information Systems and Technology (IST) Transfer in a Global Context: A Cross-National Study. Proceedings of the 4th Annual Conference of IS OneWorld, Las Vegas.
- [10] Menezes, W.(2002). To CMMI or Not to CMMI: Issues to Think About. Crosstalk 15,2; 9-11.
- [11] Mondragon, O. A. (2006). Addressing Infrastructure Issues in Very Small Settings. In Suzanne Garcia, Caroline Graettinger, Keith Kost (Ed.), Proceedings of the First International Research Workshop for Process Improvement in Small Settings. (18-21)., Pittsburgh, Pennsylvania.
- [12] Oktaba, H. (2006). Moprosoft: A software process model for small enterprises. In Suzanne Garcia, Caroline Graettinger, Keith Kost (Ed.), Proceedings of the First International Research Workshop for Process Improvement in Small Settings. (18-21)., Pittsburgh, Pennsylvania.
- [13] Software Engineering Institute (SEI), Carnegie Mellon University. (2006). Improving Processes in Small Settings, A White Paper. Pittsburgh, Pennsylvania, The International Process Research Consortium.
- [14] Visitacion, M. (2003) IDEABYTE: Consider Environment & Situation When Deciding on Six Sigma or CMMI. Retrieved from <http://www.forrester.com/Research/LegacyIT/0,7208,29610,00.html>, Nov 5, 2004
- [15] Wilkie, F.G. R., Rombach, J. D., Herndon, M. A., Penn, M.L., Konrad, M. (19 October 2004). Motivating Small-to-Medium Sized Enterprises to Adopt Software Process. The International Process Research Consortium (IPRC), 1, 8.