

SUPPORT DISCIPLINES FOR SYSTEMS DEVELOPMENT IN SMEs

A Conceptual Map

Luis E. Mendoza, María Pérez, Edumilis Méndez

Processes and Systems Department, Simón Bolívar University, Caracas, Venezuela

Wilfredo Báez

Systems Development Department, Quimbiotec C.A., IVIC, Caracas, Venezuela

Keywords: Project management, Software configuration Management, Methodology, Conceptual model.

Abstract: Both software configuration management (SCM) and project management (PM) involve applying knowledge, skills, tools and techniques which support the development of software systems (SS). Developing an effective project management plan, which minimizes risks and restrictions inherent to the project, becomes more difficult as time goes on. Achieving an effective balance between the scope, timeframe, and costs associated with the project is also a complex task. This task is equally challenge for the small and medium-sized enterprises (SMEs). SCM is a powerful tool for the administration and control of the life cycle of the SS, and it is linked to the process of quality assurance. This article presents the first results of an ongoing research whose purpose is to develop a framework which incorporates the methodological aspects of PM and SCM for SMEs. The first step for the design of this framework was to build a conceptual model that would be used as a systemic vision of the semantic basis to unify and support the relationships between these concepts.

1 INTRODUCTION

In Venezuela, small and medium-sized enterprises (SMEs) represent more than 13% of the gross national product (GNP) and employ 55% of the active population. Taking as a reference the private sector alone, SMEs generate 77% of the jobs in that sector. There are around 1.3 million micro-companies and about 68,000 SMEs in Venezuela. It is a fact that the micro and SMEs represent an essential contributor to our society (Erard, 1999). An important number of these businesses deal with the software systems (SS) development. However, currently there is not a framework which incorporates methodological aspects in SCM and PM and that can be used in the context of the SMEs. This research-in-progress presents a conceptual model that illustrates and inter-relates the main concepts of *project management* (PM) and *software configuration management* (SCM), the SS methodologies and the SMEs. The model will function as the basis for the conception and development of a framework would help SMEs

to generate high-quality products that give these industries a competitive edge over the broad corporate SS developers. The methodology used to build the conceptual model entailed using ontology format proposed by (Noy and McGuinness, 2001) for creating ontologies. Due to space limitations, this article only presents the results of step *defining the classes and hierarchies*.

2 CONCEPTUAL MODEL

2.1 SMEs

According to (Bolaños, 2006), the SMEs have the following characteristics: (1) they are a family component, (2) they lack formality, (3) their cash flow is insufficient and, (4) they exhibit solvency problems. In general, SMEs have limited access to the credit, to providers, to the government, to technology and to other resources. The human resource is a fundamental element when undertaking on a project; hav-

ing skilled personnel may make the difference between the success and failure of the PM. All of these factors may affect SMEs if they do not possess the necessary tools to realize a project in an adequate fashion. Finally, SMEs limited access to the market means that they lack elements that allow would allow them to compete for the acquisition of contract for project elaboration. Those SMEs which specialize in the SS development must focus on elements that set them apart from other companies in the market (Datanalisis, 2003). In Venezuela there are more than 500 SS companies; 90% of them are Venezuelan-owned. SMEs mainly focus on the development of tailored projects and /or commercial applications. In 2003 the SS industry in Venezuela generated profits of more than \$200,000 million (Datanalisis, 2003). In order to be competitive SMEs may apply a set of strategies including a methodology of SS development that falls within the scope of the aforementioned limitations, and which allows them to generate quality products that can be recognized on the market, helping them to captivate a niche in such a competitive market.

2.2 Development Methodologies

System development methodologies standardize the process of development defining a set of activities, methods, better practices and automated tools, which system developers and project managers must use to continually develop and improve SS (Whitten, 2004). This definition is similar to the one proposed by (Laudon and Laudon, 2004) which establishes that a development methodology is a collection of one or more methods for each activity during each one of the phases of development of a project. We can establish a relation between PM and SCM and the principles of the development methodologies, so that one can visualize the importance of both Management concepts when it comes to optimizing competitiveness for the SMEs. Table 1 shows the categories of the principles indicated by (Whitten, 2004) in relation to PM or SCM respectively, and their importance within the development methodologies context. The SS development methodologies widely known like RUP, UP, and, agile methodologies as SCRUM and XP, among others, normally require a great amount of resources to be implemented. This is the reason for which is not so simple to implant them in the SMEs. Taking into account this reality, in the future work section will settle down a draft of the steps to follow to propose methodological aspects to the PM and SCM disciplines, to facilitate their adoption by SMEs.

Table 1: Classification of methodology principles according to their relationship to PM and SCM.

PM	SCM
<ul style="list-style-type: none"> • Involve owners and users • Use problem resolution focus • Establish phases and activities • Document during the whole development process • Establish standards • Manage processes and projects • Justify systems as capital investment • Monitor Project scope • Apply divide and conquer philosophy 	<ul style="list-style-type: none"> • Document the whole development • Establish standards • Manage processes and projects • Apply the divide and conquer philosophy • Design System that grow and change

2.3 PM

Project managers must not only attempt to find the adequate scope, timeframe, cost and quality; they must also meet the needs and expectations of the people involved or affected by the project's development. In order to do this, project managers must develop a set of skills and competencies that are outlined in the (PMBOK, 2004) as the areas of knowledge of project management. There are a total of 9, and are listed next: (1) **project integration management** (2) **project scope management**, (3) **project time management**, (4) **project cost management**, (5) **project quality management**, (6) **of project human resource management**, (7) project communications management, (8) **project risks management** and, (9) project supplies management. The most relevant areas for the SMEs are highlighted in bold font above. SMEs must be especially careful with those disciplines that relate with resources of any kind, be it, human, time, or financial. This is due to the SMEs limitations regarding access to these resources. In the case of SMEs specialized in the SS development (our interest), one may say that they are able to undertake any of the diverse kinds of SS development. However, some cases they may not have access to the necessary resources in order to finalize big and complex projects. SCM also plays in important role in SS development as tools to manage and control the life cycle of the systems' development. It is closely linked to the process of SS quality assurance. SCM is essential in the development of IT projects. These kinds of projects often deviate from their original planning, mainly by the increasing complexity of the SS, the increasing demand of them, and the changing nature of SS development projects. These deviations may occur for different reasons, including variations in the original requirements. Users may need the product sooner

than originally scheduled, which means that the project must be completed in a rush. These factors have an impact on the final results of the project. SCM helps manage the changes that may arise during the development process.

2.4 SCM

The SWEBOK (IEEE, 2004) defines SCM as the discipline which identifies the configuration of SS at different points in time, with the purpose of systematically controlling the changes of configuration, while maintaining integrity and traceability through the life cycle of the system. This area of knowledge consists of six sub-areas (1) **SCM planning of the**, (2) **identifying the SS's configuration**, (3) **control of the SS's configuration**, (4) **version control**, (5) status of the SS configuration and, (6) SS configuration audit. The areas that are most relevant have been previously highlighted. It is important that SMEs be able to perform the activities related to SCM because the SCM process is closely linked to assurance of quality, and this is crucial when it comes to certifying that the product functions properly and in accordance to the established specifications. About standards we must emphasize the ITIL (Infrastructure Library) to build a frame-work for IT management services (OGC, 2006). In the case of SS development SMEs, it is recommended to perform a processes group implementation that contemplates: Change/Configuration/Version.

3 SHARED CONCEPTS MODEL

Fig. 1 shows the proposed global conceptual model, build upon the basis of the information previously presented. The model in Fig. 1 underlines the fact we incorporated the ontology proposal for SCM presented by (Barraza, 2005). The elements of this proposal are represented in medium-grey.

4 CONCLUSIONS AND FUTURE WORK

In this document we have studied the characteristics of SMEs, PM, SCM, the influence of SCM on the development process and, finally, the concept and characteristics of development methodologies. This study is documented in conceptual map, using the UML 2.0 notation. Once we have clearly understood these concepts, we possess the basis to determine

which particular characteristics are important to the process of SS development for SMEs. After we have developed the conceptual model, it is convenient to consider the following question: Which characteristics must the methodology for the SS development possess to help SMEs optimize their development processes? In order to answer this question, (a) we estimate to study the most important existing development methodologies, (b) we shall verify their characteristics in order to determine whether it is plausible to implement them on SMEs, and (c) we shall make especial emphasis on determining how these methodologies implement SCM and PM, i.e. which roles, activities and tools are used to implement those concepts.

ACKNOWLEDGEMENTS

This research was supported by National Fund of Science, Technology and Innovation, Venezuela, under contract S1-2005000165.

REFERENCES

- Barraza, M., 2005. *Gerencia de Configuración de Software en el Modelo Sistémico de Calidad*, System Engineering MSc. Thesis. Simón Bolívar University.
- Bolaños, R., 2006. *La PYME, motor de desarrollo* [On-line]. Available in: <http://www.pyme.com.mx/articulos-de-pyme/muestra-articulo-datos.php?registro=64> [Consulted: 2007, May 10]
- Datanalisis, 2003. *Estudio de la Ind. del Software en Venezuela*. [On-line]. Available in: <http://www.datanalisis.com.ve/detalle.asp?id=155&planta=14> [Consulted: 2007, July 25]
- Erard, P., 1999. *Fundes Venezuela Un apoyo para las pequeñas y medianas empresas los obstáculos a su desarrollo*. [On-line]. Available in: <http://www.pyme.com.mx/articulos-de-pyme/muestra-articulo-datos.php?registro=50> [Consulted: 2007, May 10]
- IEEE, 2004. *Guide to the Software Engineering Body of Knowledge. SWEBOK*.
- Laudon, J.P., Laudon, K.C., 2004. *Essentials of management information systems*, 6th edition, Englewood Cliffs, NJ: Prentice Hall.
- Noy, N., McGuinness, D., 2001. *Ontology Development 101: A Guide to Creating Your First Ontology. Protege Documentation*. Stanford University.
- OGC Office of Government Commerce, 2006. *Service Management - ITIL® (IT Infrastructure Library)*.
- PMBOK, 2004. *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*. 3rd edition.
- Whitten, J., 2004. *Systems analysis and design methods*, Sixth Edition. Mc Graw Hill.

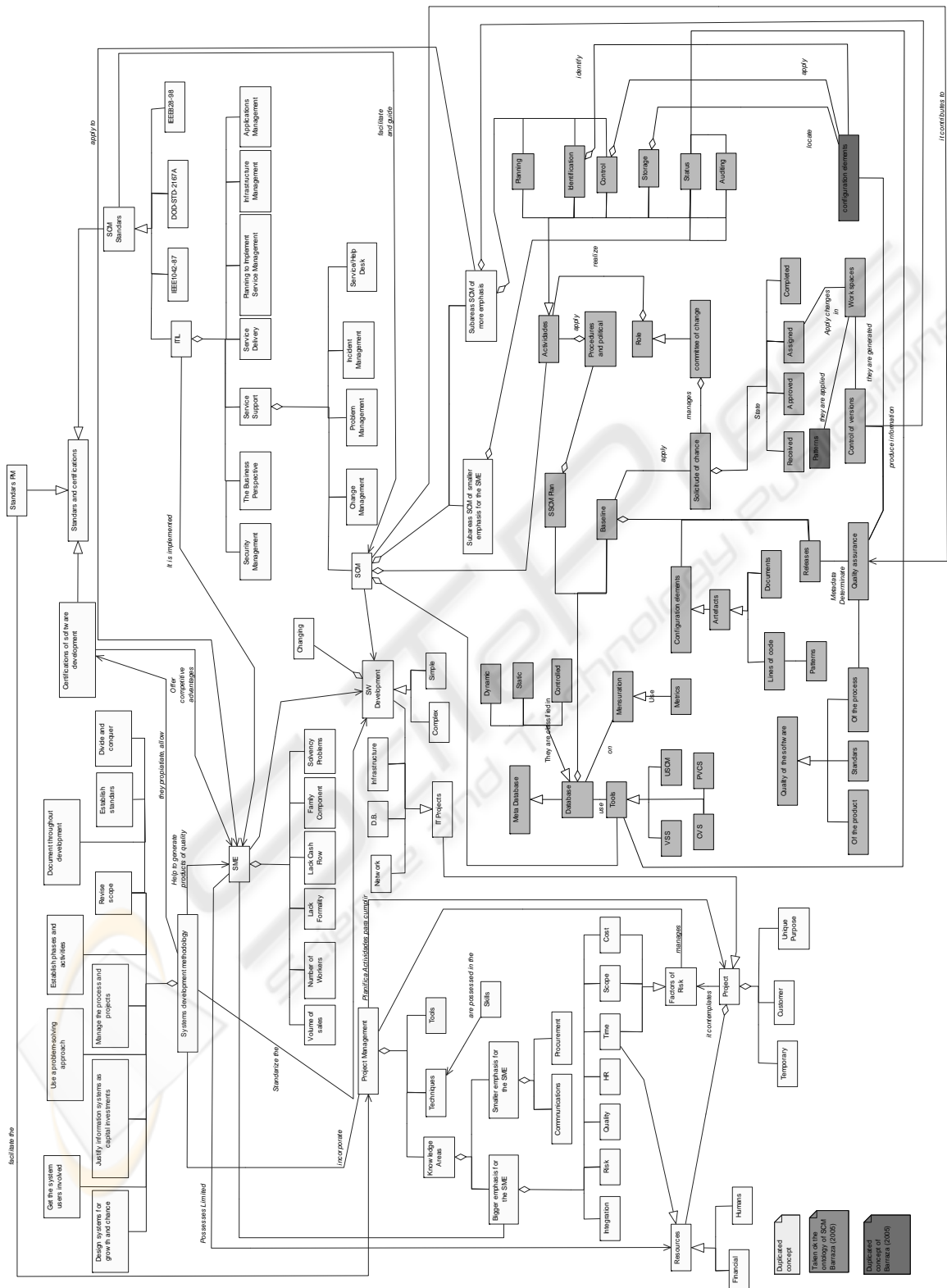


Figure 1: Conceptual Model Proposed for SCM and PM in the context of SMEs.