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Desirable criteria for evaluation of the maturity of business process management: a qualitative evaluation of a company of oil and gas exploration and production

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Abstract

This paper presents a group of criteria and subcriteria to evaluate the maturity of the business process management practices. From the review of the literature about the attributes used by the maturity models, a group of desirable criteria and subcriteria was defined to evaluate the maturity of the business process management. In the context of a case study held in a company of oil and gas exploration and production, the group of criteria and subcriteria suggested was used to evaluate qualitatively the business process management practices of the company. The data for the evaluation were obtained from interviews with company experts who had a large experience with business process management in the exploration and production of oil and gas. The results of the evaluation indicates that the practices for identifying and mapping business processes, training and knowledge management are not performed in a systematic and systemic way. The practices of innovation are not consolidated into a corporative policy of innovation. The information technology does not support the business processes actually. The absence of a corporative methodology, a functional and organizational structure and an organizational culture are the main barriers for the establishment of a business process management. The participation of managers, the reduction of the bureaucracy and the focus on improvement are the main facilitators for the establishment of a maturity evaluation.

Keywords: business process management, maturity models, evaluation criteria, exploration, production, oil.

1 Introduction

In a highly competitive environment, organizations have identified different ways to improve their results, either by reducing cost and investment in innovation, either by the improvement of the management of their business processes. The functional vision has been replaced by the business process vision, where the areas of the organization execute distinctive business processes which cross their boundaries (Hammer, 1997).

The establishment of the vision of business processes requires systematic evaluations of the progress and the path of their application, with the implementation of actions that contributes with the improvement of the business processes. Harrington (1993) emphasizes that "if it's not possible to measure, it can't be controlled, it can't be managed; if it can't be managed, it can't improve".

Especially since the 1990s, as the result of the augment of the organizations interest in the business process management, several maturity models were designed and improved. The main goal of an evaluation maturity model is to identify the level of maturity in the practices of business process management, in terms of the capacity of the business processes to be defined, used, managed and repeated, contributing to their results to be continuously improved (Quintella, 2007). These models use attributes to the business processes evaluation and, by the analysis of the stage in which the organization

is compared to these attributes, arrangements can be taken and action plans can be designed in order to reach full development or, in other words, the excellency of the business processes.

In this context, the present paper has the following goals: identify in the literature the main attributes used by the evaluation maturity models; define, based on these attributes, a group of criteria and subcriteria for the evaluation of the maturity of business process management and; present the results of a qualitative research about the evaluation of business process management practices of a large company of oil and gas exploration and production in relation with the defined criteria.

2 Literature Review

The bibliographical research aims to identify the attributes used by the main evaluation models used to evaluate the maturity business processes in the literature.

This study sought to explore the full potential of the bibliographic database available and the tools of the information technology for its treatment. First was defined a group of keywords related to the business process management to initiate the research procedures. Second was made a raw bibliographical research in the main search engines such as: CAPES Journal Portal, ISI Web of Knowledge, Wilson Web, Engineering Village etc. About one thousand and five hundred of the scientific papers found were selected, filed in a proper place and catalogued by specialized software. Third was made a filtering of the papers, using a group of criteria to help the decision-making process. In this procedure were selected one hundred and fifty bibliographic references that presented related content with the attributes used by the main models to evaluate the maturity.

The next items will present the main results of the literature review.

2.1 The evaluation of the business process maturity

The term maturity can be defined as "the complete development or the perfect condition of any process or activity" Random House College Dictionary (Urdang and Flexner, 1968). As a conclusion, the maturity denotes the aspects concerned to the motives which the success is achieved and the ways used to correct or to prevent ordinary problems that would stop the improvement of the business processes through a longitudinal and incremental perspective (Houston, 2004).

The concept of maturity has been used in many fields of knowledge and the number of models designed is significant (Valadares, 2001). Nowadays the maturity models are being used to describe the effective estate of an organization to develop certain tasks and processes, to map the logic ways of improvement of the products and services of the organizations and to allow the establishment of forms of forecasting the future development of the processes. Houston (2004) conceptualized organizational maturity as the capacity of an organization to develop its business processes accordingly to the previous defined goals in the context of its strategic and functional planning.

Accordingly to Houston (2004), the mature organizations execute their activities in a systematic way, while the immature organizations reach their results from their staff heroic efforts. To the mentioned author, the maturity is related to predictability, control and efficiency. The predictability refers to the fulfillment of what was planned. The immature organizations can plan, but cannot guarantee that their goals can be achieved. The control refers to the consistence which the organizations reach their goals. The mature organizations reach their goals with a minimum deflection of what was planned. The efficiency refers to the capacity of the organization to reach the results achieved in relation to the desired results. In this sense, the mature organizations reach the goals they committed to achieve. On the other hand, the immature organizations usually reach only some of their goals. Besides that, in most cases, the quality of the results is compromised and the costs become higher than expected. The mature organizations use systematic business processes to do their activities. The previously collected data are used to prevent what will happen when a similar effort is conducted in the future (Houston, 2004).

2.2 The main models to evaluate the maturity

The first maturity model mentioned was developed by Crosby (1985) and was called the "Quality Management Maturity Grid" (QMMG). The model was developed to evaluate the evolution level (maturity) of the management of several quality processes. It establishes five stages or levels of maturity based on the quality management practices adopted by the organization.

For its generic nature and intrinsic structure of evolution, the Crosby (1985) model became reference for several maturity models (Valadares, 2001). The main principles were adapted by SEI (Software Engineering Institute) to develop the CMM (Capability Maturity Model) to evaluate the software development processes (Humphrey, 1987). The CMM uses a structure of five maturity levels that allows the stratification of the position held by the software developer organization in relation to the maturity of its business processes.

Based on the CMM, an abundance of models guided to the measurement of the maturity of the process management were launched. Basically all of them pointed to a logical path of progressive development of the process management empowerment. To most of these models what matters is not only define in which level a certain organization is, but what must be done to ensure the evolution through time (Valadares, 2001).

The main models identified in the literature were (CIP E&P, 2009):

- Maturity models for Quality Management
    - QMMG (Quality Management Maturity Grid) – Crosby (1985)
- Maturity models for Software Process Management
    - CMMI (Capability Maturity Model Integration) – SEI (2006)
- Maturity models for Business Process Management
    - PEMM (Process and Enterprise Maturity Model) – Hammer (2007)
    - BPMM (Business Process Maturity Model) – Rosemann and Bruin (2007)
    - CEMO (Checklist for Evaluating the Maturity of an Organization/Process) – Harmon (2004)
    - BPOMM (Business Process Orientation Maturity Model) - Lockamy e McCormack (2004)
    - BPMM (Business Process Maturity Model) – Fisher (2005)
- Maturity models for Management Projects
    - OPM3 (Organizational project management maturity model) – PMI (2008)
    - PMMM (Project Management Maturity Model) – Kerzner (2001)
- Maturity models for the Chain of Supply Management
    - SCOR (Supply Chain Operations Reference) – SCOR (2008).

2.3 Criteria for the maturity evaluation

Among the ten models identified in the literature, four were selected to serve as base for the definition of the criteria for the evaluation of the business process management maturity: the CMMI, the PEMM, the BPMM and the BPOMM. These models were selected because they have a clear set of attributes for the specific evaluation of the business process management. The other ones were not selected because were specific for a certain area or did not establish observable subcriteria and indicators for the evaluation. Table 1 presents the attributes used by the four models to evaluate the maturity.

Table 1: Attributes used by the evaluation models of the business process management maturity

CMMI	PEMM	BPMM	BPOMM
Project Management	Executers	Strategic Alignment	Process Vision
Process Management	Responsible	Governance	Structures
Support	Infrastructure	Methods	Attributions
Engineering	Indicators	Information Technology	Measurement and management systems
	Leadership	People	Processes values and beliefs
	Culture	Culture	
	knowledge		
	Governance		

Source: The authors 2011

From the analysis of the attributes used by the four selected models, were defined eleven criteria and twenty seven subcriteria for the evaluation of the maturity for the business process management that are presented on Table 2.

Table 2: Defined criteria and subcriteria

Criteria	Subcriteria
Definition	Procedures to define the business process requirements
	Procedures to disseminate the "client focus" culture between the employees.
Mapping	Mapping techniques
	Prioritization Techniques
Indicators	Definition process
	Classification criteria
Control	Nonconformities treatment
	Implementation of corrective actions
Analysis and Improvement	Variability reduction and reliability increase methods
	Procedures for the application of the tools
	Analysis and improvement of tools (ex: six sigma, process statistic control etc.)
	Contribution of tools for the process improvement
Innovation	Procedures to evaluate the potential of creative ideas
	Procedures to convert creative ideas into innovations
	Procedures to disseminate and stimulate the innovative practices of the processes
Capacitation	Procedures of employees training in problem-solving tools
	Procedures of employees capacitation in process improvement techniques
	Procedures of employees capacitation in teamwork
IT Support	Support from the IT services to process management
Knowledge Management	The use of the knowledge management in the execution of processes
	Procedures of dissemination and systematization of the knowledge established in the process management
Process Management Establishment	Implementation procedures
	Barriers
	Facilitators
Maturity Evaluation Establishment	Implementation procedures
	Barriers
	Facilitators

Source: CIP E&P 2009

3 Methodology

In this item will be presented the research classification, its phases, the instrument for data collection and the profile of the respondents.

Because of the goal of this study, it can be classified as a research: applied; qualitative approach; exploratory; bibliographical; and field research.

Considering its nature, it is an applied research because aims to generate the knowledge to practical application, directed to answer the specific questions of the business process management.

The qualitative approach of this research is due to the fact that it does not use a statistical instrument, but obtains the descriptive data through the contact with the object of study. According to Gil (2008), this analysis is less formal. It is descriptive, based on the observation and uses interactive and humanistic methods, as it uses the researched material to perform analysis and interpretations.

The research is classified as exploratory because according do Gil (2008) it has as main goal to develop, to clarify and to change concepts and ideas from the formulation of problems. In other words, it is not intended to verify theories, but to gain more familiarity with them, focusing to make a contribution to profound the subject studied.

To Gil (2008) the research procedure deals with its design and its main point lies in the collection of data. As an approach for the fulfilling of the goals of this research, it was made a bibliographical research through the main search engine (Capes Periodic; Academic Google; internet etc.) to review the materials already published, formed by books, articles, essays, regulations and guides about the business process management and maturity evaluation themes. The method used in this research aims to obtain information through the analysis of the data available in the regulations, guides and in the literature, comparing them with the practices of business process management.

To make it possible to know and to study the main business process management practices and their maturity, a field research was conducted, supported by an open questionnaire that was used in the interviews to collect information about the opinions of specialists on presented theme.

According to Vergara (2010), the case study is a particular type of research that is applied to one or few units, also known as "a person, a family, a product, a company, a public agency, a community or even a country. It has the feature of depth and detail".

The research was divided into four stages. During the first stage was made a bibliographical research to identify the attributes used in the main maturity models and to define a group of criteria and subcriteria to evaluate the maturity of the business process management. During the second stage, from the defined criteria was created a research instrument to evaluate the business process management practices of a large company of oil and gas exploration and production. During the third stage, the data about the business process management practices of the company were collected in interviews with focal points were previously selected. During the fourth stage, the collected data were analyzed and discussed.

3.1 Research instrument

The field research aimed to collect information to evaluate the business process management practices of the company in relation to the group of criteria for the evaluation of business processes maturity.

Among the available methodologies for the field research, was chosen a qualitative approach, involving data gathering through the research instrument applied in the interviews with the selected focal points. The research instrument, elaborated from the defined criteria for the evaluation of the maturity of the business process management, was used to collect information about the management practices of the large company of oil and gas exploration and production.

The research instrument was structured into criteria, subcriteria and questions, and before its appliance, it was adapted to the company's reality. The research instrument has twenty questions and is presented on Table 3.

Table 3: Research instrument

Criteria	Questions
Definition	The processes that you lead or where you´re inserted were defined with the participation of your clients?
	How the client is seen by the executers of the processes?
Mapping	How were the processes mapped?
	What type of prioritization was used for the mapping?
Indicators	How are defined the indicators to measure the process development?
Control	How the processes are controlled?
Analysis and Improvement	How the processes are analyzed and improved?
	Which improvement tools are used?
	In which way the use of these tools contribute to the process results?
Innovation	How the innovations are incorporated to the processes?
	How the company identifies the practices that lead to the innovation of the processes?
Capacitation	How the collaborators are qualified and trained to execute their processes?
IT Support	Is there an IT (Information Technology) system that supports its process? How this system contributes with the achievement of the processes?
Knowledge Management	How the company disseminates and systematizes the knowledge created during the execution of the process?
Process Management Establishment	How the business process management must be implemented inside your company?
	What are the barriers for its implementation?
	Who are the facilitators for its implementation?
Maturity Evaluation Establishment	How the maturity evaluation of the business processes must be implemented at your company?
	What are the barriers to evaluate the maturity of the processes?
	Who are the facilitators for the maturity evaluation of the processes?

Source: CIP E&P 2009

3.2 Respondents profile

The field research was held during the action of the authors of the Research Project in CIP – Centro de Inovação e Produtividade (Innovation and Productivity Center) – in the Performance Evaluation Pillar (CIP E&P, 2009), particularly in the perception of the business process management practices and the business process maturity evaluation inside a large company from the segment of oil and gas in Brazil.

The profile defined for the respondents was: specialist with experience in applying the business process management practices in the exploration and production of oil and gas area. The company leadership provided ten managers with high experience and knowledge in the application of the business process management practices to answer the formulated questions. The research instrument was sent before to each one of the respondents and the interviews were taped to further analysis.

4 Results

Based on the interview recordings and using a specialized software, a content analysis was made. Table 4 presents the results of the evaluation of the business process management practices according to the established criteria, subcriteria and questions.

Table 4: Results of the evaluation of the business process management practices of the company of oil and gas exploration and production

Criteria	Of the evaluation of the management practices
Definition	The processes are defined only with the participation of the internal client.
	The definition of who is the client becomes clear at the business units level.
	At the macro-level of process management are defined the premises that serve as base to the macro processes management.
	There are stakeholders at the organization that establish the requirements to be attended by the processes.
	It seems that it doesn't exist a defined and systemized practice of definition of the requirements to be attended by the processes

	The client does not participate in the definition of the processes As the company includes practically the hole productive chain of oil and gas, it has some difficulty to incorporate the customer focus culture, because most of the clients are from the own company It can be considered that in the corporative level the role of the client is very abstract and it can be considered that the clients are the managers themselves But as it approaches the operational level, becomes clear who the client is. The company does not have defined and systemized procedures to disseminate to its employees the culture of client focus.
Mapping	The company uses the corporative methodology to mapping and definition its processes and uses the ARIS software as a support tool. However, the mapping is made in a non-standard way and at the criteria of each manager area. The practice of standardization of the processes is functional, based on the necessity or on the experience of the managers of each area.
Indicators	The strategic indicators that measure the goals related to the processes that are directly linked to the company strategy are defined from the strategic map of its Balanced Scorecard (BSC). There are not clearly defined criteria to classification, but there are orientations from the company to measure the performance of the processes according to their expectations: vertical and horizontal. At the vertical perspective, the performance driver is the strategic goal defined by the BSC, that is related to results and that measures the quality of the process in relation to its ability to achieve the proposed goal. At the horizontal perspective, the concern is with the efficiency and the quality of the process itself.
Control	The organization performs the control of its processes in a non-systematized way. In some areas of the company there are initiatives with control procedures defined and systemized. The procedures of identification of the non-conformities and of implementation of the corrective actions used by the company were not mentioned.
Analysis and improvement	The use of traditional tools to improve the processes is incipient in the company. At the organization basis there is a culture of processes, because there are groups made to implant the practices of process management. The major challenge of the company is to develop a corporate methodology of analysis and process improvement that considers the specificities of activities of exploration and production of oil and gas.
Innovation	The processes of exploration and production of oil are of different natures and the matter of innovation must be discussed considering this context. The company uses two kinds of innovation practices. First there is little innovation practice that occurs in the operational processes with a high level of standardization. It is encouraged through programs with good ideas that, in a certain way, are already systematized. Second there is a great innovation. It is the one that the E&P companies need. It happens in those areas where there is a great intellectual complexity such as, for example, in the geology, geophysics and engineering areas of a tank. In those areas the work is done with expensive processes that are responsible for most of the income generation. In those processes the organization and systematization level must be lower because these great innovations often appear because of questions about the existing models. The practice of encouraging the great innovation is held in the processes that generate income, because they have a higher innovation potential. The company's challenge is to make the processes with a high innovation potential to absorb the procedures that stimulate the innovation. The company has a fertile ground for innovation because it invests heavily in training of its staff. The company has partnerships with R&D companies whose main function is to generate technology and innovation for their E&P processes.
Capacitation	Some processes have the procedures to capacitate their employees in problem solving, techniques of process improvement and teamwork. Generally the employees are trained using the work standards defined for these processes. The company performs trainings for the teamwork and the identification of problems and structures to support these actions were created, but these activities are not treated in a systematic and structured way. The company invests heavily in training, mostly the training of employees in the operational level, through formal courses, oral transmission, courses performed at work etc. This qualification is less intense for managers.
IT Support	The major support has been in terms of process mapping. The company defined the macro processes and started to unfold and link them to their other actions.

	The company wants to fortify the process view and the Information Technology (IT) area has been working in this direction. It uses a corporative IT system that supports the processes and aims to integrate the whole company. The IT system used to support the processes is far from a technological solution that effectively withstands the processes in what they are most critical. The IT tools that exist in the company are enough to support the process management.
Knowledge management	The company uses several ways to disseminate the knowledge generated during the process execution. At the management level, periodic meetings are conducted with the participation of the managers and the main leaders. For the implementation of the orientation by processes were selected people with great knowledge on the subject and that help in the trainings and in the construction of a culture favorable to the orientation by processes. The systematization and dissemination of the knowledge generated during the process execution is made individually. The areas perform meetings for the exchange of experience.
Process management establishment	It has not yet been defined a process management methodology which contains the procedures for its establishment in the whole company. Continuously the organization has to generate innovations to mitigate the production decline or to increase the income or to reduce the cost. For the process management get into the culture of the company, it must support the intense work executed by the organization. The barriers identified for the establishment of the business process management are the ignorance about the subject and the organization structure by business areas that influence how the process management should be implanted. The vertical vision of the company stimulates the isolation of some areas.
Maturity evaluation establishment	The evaluation must work as a tool for the induction and encouragement of the pursuit for quality. It must stimulate the managers to improve the quality of their processes. The establishment must not be centered and use self-evaluation procedures. The comparison between similar processes must be stimulated. The maturity evaluation mustn't be to supervise, but to induce the improvement. If it is transformed into an auditing tool of the company, the resistance will be big and will hardly be incorporated into the company culture. You cannot think of a standard model for the company. Each group of processes has different features that must be respected.

Source: The authors 2011

The results of the evaluation indicate that the organization already use tools in defining and mapping of processes and indicators to measure the performance of processes. In some areas there are initiatives of process control. However these procedures are not used in a systematic way and were not disseminate through the whole organization.

The organization strongly invests in innovation. Two practices are used for innovation: one is (pontual) and occurs in operational processes with a high level of standardization; the other one is systemic and is used in the processes that generate income, where the standardization is lower. The company does not have an innovation policy to the processes.

The capacitation in process management is mainly guided for the employees at the operational level and explains mostly of the teamwork and the identification and solution of problems. Nevertheless this activity is not treated in a systematic way and uses systems from Total Quality team.

The IT support is mostly linked to the process mapping and does not support effectively the processes which are most critical.

The company uses several ways to disseminate the knowledge, however the standardization and the dissemination of the practices is held in a (pontual) way.

As the establishment of the process management, the company does not have a corporative methodology for it. The ignorance about the process management and the structure by business units are barriers for this establishment and the organizational culture is a great challenge.

In relation to the establishment of the maturity evaluation, it must stimulate the participation of the managers; avoid excessive bureaucracy in its establishment does not turn into a supervision tool, but into an instrument to improve the quality of the processes.

5 Conclusion

This paper presented a group of criteria and subcriteria desirable for the evaluation of the maturity of the process management.

From the literature review about the attributes used by the maturity models, were proposed eleven criteria and twenty seven subcriteria for evaluation. The group proposed was used for the evaluation of the business process management practices of a large oil and gas company.

The results indicate that the organization uses tools in defining and mapping of processes and indicators, but not in a systematic and disseminated way through the whole organization. Despite the fact that it uses innovation and systemic practices, the company does not have a corporative policy of innovation. The qualification in process management is performed mainly for the employees of the operational level and it's not treated in a systematic way. The support of information technology does not support the processes effectively. The company uses several ways to disseminate the knowledge, but in a (pontual) way. The main barriers for the establishment of the process management are: the lack of a corporative methodology, the ignorance about the subject, the organizational structure by business units and the organizational culture. To facilitate the establishment of a maturity evaluation of the processes, the company must stimulate the participation of the managers, avoid bureaucracy and use the evaluation as an instrument for the improvement of the process quality.

The main limitation of this paper concerns to the fact that there may be other characteristics that were not included in this study.

As guidance for future researches related to the present theme, it is suggested the statistic validation of the group of criteria and subcriteria proposed in other organizations that are recognized by their excellent practices in business process management.

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