
Knowledge Oriented Process Portal for Continually Improving NPD

Andrea Padovan Jubileu^{a1}, Henrique Rozenfeld^a, Creusa Sayuri Tahara Amaral^a, Janaina Mascarenhas Hornos Costa^a, Marcella Letícia de Souza Costa^a

^a University of São Paulo, São Carlos, SP, Brazil.

Abstract. Business process management integrated with new product development (NPD) provides practices to help companies to improve their competitiveness. However, few companies know the benefits of these practices and few have the culture of systematically sharing knowledge about these practices to continually improve their NPD. In order to encourage companies to use process management with systematic sharing of knowledge, this paper proposes the development of a knowledge oriented process portal. This portal comprises information related to generic NPD reference models and its continual renewal by using the body of knowledge (BOK), made available by a community of practice (CoP).

Keywords. business process management, new product development, web-based systems, knowledge sharing, community of practice.

1 Introduction

New product development (NPD) is a business process aimed at converting needs into technical and commercial solutions. To accomplish an efficient NPD it is important to define and to manage it in agreement with business process management (BPM). BPM along with strategic planning provide inputs to monitor business process performance indicators. This combination may indicate the way to perform necessary changes to continually improve NPD. The definition of a NPD reference model promotes a single vision of product development to all actors in the process. This vision has the purpose of leveling important knowledge between the stakeholders.

Existing elements of the reference model, i.e. tools, methods, templates, can be adapted to the company's NPD maturity level. This knowledge associated to these elements should be dynamic, that is, it should be updated in agreement with the creation of new solutions and corresponding information. Thus, it is possible to have a continuous improvement from simple piece of information to complex information structures. A way to make this knowledge dynamic is by participating

¹ University of São Paulo. Trabalhador São Carlense Av., 400, NUMA, São Carlos, SP, Brazil, Tel.: +55-16-3373.9433, E-mail: andreapjubileu@gmail.com

in a community of practice because it enables production and sharing of knowledge related to reference models.

In reality, few companies know the advantages of these practices and few are used to systematically share knowledge on these practices to continually improve their NPD processes. To obtain these advantages companies have to incorporate these concepts into their strategies.

Therefore, it would be very useful for these companies to have a Web environment that helps them to know how to integrate BPM to systematical knowledge production and sharing. The use of information and communication technology (ICT) combined with the Internet increases the access to knowledge and specialists, wherever users interested in BOK are.

This environment could enable people to access reference models and all the information pertaining to them; to insert learned lessons and best practice related to the model activities to be shared with all stakeholders in the company; to access a community of practice, which allows contact with specialists and knowledge sharing.

The objective of this paper is to develop proposal of a knowledge oriented process portal, which offers an environment that enables organizations to define their own NPD reference models (standard process) — or even to use existing reference models—and to continuously update the BOK associated with their reference models.

It is important to emphasize that the use of this technology should be combined with other necessary aspects to create such an environment. Some of these aspects are: business strategies; knowledge management strategies and process; organizational culture; human resources management and so on. All these aspects contribute to continuous improvement of the process. This paper will deal with the development of a tool to manage NPD business process knowledge.

The following sections briefly summarize research on BPM, NPD, knowledge sharing, and web portals. Section 2 outlines BPM because of advantages of these management principles. Section 3 presents some NPD concepts and features. Since knowledge sharing and IT are powerful aspects of BPM, Section 4 describes knowledge sharing and web portals. Section 5 presents the goal of this project: to create a portal to assist companies in using NPD.

2 Business Process Management (BPM)

Business Process Management (BPM) is about both business and technology [15]. BPM is regarded as a best practice management principle to help companies sustain a competitive edge. Based on a holistic perspective, BPM combines Total Quality Management (TQM) that is incremental, evolutionary and continuous in nature and Process Re-engineering that is radical, revolutionary and a one-time undertaking, and is regarded as suitable for performance improvement in most circumstances [7]. In the so called third wave the goal is to apply BPM toward innovation [15]. On the other hand there are author that emphasizes BPM as a technological tool, seen as an evolution of workflow management systems [1].

In this case BPM life-cycle has four phases: process design, system configuration, process enactment and diagnosis. The focus of traditional workflow management (systems) is on the process design and process enactment phases of the BPM lifecycle. This definition of BPM extends the traditional workflow management (WFM) approach by supporting the diagnosis phase and allowing for new ways to support operational process [1, 2].

Since in this paper the scope is to integrate NPD process improvement in a broader BPM framework, the focus is on the business vision of BPM. However the implementation of BPM technology is a very important issue, though it is considered in the Product Lifecycle Management (PLM) systems.

Hung [7] defines BPM as an integrated management philosophy and set of practices that incorporates both incremental and radical changes in business processes, and emphasizes continuous improvement, customer satisfaction and employees' involvement.

BPM is a structured and systematic approach to analyze, improve, control and manage processes to increase the quality of products and services. This approach depends on the alignment of business operations with strategic priorities, operational elements, use of modern tools and techniques, people involvement and, most importantly, on a horizontal focus that can best suit and deliver customer requirements in an optimum and satisfactory way [10, 17].

New product development (NPD) is often recognized as the key process to enhance competitiveness [4]. To this end, NPD improvement should be in harmony with BPM practices to ensure the commitment with the company's strategic goals.

3 New Product Development (NPD)

New product development is a business process carried out by a group of people to transform market opportunities and technical possibilities into information to assist the design of a commercial product [5]. NPD is considered to be a critical business process to increase a company' competitiveness, diversity and product mix—especially in the international market—and to reduce product lifecycle [4, 13].

Some characteristics of NPD are: high level of uncertainty and risk in activities and results; important decisions made in the beginning of the process when uncertainty is higher; manipulation and generation of great amount of information; activities and information deriving from many sources and, because of this, in need of integration; multiple requirements considering all phases of product lifecycle and customers' needs [13].

To obtain efficient management of product development it is necessary to make the process visible to all stakeholders. This may be achieved by business process modeling, which results in a map or representation that describes the company's business process. It is possible to create such a business process model to define other instances in accordance with each company's projects. Usually, a generic reference model is created for one industry sector, which may be used in other sectors. Thus, companies pertaining to the same sector can define their standard process models by adapting the generic reference model to their contexts. The instances may be created based upon standard processes for many types of

projects. It is possible to obtain with a reference model a single vision of product development and, thus, to equalize the knowledge among all stakeholders participating in a specific development [13].

Some examples of NPD reference models with different levels of detail are: the PDPnet reference model [13], MIT Process Handbook [9] e Capability Maturity Model Integration (CMMI) [16]. The PDPnet model was adopted as a generic reference model to NPD in this work, which will be described in Section 5. This model synthesizes the best NPD practices [13]. This reference model contains following phases: product strategic planning; design planning; informational planning; conceptual design; detailed design; product production preparation; product launching; product and process follow-up; product discontinuation. The model highlights the integration of strategic planning and portfolio management; the incorporation of PMBOK concepts [12] into the planning phase; definition of integrated cycles for detailing, acquisition and optimization of products in the detailed design phase; insertion of optimization activities; validation of productive processes and techniques to meet ergonomic and environment requirements; and integration of product launching phase where other business processes such as technical assistance and sales processes are defined and implemented.

Existing elements in the reference model—i.e., tools, methods, templates, best practices—can be adapted to the company's NPD maturity level. This knowledge should be dynamic, that is, it should be updated to be consistent with new information. Some ways to share knowledge—knowledge sharing concepts (strategic resource to companies) and portals (one of the web-based tools)—are explained in the next section.

4 Knowledge Sharing and Web Portals

Since knowledge is considered to be the companies' primary strategic resource, researchers and managers have tried to determine new ways to efficiently gather these resources and manage them to produce new knowledge [6]. There is an increasing need for companies to be pro-active—i.e., to support knowledge creation and reutilization—and to have systems that assist them in making knowledge sources or information available to users, wherever they are. In this direction, new Internet-based technologies facilitate information exchanging among companies and enhance collaboration among people, in synchronous and asynchronous ways. Moreover, these technologies improve knowledge generation, storage and transference [3].

In this context, it is possible to use web portals—i.e., infra-structures that promote, through a single access point, the integration of people, applications and services. They allow the collection, management, sharing and utilization of information, structured (e.g., textual documents, web pages, etc.) or not structured (e.g., images, videos, sounds, etc.), available in many sources, such as application databases. Web portals provide these services in a secure, individualized and customized way, allowing the visualization of relevant information according to users' permission [3, 14].

5 Knowledge oriented Process Portal

Nowadays, markets are generally perceived as demanding higher quality and higher performance products, in shorter and more predictable development lifecycle and at lower costs. Companies are using Information and Communication Technologies in their NPD activities to accelerate it, to increase productivity, facilitate collaboration, communication and co-ordination of NPD teams, foster versatility, produce and share knowledge on new products, improve new product decisions, and develop superior products [11].

The development of the Knowledge oriented Process Portal in this project was based on the aforementioned concepts. This proposal is also part of a broader project, which aims at establishing a web environment to integrate many NPD tools.

5.1 Objectives

The purposes of this Knowledge oriented Process Portal are:

1. To offer an environment that enables organizations to define their own NPD reference models or to use existing reference models. This reference model comprises best practices and describes activities, information and resources utilized in these activities, including methods, techniques and tools, as well as roles played by the people in the organization in charge of them.
2. To manage the body of knowledge (BOK) associated with the NPD reference model. This BOK can be modified by a community of practice, producing and sharing knowledge about the model components.

5.2 Methodology

The research method adopted was of a hypothetical-deductive nature. A portal prototype was developed, which included a generic NPD reference model. The hypothesis was that a portal could facilitate the access to a reference model by companies, integrating systematic creation and sharing knowledge, to obtain the NPD continuous improvement. To this end, the PDPnet reference model [13] was made available to the community of practice (<http://www.pdp.org.br>).

The method employed in the development of the portal was the Rational Unified Process (RUP) [8]. It is based on the iterative and incremental development by means of the following phases: conception, elaboration, construction and transaction. This method was chosen because it has an evolutionary character, necessary to make the portal requirements clear in each development phase, which are described in the next section.

5.3 Requirements

The portal functional requirements can be classified into 5 categories:

- To allow the portal administrator to insert the reference model components: activities, activity inputs and outputs, activity-detailing tasks and description, methods, techniques, tools and templates of documents

(resources) used to carry out activities; and roles played by people in charge of activities;

- To allow the portal administrator to import the graphic process model of process modeling tools and create a textual model accordingly and vice-versa;
- To allow portal users (companies) to use the available reference models in order to define their standard NPD processes. The users may adapt the reference model to their contexts excluding or inserting activities and other model components.
- To allow portal users to insert lessons learned about the NPD reference model to achieve the continuous improvement of the process. To this end, it is necessary to report lessons learned from using the model components (activities, information, tools and methods) and the knowledge about these components. The related knowledge may include any object of the BOK (described in following).
- To allow portal users to participate in a community of practice because it is a way of managing the body of knowledge (BOK) associated with the reference model. Users can access knowledge available in articles, presentations, books, magazines, research projects, academic work, sites, cases, news, events, dictionaries, e-learning courses, standards, guides, contact of specialists and formal courses. Any kind of information that carries tacit knowledge too. Furthermore, users can access the community's comments about the BOK of the reference model.

5.4 Functional Structure

Figure 1 shows the functional structure of the portal. The idea is that users/companies could refer to a model—initially the PDP reference model [13]—existing in the portal. The model contains information about tools, methods, procedures or routines, and document templates to assist in the accomplishment of the activities.

The portal may also be used by users/companies as an instance to create their knowledge bases using the structure developed in the portal. Once users create their standard process models, the information in them could be modified or criticized when allowed by the companies/users.

The support to users to improve the knowledge related to standard process models will be provided by the community of practice (CoP), which will allow users to contact NPD specialists, access links to interesting websites, papers, books and other important research material. Thus, the portal will have a dynamic nature, promoting knowledge sharing among users, who in turn can improve their BOK's on their standard process models. At the moment CoP support is being provided by means of PDPNet.

The integration with modeling tools allows the conversion of textual models in graphic models and vice-versa.

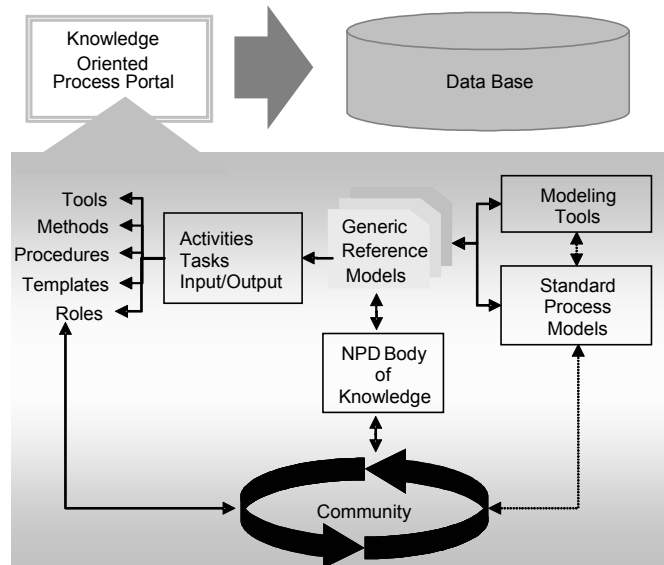


Figure 1 – Functional Structure of the Knowledge oriented Process Portal

6 Conclusion

In the context of NPD management with BPM principles, portals could be used to integrate people and provide access to information/knowledge collaboratively and with a cycle of knowledge retention, use and sharing. This cycle generates new knowledge, which is incorporated into NPD reference model activities, continually increasing companies' capability in product development.

It is hoped that the knowledge about NPD reference models will be used by a larger number of companies, since the content of the portal is open and free.

The integration between the NPD reference model and the dynamic BOK allow users to select the knowledge more appropriated to their needs and even to define their own standard NPD process. Moreover a company can include in its standard NPD process part of the BOK available, so it can leverage the competency of its NPD team members. The participation in the available community of practice is important to keep the company updated. Being free and open make it possible to be used by small and medium enterprises (SME), which cannot sometimes afford to hire consultants to improve their NPD processes.

Acknowledges

The authors are grateful to GEI2 colleagues for suggestions and to CNPq for the financial support.

References

- [1] Aalst, W. M. P. van der; Hofstede, A. H. M. ter; Weske, M. Business Process Management: A Survey. BPM Center Report BPM-03-02, BPMcenter.org, 2003, <http://is.tm.tue.nl/staff/wvdaalst/BPMcenter/reports/2003/BPM-03-02.pdf>.
- [2] Aalst, W. M. P. van der. Business Process Management Demystified: A Tutorial on Models, Systems and Standards for Workflow Management. In: Desel, J.; Reisig, W.; Rozenberg, G. (Eds): ACPN 2003, LNCS 3098, pp. 1-65, Springer-Verlag Berlin Heidelberg, 2004.
- [3] Benbya, H.; Passiante, G.; Belbaly, N. A. Corporate portals: a tool for KM synchronization. *Inter. Journal of Inf. Manag.*, 24, 201–220, 2004.
- [4] Büyüközkan, G; Baykasoglu, A.; Dereli, T. Integration of Internet and web-based tools in new product development process. *Production Planning & Control*, 18(1), 44–53, 2007.
- [5] Clarck, K. B.; Fujimoto, T. Product Development Performance: strategy, organization and management in the world auto industry. Boston, Harvard Business School Press, 1991.
- [6] Hahn, J.; Subramani, M. R. A Framework of KMS: Issues and Challenges for theory and practice, http://ids.csom.umn.edu/faculty/mani/Homepage/Papers/Hahn&Subramani_ICIS2000.pdf.
- [7] Hung, R. Y. Business process management as competitive advantage: a review and empirical study. *Total quality management*. 17(1), 21–40, Jan, 2006.
- [8] Kruchten, P. The Rational Unified Process: An Introduction. 3th ed. Harlow: Addison-Wesley, 2003.
- [9] Malone, T. W.; Crowston, K.; Herman, G. Organizing Business Knowledge: The MIT Process Handbook. Cambridge, MA: MIT Press, 2003.
- [10] McKay, A.; Radnor, Z. A characterization of a business process. *International Journal of Operational and Production Management*, 18(9/10), 924-936, 1998.
- [11] Özer, M. The role of the internet in new product performance: a conceptual investigation. *Indust. Market. Manage.*, 33, 355–369, 2004.
- [12] PROJECT MANAGEMENT INSTITUTE. A guide to the project management body of knowledge (PMBOK guide), Pennsylvania, 2002.
- [13] Rozenfeld, H.; Forcellini, F. A.; Amaral, D. C.; Toledo, J. C. de; Silva, S. L. da; Alliprandini, D. H.; Scalice, R. K. *Gestão de Desenvolvimento de Produtos – Uma referência para a melhoria do processo*. São Paulo: Saraiva, 2006.
- [14] Smith, M. A. Portals: toward an application framework for interoperability. *Commun. ACM*, 47(10), 93–97, 2004.
- [15] Smith, H.; Fingar, P. Business Process Management: The third wave. Meghan-Kiffer Press, 2003
- [16] SOFTWARE ENGINEERING INSTITUTE. CMMI for Systems Engineering/Software, IPPD, Development/Supplier Sourcing, Version 1.1, <http://www.sei.cmu.edu/cmmi/models>.
- [17] Zairi, M. Business process management: a boundary less approach to modern competitiveness. *Business Process Management Journal*, 3(1), 64-80, 1997.