Learning Product Development Process Modeling from a Real Case

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Abstract

New product development is an information based process, therefore quite intangible. Frequently, people involved with product project, develop tacit knowledge that, if not made explicit may be lost if a member of the team leaves the organization. The process graphical modeling is recommended not only to explicit individual tacit knowledge but also to give a good visibility of the process to every team member, creating the basis to process improvement. For this reason the product development process (PDP) modeling can be considered an important subject in design and engineering graduation courses. The aim of this paper is to propose a way of motivating students to learn PDP modeling from a real case. This study was conducted within the Product Development Management discipline from the Industrial Engineering graduation course in a Federal University from south Brazil. Modeling this process in a company is a non trivial task that depends on interviews with PDP team in order to achieve information and to convert it in a model. Time and organization information access restrictions would make this task impossible to be performed by graduation students. In order to overcome the mentioned restrictions an interview with the project manager of a large Brazilian shoe company was recorded in video to be used in a practical modeling class. In this video, she describes shortly how the organization's PDP is. The interview was performed following a semi structured questionnaire and attended the qualitative research theory. The results show that there are differences between students groups mapping and between the groups and the real representation. Moreover, the learning achieved by the students from this exercise can be divided in two categories: the use of swim lanes as a modeling tool that allows converting tacit into explicit knowledge and the perception of the importance of structured interviews to obtain useful information.

1 Introduction

After 1980's decade, the product development process (PDP) became an important factor in international scenario. This process is situated in the interface between market and the company, identifying necessities and designing solutions [1] [2]. The use of best practices in engineering design and the focus on customer's expectations lead Japanese companies to develop higher quality products in a shorter time than their American competitors [2].

Now, product development process (PDP) is considered a critical business process for companies' competitiveness [1]. In order to supply market specific needs, new products are developed by a multifunctional team incorporating technologies, patterns and restrictions in an integrated process. Therefore it is necessary to place specialists acting in specific stages of the process, which covers from the portfolio strategic planning to the product end-of-life. Limited visions of the whole process, by the team members, may difficult the process improvement. This limitation is a problem that can be overcome by the construction of an adequate process graphical model.

For this reason, PDP modeling can be considered an important theme in design and engineering learning. The aim of this paper is to propose a way of motivating students to learn PDP modeling from a real case. This study was conducted within the Product Development Management discipline from the Industrial Engineering graduation course in a Federal University from south Brazil.

2 The product development Process (PDP)

Over the past decades, several authors discussed PDP from different approaches that have in common the idea of PDP as one of companies' key business process that must be conducted in a holistic manner. This view includes phases that are not usually covered by product design and some kind of check-points between phases [3]. The recent integrated product development approach has arisen from these

propositions, and includes Simultaneous Engineering, [4] [5]; Stage Gates [6] [7] and Product Based Business [8] [9] concepts [1].

To represent this PDP approaches, some authors have created reference models that describe the phases, activities, project milestones and deliverables, providing guides for product development [1] [2]. The reference models may be generic or specific for some manufacturing segments, as pharmaceutical [2], food or shoes. In shoe industry, otherwise, these specific models cover only the design project phase and do not threat product development as a process [10] [11].

The use of a generic model can be an alternative to describe all the activities and deliverables of a company's PDP. These generic models are business representations, covering steps that go beyond the product design [1] [8] [12]. These are the reasons why a generic PDP reference model is considered the most adequate model for learning purposes.

The PDP reference model used in class is divided into three macro phases and subdivided in nine phases, most of them commonly found in other PDP models [1]. These phases are organized as follow:

- a) Pre-development macro phase: Product Strategic Planning and Project Planning;
- b) Development macro phase: Informational project, Conceptual design, Embodiment design, Product production planning and Product deliverable; and
- c) Post-development macro phase: Product attendance and Product discontinuation.

The purpose of the Pre-Development macro phase is to align the corporate strategic planning with the products offered by the company. The result of the phase is a portfolio of products and a plan of the products projects to be developed.

The development macro phase aim is the creation of product concepts that will be converted into physical products, along with the planning of the production process, marketing plans and product launch.

The post-development macro phase is focused in investigating the product performance in market, including sales and necessary modifications up to the product discontinuation.

3 Method

The study was accomplished in three stages, concerning the activity preparation, execution and evaluation. The program subject was PDP intervention and the class objectives were: to present the qualitative research theory and PDP modeling tools.

3.1 Class Activity Preparation

The first stage was the activity preparation which was performed before class. In order to overcome time, access to expert professionals and other restrictions, the professor recorded in video an interview with the project manager of a large Brazilian shoe company. The interview was performed following a semi structured questionnaire and attended the qualitative research planning theory [13].

The professional selection considered her personal broad knowledge about the company PDP. The interview lasted 20 minutes. It is important to be concise in gathering the information needed, viewing to attend class time restrictions. The interview was based on questions about the company's PDP, covering the existence of a formal process model, the process flow, some PDP activities details, and the project team components. The information was recorded in video with the interviewee agreement and saved in DVD, so the students could watch it at home or during the class activity.

Both class program objectives were accomplished in this stage, since the interview was planned accordingly to qualitative research theory and the interview content included PDP information necessary to be, further converted in a graphical representation or modeled.

3.2 Activity Execution

The second stage, the activity execution, was conducted in two class meetings and divided in five steps, described as follow.

3.2.1 Task Presentation and PDP modeling activity

In the first class, the professor presented the theory about intervention on PDP, including diagnostic, interview and modeling techniques, referential models and implementation. In the end of the class, the professor presented the modeling activity. She instructed the students to make individual tasks at home that would be finished in groups during the first part of next class.

3.2.2 Qualitative research Information Assessment

Individually, the students were asked to watch the video and answer the following questions:

- a) What is the interview goal?
- b) What is the interviewee profile?
- c) What is the interview script?
- d) Is there an introduction explaining the interview goals?
- f) Is there an initial question to break the ice?

What is it? g) What are the interview central questions? h) Is there a resume question used to verify the comprehension about the interviewee answers? i) Is there a final question to give the interviewee the opportunity to talk something else? j) How were the data registered by the interviewer?

The professor objective, with these questions, is to access the students' comprehension in relation to the qualitative research theory behind the interview.

In the second class, the students were divided in groups. They watched the video another time and discussed their answers, until a consensus.

3.2.3 PDP Modeling

At home the students were instructed to watch the video interview and model the shoe company's PDP, individually, using the swim lanes tool.

In the second class, the students would compare their models and consolidate the PDP in a single representation of the group.

3.2.4 Students' Models Comparison

The consolidated PDP models were presented by the students to the other groups for comparisons purposes. The similarities and the differences between them were identified and the professor asked the students about the reasons for such results, since the models have come from the same interview.

3.2.5 Comparison with the Real Model

The last step was the comparison among the student's graphical representations and the company's real PDP swim lanes model. Again, the results were highlighted. To finish the activity, the professor called the students attention to the interview and its importance for PDP modeling.

3.3 Activity Evaluation

The activity was evaluated through the application of an online questionnaire. This questionnaire aim is to collect the students' impressions about the modeling activity in order to improve it for future classes.

The questionnaire was available on the address <http://spreadsheets.google.com/viewform?hl=pt_BR&formkey=cIJjamFtVW9JUTczNkh3clRwNkNfWIE6MA..> for students access and filling. The questionnaire questions were:

a) How the experience of modeling the company's PDP through a recorded interview was? b) What's

your opinion about the interview conduction? c) Is there any difficulty in translating the interviewee answers in a swim lanes graphic? d) If so, what is the reason for the difficulty? e) In your opinion, time spent in class for the modeling was sufficient? Why? f) What was the reason of the differences between your and colleagues graphics? And what about the real company's graphic? g) What do you learned from this activity? How can you apply it in real life? h) What content the professor intended to transmit with this activity?

4 Results and Discussion

This study was performed within the Product Development Management discipline from the Industrial Engineering graduation course in a Federal University from south Brazil.

The interview was conducted with the project manager of a large Brazilian shoe company, following the procedures described in last section. This company has, as a particularity; the team project is spread along different units, placed in different Brazil regions: South, Southeast and Northeast, what makes it complex. Design and Marketing departments are located in São Paulo (Southeast) because of its business potential. Development and Research is located in South Brazil, because of this region cluster characteristic. Production is located in Northeast Brazil and in China, because of lower production costs. For this reason, project team components do not have familiarity with the whole product development process.

Recently, company's PDP was modeled in a set of meeting sessions between university researchers and company's project team. The information gathered by the professor in the interview with the company's project manager was a synthesis of the procedures used by that company, turned explicit in the real company swim lanes model.

The groups swim lanes graphics resultant from the procedure described in last section resulted in partial visions of the real process. The particularities of students' graphic models can be understood by the analysis of Figures 2 and 3. The comparison between the groups' graphics demonstrates that students highlighted different PDP phases, departments and activities. These differences can be explained due to students' individual perceptions and personal interpretations of the information caught from the interviewee, as well as, by their past PDP knowledge and experience.

Figure 2 shows a PDP process divided in five phases and 11 activities performed by five

departments. Group A did not detail the activities but ordered them into a sequence of repeated boxes (see the box 'Development') demonstrating a poor understanding of the interview information.

A more detailed graphic is presented in Figure 3. Group B divided the PDP process in four phases, ten activities, four decision gates and two deliverables performed by four departments. These departments correspond to the real company's departments responsible for the process. The activities were allocated into project phases accordingly to a reference model [1] presented previously in theoretical classes. The combination of theory and practice produced a richer process model and required a better understanding of the information provided by the interview.

The comparison between the groups' swim lanes graphics with the real company's PDP model (partially represented in Figure 4) demonstrates that the detail level of a single interview is not sufficient to produce a process model that represents the reality. The company's model is richly detailed, in part because of the effort of the company's project team and the great time spent modeling the process and also because of the presence of all the stakeholders involved with the process. The presence of stakeholders from all departments is important to explicit some activities that are made exclusively inside a single department.

The evaluation questionnaire filled by the students revealed their perception about the activity. The

students considered it an interesting exercise that allowed the understanding of the complexity of modeling an existent PDP what turns the company's PDP problems clear.

Most students considered the interview well conducted, a requirement for the activity success. In their perception, the interviewer was capable of gathering sufficient information to map the company's PDP macro view. Some students considered the necessity of more questions to acquire more details.

A percent of 62% of the students had some kind of difficulty to translate the interview information in a swim lanes graphic. They attributed this to their low experience in PDP tools and their capability to convert theory into practice. Another reason highlighted by the students were the poor process details and the impossibility to ask questions to clear doubts.

Most students considered the time spent in class sufficient, although it has taken more time than planned. The pre modeling performed individually at home gave the basis for the group work and the final model could be more easily finished. Students could observe that, in a real situation, the time necessary to complete the modeling task should be longer.

Regarding to the differences between groups' graphics, students attributed them to differences in particular points of view, what interfered with answers interpretation. Also, the differences between students' drawing skills were highlighted as the reason why some graphics were simpler than others.

Figure 2. Group A PDP model representation

The differences between students' graphics and the company's real PDP model were attributed mainly to time. This restriction was the reason for the one person interview, what did not provide the vision of the company's team process but only the interviewee point of view. It is important to mention that the interviewee was a project manager who has a broad vision.

In relation to what they learned from the activity, students mentioned the increase of their interest in Design Engineering and the importance of modeling for processes improvement. They also perceived how valuable information sources are interviews and the necessity of consult more stakeholders in order to bridge the gaps left by the single interviewee. In real life, they expect to apply their new modeling knowledge not only in PDP but also to map other industrial processes.

With reference to the content the professor intended to transmit, students' answers included modeling tools, the relation between PDP and project management, interview techniques and the differences between individual points of view. These perceptions were aligned with the class objectives presented in section 3, which were to present the qualitative research theory and PDP modeling tools.

5 Conclusions

This paper aim was to propose a learning activity that motivates students to model a PDP, using an interview with a professional as the information source of a real process.

The success of this activity is strongly dependent on a previous theoretical basis. It helps the students to understand PDP particularities (as the division in phases) contributing to a better interpretation of information and the consequent increase in interest. It could be perceived by Group B graphic, more detailed than the other. This demonstrates that students are able to connect PDP theory and companies' practice in a simple modeling activity.

As well, the existence of the company's PDP model is necessary for the comparison with students swim lanes graphics. It demonstrates the complexity of PDP modeling and the restrictions of gathering information from a single source.

The students' feedback was positive. They were able to note some limitations of this activity caused by little time and by a single information font, as well as the importance of learning PDP modeling for their formation.

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