IMPLEMENTATION OF THE PRODUCT INFORMATIONAL DESIGN PHASE IN INCUBATED TECHNOLOGY-BASED COMPANIES: A CASE STUDY

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Abstract. *The Product Development Process is one of the main sources of competitiveness of the contemporary companies. Another current tendency is the increase of the number of Technology-Based Company that are born in business incubators, where the Product Development Process is still more critical because the innovation is their main competitive differential. In this work it is presented a Reference Model for the Product Informational Design of Incubated Technology-Based Companies, with base in the business process approach proposed by the Unified Reference Model. This model adapts the best practices of product development for the reality of these nascent enterprises, describing the application in a company that develops products for data acquisition and it is linked to an business Incubator. The Informational Design model was applied on the development of a power generating units monitoring system, product that includes the data acquisition of mechanical signals in electric power generation plants (turbine, generator and sub-systems). The study is an applied research with qualitative approach and descriptive objectives, with technical procedures that characterizes it as bibliographical and documental with case study. The data gathering was accomplished through questionnaires and interviews with the responsible of the companies. The obtained results indicate that, even with the limitations imposed by the characteristics of these emerging organizations, there are several benefits that the incubated companies can obtain with the implementation of the model to their product development reality.*

Keywords*: Product Informational Design, Business Process, Unified Reference Model, Technology-Based Company, Business Incubators.*

1. INTRODUCTION

The business incubators movement began in the United States in the decade of 60 and, along the last 40 years, it has globally been growing and in a way still more intense in the last decade. In Europe the movement began during the 80´s and today there are 900 business incubators along several countries, and in United Kingdom the number of institutions passed of 25 in 1997 for 270 in the year of 2005 (UK Business Incubation, 2006).

As well as in the case of Europe, the business incubators movement began in Brazil at 80´s and, since then, the number of growing Technology-Based Companies (TBCs) increases every year. This tendency has been stronger in the South Area of the country where the number of incubators increased of 50 in the year of 2000 for 128 in 2005, according to National association of Entities Promoters of Innovative Enterprises data (ANPROTEC, 2005).

Business Incubators are institutions that promote and help in the sustainability of nascent enterprises, with the objective of increase the survival rate of this organizations. In this environment, the new entrepreneur has access to several types of resource that goes from rental space, support services (consultancies and training), help with the search for investors and partnership with universities and institutions that develop the technological knowledge (SEBRAE-SC, 2005).

The positive result of the action of the business incubators is confirmed by several factors, among then the low mortality rate of the companies that came from the incubation process in relation to companies in general (up to 59,9% after four years of life, according to SEBRAE-SC).

According to the National Business Incubation Association (NBIA, 2006), in the end of 2006 existed more than 1,400 Business Incubators in North America (1,115 in the United States, 191 in Mexico and 120 in Canada) and a estimated number of about 5,000 business incubators worldwide. According to data of ANPROTEC (2005), in 2005 there were 297 incubators in Brazil, which 40 percent was exclusively of TBCs. In North America, 37 percent of all incubators are focused in technology-based enterprises (NBIA, 2006).

The TBCs differ of another kind of company for the following characteristics mainly: (i) possess bonds with universities or research centers; (ii) act with the systematic application of knowledge and (iii) have as differential the development of innovative processes and/or products.

These companies face several difficulties during his birth and maturity process, even in the cases where the support of business incubators exists. Andrade Junior (2001) mentions some of these limitations: “appropriate conditions financing shortage; absence of abilities and management experiences of the leaders of TBCs; difficulties to identify

distribution channels; and lack of specialized salespersons to products with great technical specificities". The present paper approaches the problem of lack of ability in management processes in a specific way, more precisely the Product Development Process (PDP) management limitations of this Incubated TBCs (ITBCs).

Considering that the success of any company is directly proportional to the acting of their products in the market, it is supposed that to improve PDP helps the organizations the if they position in a more competitive way. Rozenfeld et al. (2006) affirm that: "The product development is considered a business process more and more critical for the competitiveness of the companies, mainly with the growing internationalization of the markets, increase of the diversity and variety of the products and reduction of the cycle of life of the products in the market".

For the specific case of TBCs the PDP is still more critical, considering that the product innovation is their main competitive differential. In the incubation process – where the company is in their initial phases of life – the impacts of problems of this nature are intensified, seen that the planning of the products and the strategies of performance in the market are crucial to determine the future success or failure of the enterprise.

Ferreira (2002) confirms this line of thought when affirms: "Having strong involvement with technology-based companies for a long period, the professional experience developed in activities related to the software project development and coordination allow to affirm that these companies present a lack in formal methodologies of control of their products and processes for execution and attendance of the company strategies".

2. OBJECTIVE

This article aims the definition of a process of information search and description of product requirements in TBCs residents in the Microdistrito Industrial de Base Tecnológica (MIDI Tecnológico) incubator of Florianópolis/SC.

Additionally is presented the application of the defined process in one of the companies incubated that composes the investigation, documented in the form of a case study.

The present work is part of a wider study, that seeks the investigation of the PDP of these companies and the elaboration, with base in the Unified Reference Model (URM) proposed by Rozenfeld (2006), of a Incubated Technology-Based Companies Reference Model (ITBCRM).

3. METHODOLOGY

In relation to the research methodology and about the nature viewpoint (Gil apud Silva, 2005), the study in subject is characterized by an applied research, whose objective is the generation of a process to be used as practical base by the company teams, involving the specific problem of the Informational Design (ID) of these enterprises.

Of the approach viewpoint the research is classified as qualitative, because involves the partial adaptation of the URM for the reality of incubated TBCs, generating a specific Reference Model adapted to the characteristics and limitations of these enterprises.

The research objectives characterizes it as descriptive and exploratory, considering that involves the interview with members of the companies for data gathering and the bibliographical information research (Product Development Process URM) that can be used as solution to the described problems (Gil apud Silva, 2005).

Finally, of the technical procedures viewpoint (Gil apud Silva, 2005) the research is characterized as bibliographical (study of URM and another methodologies published in the literature) and documental (analysis of documentation of the studied companies). The final part is essentially a case study, because it seeks the application of the elaborated ID Reference Model in an ITBC linked to the MIDI of Florianópolis.

The developed study resulted in a resolution process for the problem that is divided in four different stages, as shown in Fig. 1.

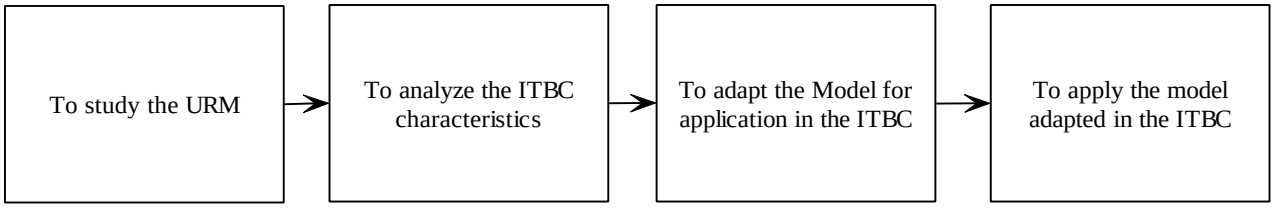

Figure 1 – PDP problem resolution process

In the following sections these stages are described in details.

3.1 To study the URM

The chosen model to be used as base for the PDP improvement in the incubated companies was the URM proposed by Rozenfeld et al. (2006), that includes a series of best practices of product development of the viewpoint of the business process approach.

A business process is defined as a grouping of activities, that, accomplished in a logical sequence, has as objective the production of goods and services that can be marketed in a lucrative way in the market, in other words, that have value for a specific portion of consumers.

As can be seen in Fig. 2, the URM is composed by three macro phases: Pre-development, Development and Post-development. These macro phases are divided in phases, activities and tasks that, according to Rozenfeld et al. (2006), represent the best practices for PDP management.

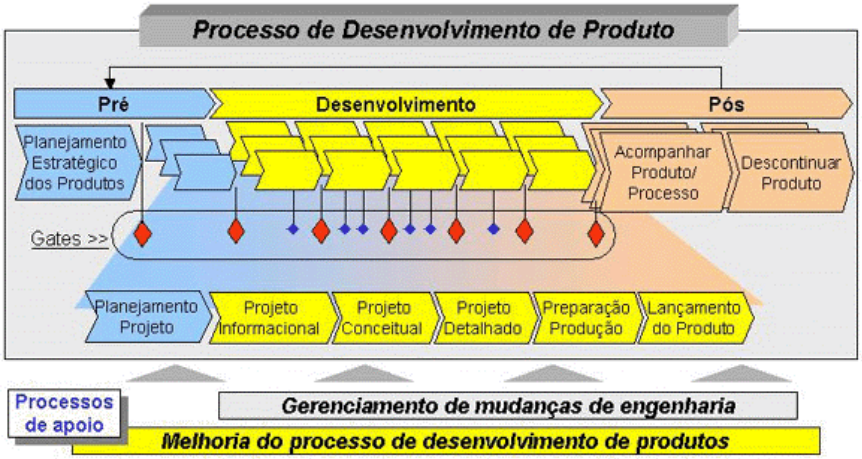

Figure 2 – Unified Development Process

In this model, the macro phase of Pre-development approaches the Strategic Product Planning (SPP), that translates the product portfólio of the company and his alignment with the strategic objectives of the organization, and also the planning of each individual project to be developed.

In the macro phase of Development are accomplished the design activities, involving the phases of Informational Design, Conceptual Design (CD), Detailed Design (DD), Production Preparation (PP) and Product Release (PR).

The Post-development contemplates the subsequent activities to the Product Release (life cycle management, performance evaluation and product discontinuation).

To reach the objective of this work – improvement of the process of information search and description of product requirements in TBCs –the study of the ID phase of the URM was accomplished, what compose the first phase of the Development macro phase. A overview of this specific phase and their activities can be visualized in Fig. 3.

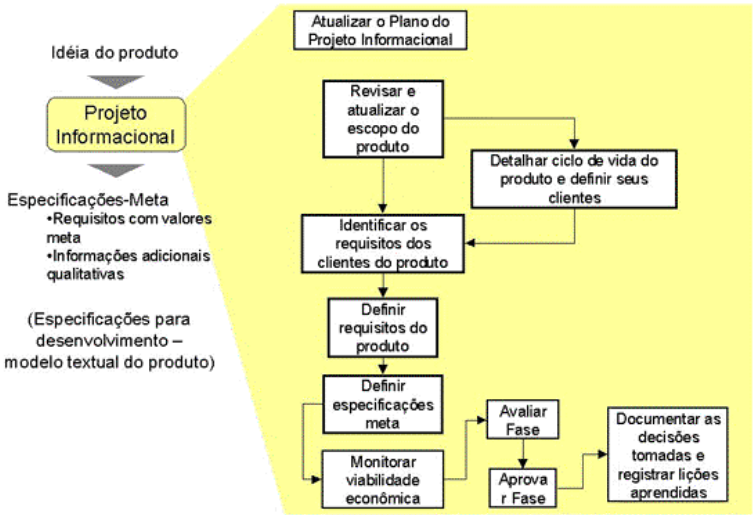

Figure 3 – URM Informational Design phase

The input information of this phase is the product idea, that was defined in the previous phase of the model (Project Planning) and that is described in the draft of the project plan in development. The objective of the ID phase is to develop and complement this first basic description of the product, in order to reach a group of more detailed information with quantitative characteristics – called goal-specifications – that can be used in a more effective way in the subsequent phases of the PDP.

To arrive to this result, the activities that in Fig. 3 are unfolded in tasks that must be performed by the product development team. In the Appendix A are described the activities of the ID phase and the respective tasks, according to the URM.

At the end of the study of the URM best practices, it was obtained a vision of as the problem of gathering information and definition of the product will be systematized, what makes possible a perception of which situations should be avoided inside the TBCs to reach a better result in the product development management.

From this point, it is possible to advance for the next stage of the problem resolution process of this work: analyze the company characteristics.

It is important to point out that the study of the reference model preferentially should be accomplished before a deepened analysis of the company, to have enough information to elaborate a based critical analysis of the limitations of the organization.

3.2 To analyze the ITBC characteristics

In this stage, information about the TBC where the model will be applied must be gather. Internal data as company available resources (employees, partners, financial availability for outsourcing consultancy) are used to define the complexity level that the model should possess to reach in an efficient way the ID objectives.

The organizational structure and the involved people's competences define as the tasks of the ID will be allocated in an effective way, in other words, taking advantage of each individual's potentialities.

Strategic characteristics of the company must be taken into account, including the internal (organization strengths and weaknesses) and external (market opportunities and threats) analysis and the competitive positioning.

Also it is accomplished an evaluation of the TBC Product Development Process, to define which activities of the URM are already predicted in the usual process of the company and which of this activities are truly accomplished by the development team. For this, it is appealed to diagnosis tools to analyze the company current process, as the PDP maturity level evaluation model proposed by Rozenfeld et al. (2006) that was used in the work here described.

This model of diagnosis of the PDP maturity evaluates, for each one of the phases described in the URM, the way as the company develops their products, with the objective of identify the performance degree and define in what level of maturity the process is before the application of the proposed model and, also, which is the level to be reached after the implementation.

In the model of maturity used, Rozenfeld et al. (2006) propose the following levels of maturity, that are interdependent:

- Basic (Level 1): Some essential PDP activities are accomplished in an informal way, without standardization, measurement or control;
- Intermediary (Level 2): besides having practiced, the activities are standardized and take to results that are previsible, and still consecrated product development methods and tools are used;
- Measurable (Level 3): Beyond the standardization, the company elaborates and uses indicators to measure the activities performance and the quality of the reached results;
- Controlled · (Level 4): With base in the evaluation of the indicators that presented deviation of the expected value, the company works in a systematic way to correct the activities;
- Continuous improvement (Level 5): Exists in the own PDP and inherent to the organization, processes of PDP continuous improvement of short and long term.

Besides that, the levels 1 and 2 are subdivided in sub-levels, containing practices for group of knowledge areas, such as: product engineering; marketing and quality; process, production and supply engineering; and project, cost and environment management.

For a process of specific improvement as the proposed, the maturity model is only applied in the specific phase of interest for the study. In the case described in this article the only phase to be diagnosed is the ID, with focus and detail in the evaluation of the URM activities and tasks described in the Appendix A.

With a greater knowledge of the characteristics of the TBC where the model will be applied, the next step is to accomplish the activities of adaptation of the URM to the company, as described in the following section.

3.3 To adapt the Model for application in the ITBC

After obtaining the knowledge about the ID best practices and about the company characteristics and ID maturity degree, the next step is to adapt the activities and tasks described in the model for the reality of the organization.

As ITBC are usually small enterprises in ascension, in most of the cases they possess several restrictions that impede the implementation of every task foreseen in the URM. In every case, it is important to have in mind the main objective of the ID, so that the adapted model accomplishes the greater feasible result inside the limitations imposed by the characteristics of the organization.

In other words, it is important that even if it is not possible to execute every task of each activity, those that results in a larger value for the TBC must be executed, in agreement with the analysis and diagnosis previously accomplished.

For instance, if the company possesses a history of problem of competitiveness in the market due to an excessive price of his product (in other words, exist competitors products with smaller price and with similar value noticed by the customers), and the PDP diagnosis indicates that this difficulty is caused by the absence of a product cost study in the ID phase, when adapting the model for process improvement the task "update project estimated budget "should be prioritize in detriment of the others.

In a similar way, if it is reached the conclusion that the company products are "uncoupled" of the value notion of the customers (in other words, that the products possess characteristics or functions that the customer doesn't want and/or vice-versa), tasks as "to define the project clients along the life cycle ", " to collect the clients needs for each phase of the life cycle", "to define the clients requirements" and "to value the clients requirements" should be focused in the development of the futures project of the company.

The focus of this stage activities of model adaptation is to potentiate the improvement degree of the Product Development Process of the TBC.

The information detailed in the maturity level diagnosis of the previous stage should be used for the elaboration of an initial vision of the PDP evolution plan, in other words, for which maturity level is wanted that the process of the company grow.

3.4 To apply the model adapted in the ITBC

After the definition of the URM adaptations to be implemented, the last stage of the proposed process is the application of the adapted model in the ITBC that is the focus of the wanted improvements.

This stage has as objective the implantation of the adapted model activities and tasks in the company, in way to modify the existent process and to potentiate the improvements in the ID phase of the products development. To reach this goal, the proposed process was divided in the following activities:

- To plan the transformations: the activities and deadlines of the own transformation process must be defined, in other words, how and when the changes will be implemented inside of the organization;
- To define the requirements: With base in the initial plan to the ID evolution maturity, a more detailed plan is elaborated, with the necessary changes to the existent company process;
- To document the solution: The adapted model is drawn and formalized, allowing the involved people to execute the tasks foreseen inside the ID activities in an efficient way. This documentation involves, besides the own adapted model, the techniques, tools and concepts related with the defined tasks in this model;
- To provide resources for implementation: Together with the company managers, allocate the resources (employees, partners and consultants) that will be used for the execution of the activities of transformation of the organization process;
- To train the execution people: With base in the documentation of the adapted model, to provide training for the involved professionals to make possible a greater productivity in the implementation of the process changes and execution of the planned activities;
- To execute the implantation: The adapted model activities and tasks planned are executed by the development team in the subsequent projects. The planning deviations, difficulties and proposed of improvement are monitored and registered;
- To evaluate the results: The planning and execution registries are analyzed and appraised, with the objective of defining if the activities and tasks planned were accomplished and if the results of these are satisfactory for the ID objective;
- To propose improvements: The development team results, difficulties, suggestions and improvement proposals are registered, in way to compose a group of best practices that can be used to improve the adapted model continually.

4. CASE STUDY

This part of the article seeks the application of the four stages of the process described previously in an TBC incubated in the MIDI Tecnológico of Florianópolis/SC.

The TBC in subject acts in the electronic instrumentation segment, developing and manufacturing instruments for digitization and analysis of electric signals (data acquisition) for the electric power generation sector. It is part of the MIDI tecnológico incubator since his constitution in September of 2004 and it is located in the Condomínio Industrial de Informática, in Florianópolis/SC.

Of the products that the company now possesses in his portfolio, two were already launched and are being marketed, one is in development and the others are still in concept and evaluation phase for future development.

The project in development aims the creation of a power generating units monitoring system, product that includes the data acquisition of mechanical signals in electric power generation plants (turbine, generator and sub-systems). This product possesses a larger innovation level and complexity in relation to the others products that they were already developed by the company, besides being especially important inside the long term strategy of the organization.

The opportunity of application of the URM in the company was born from the relationship between the director-president's of the TBC with the authors, that, among other aspects, it is resulted of the proximity of the company with research centers and universities. In both parts there was a perception of the benefits that the study could provide, so much for the improvement of the company process as for the practical application of results of researches obtained in the knowledge field.

For the reach of these potential benefits was accomplished, among other studies, the application of this proposed process for the improvement of the ID in the product that the company was developing at the time (power generating units monitoring system).

The first stage of the proposed process aim the URM study. The study was accomplished together by the authors of the present paper (among which one is a employee of the TBC in subject), with base in the proceeding described in section 3. The activities and tasks that are described in the ID phase of the URM were detailed in the Appendix A.

In the second stage of the process - TBC characteristics analysis - the gathering of necessary information was accomplished, with interviews in personal meetings with company representatives and with the analysis of documents of the organization.

For a best understanding regarding the organization in subject in the present paper, it is important to mention here that it is a company that possesses 15 collaborators, three of these working full time. The others twelve work in partial regime, what includes the operational staff (composed by nine graduation students and one engineer) and two directors. Besides these direct collaborators the company uses external consultants services, as much in administrative activities as in the technology development.

Of the viewpoint of organizational structure the company possesses a matrix configuration, where there was a basic functional hierarchy that rules the normal task flow of the company. However, usually the company assumes a project structure, where collaborators of different areas are designated for specific activities, executing eventual tasks with short duration, usually related to product projects.

In relation to the competences, the team is composed by two Industrial Engineering Masters, three Electrical Engineers, one Administrator, six students of Electric Engineering , one student of Administration, one student of Control Engineering and a Administration student.

As planned in the described process, in the third stage was executed an evaluation of the ID maturity level of the company with base in the model proposed by Rozenfeld et al. (2006). In the Tab. 1 are described the inquiries regarding the ID, with the qualitative evaluations of the maturity level of the company process.

Table 1 – Maturity level diagnosis for the ID of the incubated company

Inquiries	**Evaluation**
Defines requirements, conception, structures, drawings, uses CAD, design items	Yes. Exists detailes documentation in the intranet and a CAD tool it is used (virtual prototype).
Unfold requirements, analyze life cycle	No. The specifications are defined internally, without life cycle analysis.
Accomplish simple approval of phase (Gates)	Yes. Approval accomplished in a basic and informal way, with a macro vision of the process (few gates).
Functional modeling, defines solution principles, applies DFx, alternative conceptions, applies QFD	No. Those actions are not accomplished.
Integrates partners of the supply chain	Yes. Integrate partners with a basic and informal way.
accomplishes all activities of project management	No. Accomplishes part of the activities of project management.
There is integration between plans	No. Plans are not integrated.
accomplishes project gates with very defined criteria	No. Project gates criteria are not well defined.
Monitors costs, volumes and foreseen prices continually	Yes. The costs, volumes and foreseen prices are monitored eventually.
Monitors risks	No. The risks are not monitored.
Accompanies project management indicators	No. There are no projects management indicators.
Maintainable development is considered	No. The maintainable development is not formally considered.
Possesses performance indicators for all the activities	No. No performance indicator is used.
It happens control of all activities with base in the indicators and integrated corrective actions with the changes management and incremental improvement support processes take place. Critical parameters management and robust project (Tagushi method) are applied.	No. That control is not accomplished.

PDP transformation cycle integrated at the incremental improvement cycle, to the changes management and the project planning.	No. The PDP transformation is informal and not integrated.

As it can be observed in the Tab. 1, the maturity level evaluation indicated that the company possesses an immature process for the ID phase, where a few URM activities are performed, and, when they are, it is in an informal and no systematic way.

The information gathered for the maturity level diagnosis resulted in a decisive conclusion in relation to the limitations of the company process in the ID phase. The company collaborators related several difficulties in relation to the definition of requirements in previous projects, that it resulted in several problems for the business, as for instance:

- Products with functionalities that the customers do not value;
- Products with characteristics below sales personnel expectation;
- Sales with low markup;
- Products difficult to produce;
- Strong dependence of the suppliers.

These information indicated a strong need to focus the model adapted for the resolution of these problems, that, according to the collaborators of the company, case was eliminated or even softened would bring great benefits for the business.

After the stage of evaluation of the organization characteristics, the adaptation of the URM (the third stage of the process) consisted of the analysis of the information gathered for prioritize the tasks to be defined for the company adapted model.

This adaptation process took into account the low readiness of resources of the company, that in a common way possesses a great amount of operational tasks distributed among few people, what typically results in collaborators with time restrictions to execute the necessary tasks for the ID implementation in an appropriate way.

Starting of this premise, it was stipulated by the management of the TBC that the adapted model for the ID must be as lean as possible, so that the tasks didn't occupy much of the time in that the organization collaborators should be executing their normal tasks.

The problems in the previous projects supplied an indication that the tasks regarding the customers' definitions and product requirements should be prioritized, as well as those regarding the financial analysis of the project and the external acquisitions (suppliers). The objective was to potentiate the benefits that the model can supply to the TBC.

Besides that, due to the low maturity level of the company ID and the usual resource restrictions, the URM more advanced activities had to be unconsidered in this first adaptation. The activities and tasks of the adapted ID model for the ITBC in subject can be seen in the Appendix A.

To apply this adapted ID model in the company, an initial meeting was accomplished with the representatives of the organization for the planning of the change activities, where they were defined the responsible and deadlines for the execution of the tasks. As the project management was already integrated into the TBC culture (the managers already practice activities based in PMBOK and the company uses the open source tool dotProject), this task of initial planning was easily implemented.

The necessary requirements for the change of the ID process were also defined in the initial meeting, with base in the initial (diagnosed) and final (to reach after the transformation) maturity levels.

Due to the company need of maintaining a lean transformation process, the design of the model was executed in a simplified manner, where the drawing of the process was documented in the own record of the initial meeting.

Initially the implantation of the adapted model was executed in agreement with the planning, where were predicted weekly meetings within the company personnel and the authors, with the objective of evaluate the execution of the activities, discuss the next steps and solve doubts in relation to the application process of the model.

Though, due to changes in the priorities of the company that happened during the implantation process, deviations happened in relation to the planning and this had to be revised and updated to adapt to the new situation. The dates and periodicity of the meetings had to be modified.

Within that context, one of the company collaborators became the coordinator of the change process, being responsible for assuring that the tasks were being developed in agreement with the planning and in an effective way.

For instance, the task of "to define the project clients along the life cycle" for the power generating units monitoring system was accomplished in the following manner:

1. The needs of the task to be executed were discussed in periodic meeting, with the information gather: project planning documentation, technical papers and standards about power plant monitoring, brochures of potential competitors, prospect reports, etc;
2. There were defined the responsible for looking for the necessary information (with deadline until the date of the subsequent meeting), and also which the people that should be present in the next encounter for execution of the task (collaborators of the sales, marketing, management and development areas);

3. In the subsequent meeting was happen the data discussion and the project clients definition, as planned. one team member was responsible for formalize and store the information in a document, that would be approved formally in the subsequent meeting;
4. The accomplishment of the task was evaluated together with the planning of the subsequent task.

With this successive steps, the ID activities were executed inside the TBC in subject. The results of the task "To define the project clients along the life cycle" described above can be observed in Tab. 2.

Table 2 – Project clients of the power generating units monitoring system

Life cycle phase	Client	Type[(1)]
Design	Hardware Developer	I
	Software Developer	I
Production	Circuit board manufacturer	E
	Insulator manufacturer	E
	Cabinet manufacturer	E
Purchase	Components and raw material buyer	I
Assembly	Assembler	I
	Packager	I
	Responsible for tests and quality	I
Inventory	Inventory personnel	I
Transportation	Delivery personnel	I
	Transportation personnel	E
Sales	Internal salespersons	I
	External salespersons	E
Marketing	Power plant buyer	M
	Power plant manager	M
Use and Function	Power plant operator	E
	Power plant maintenance technician	E
	Power plant research personnel	E
	Electric system research personnel	E
Maintenance	Company maintenance technician	I
Deactivation and Recycling / Discard	Company maintenance technician	I
	Power plant maintenance technician	E

[(1)]: Internal, Market or External

5. CONCLUSIONS

Until the date of this paper publication, the practical results of the adapted model implantation in the company had not appeared yet, due to the own evolution dynamic of the product development. However, the process developed until then already offered enough subsidies for the verification of important benefits to the company. Those benefits refer, above all, to the learning of the ID best practice and the diagnosis of the maturity level of the company.

Regarding the generic application of the adapted model in Incubated TBCs (ITBCs), the conclusion was that the adapted model should be custom to each individual company, to generate a model still more specific for each case. It was also verified that it will be necessary, in futures studies, that the adapted model possesses his own diagnosis model, so that the ITBCs can accomplish a more appropriate implementation.

The study of the ITBC characteristics also resulted in new possibilities of URM application in different processes of the company, where was found other deficiencies that could be corrected and improved by the use of the practices and tools proposed by the model. The adaptation and implementation of different phases of URM to supply these difficulties didn't constitute subject of the present work, configuring a proposal for development of futures studies.

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7. RESPONSIBILITY NOTICE

The authors are the only responsible for the printed material included in this paper.

Appendix A - URM and ITBC adapted model activities and tasks

Activities [1]	**URM foreseen tasks**	
	Discarded tasks in the adaptation	**Tasks prioritized in the ITBC adapted model**
To update Informational Design Plan	- To analyze the current project plan - To analyze and synthesize the new conditions for the accomplishment of the project - To update, monitor, value and define new performance indicators - To evaluate new risks - To update communication plan - To define/update the gate passage criteria	- To update Product Scope - To revise and update Project Scope - To update and detail the activities, responsible, deadlines and schedule - To update and detail necessary resources - To update estimate project budget - To analyze economical-financial feasibility of the project - To plan, update and prepare new acquisitions
To revise and update Product Scope	- Project problem analysis - To analyze available and necessary technologies	- To research standards, patents and legislation - To research competitive and similar products
To detail life cycle product and define clients	- To refine the product life cycle	- To define the project clients along the life cycle
To identify product clients requirements		- To collect the clients needs for each phase of the life cycle - To group and classify the needs - To define the clients requirements - To value the clients requirements
To define product requirements		- To convert clients requirements in measurable expressions - To analyze and classify the product requirements - To order the project requirements of the product in a hierarchy
To define product goal-specifications		- To value product requirements - To analyze technical and market profile - To analyze restrictions of product project (contract, environmental, legislation, standards, ...) - To elaborate the group of goal-specification of the product

[1] The generic Activities to "Monitor the economical-financial feasibility of the product", "To evaluate phase", " To approve phase" and " To document the taken decisions and to register learned lessons" was suppressed to simplify the information visualization in the table.