PREREQUISITES FOR THE IMPLEMENTATION OF A PRODUCT DATA AND PROCESS MANAGEMENT TOOL IN SME

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Keywords: SMEs, organisational stucture, project management, product data management

1 Introduction

The overall goal of this research is to support the emergence and the development of innovation in SMEs (Small and Medium-sized Enterprises) [1]. This work is mainly focused on the organisational aspects of SMEs involved in networks composed of large companies, subcontractors and other industrial partners. The problems, that arise in this context, of organisation, project management and relationships between suppliers, customers, and subcontractors are addressed in this paper. This research focuses on the prerequisites for the development of an "extended PLM" (Product Life Management) tool to support the organisational structure, document management, project management and collaboration between designers. However, in the context of an SME, the introduction of such a tool makes it necessary to study and formalise different rules concerning the main development processes. Here, the main objective is to formalise these complex processes whilst still maintaining flexibility in order to promote the emergence of continuous innovation. Thus the objective of this paper is to define the preliminary tasks and conditions required to implement such a tool within this constraint.

Our study examines aspects of organisation, document management, project management process, collaboration, and tools to support the new organisational structure. After a section on the state of art, we will present the case study of an SME and the prerequisites found in preparing the company to implement a new product data and process management tool. A discussion is then proposed concerning the problems that can arise in this situation of preliminary work and some conclusions about its applicability to other SMEs and PDM (Product Data Management) implementation are drawn.

2   State of the art

The need to reduce time to market and the development costs of products has driven many companies to attempt to control and improve their product development process. Thus the improvement of coordination of the whole development cycle of products has become an important issue for those responsible at each level of projects. This is particularly true within SMEs where human factors play a significant role. Thus SMEs must be more reactive in order to survive in a competitive environment. Moreover, most of the time, the form of collaboration in SMEs is based on mutual agreements between actors[1] to work, and in this

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[1] In this paper the word "actor" is used to denote any person involved in the complex network of collaborative relationships within and across the company's boundaries.

form of collaboration many problems of document management and project management occur. Thus there is a growing demand from small companies who are looking for tools which can address these problems. There are many product data and process management tools which focus on these topics, several examples could be cited of generic PLM and PDM tools used in large companies. These generic tools are more oriented towards document management than project management, as opposed to those specific tools developed to meet the requirements and skills of employees which are often developed around commercial office software. For all such tools companies cannot implement them successfully without making changes in terms of organisational structure, collaboration, document management and project management.

Thus before any tool implementation there are prerequisites that must be addressed to create a favourable situation and ensure a successful outcome. Amongst all the aspects that must be studied we propose in the next section a state of the art concerning some generic topics related to the organisational aspects.

2.1 Collaboration

The problems of collaboration have been studied in different scientific fields (e.g. design, management, sociology, cognitive sciences). In our case, we propose to define collaboration as a complex combination of co-ordination and co-operation processes. According to [2] co-ordination is the process that aims to plan and schedule different tasks, and to distribute resources. This prescriptive process defines the designers' activities and their interrelations. Co-operation is considered as an effective and concrete articulation among designers involved in a collective action (working in practice towards a consensus end). In a given situation it is the co-operation between designers which will be effective in a collective action. During the action of co-operation [3] the designers may redefine the co-ordination rules and create new interactions. This co-operation is a logical alternative because the co-ordination rules cannot prescribe all the situations that can occur during product development.

2.2 Design process modelling

Many design models referring to sequential, iterative, cognitive and socio-technical points of view have been proposed and synthesised in the literature. The design process is constrained by the enterprise organisation and by the design steps and is influenced by technologies or human and physical resources [4]. Design is mainly a human activity and it is very difficult to understand the activities carried out by designers [5]. So, many design models have been proposed [6]. [7] classifies these models into five categories, as follows: a succession of hierarchical steps [8]; iteration of an elementary design cycle [9], [10]; the emerging phenomenon of self-organisation [11]; cognitive processes [12], [13]; and socio-technical communication and interactive mode [14], [15].

2.3 Control of engineering design

The co-ordination and the control of engineering design refer to a global approach to the development of new products. It implies the need to identify the different situations occurring during the design process and ensure adequate resources to satisfy the initial objectives. In the "succession of hierarchical steps" model, the project manager acts upon traditional costs-quality-delays parameters [16]. Other models define technical evaluation based on document deliverables, or evaluation based on resource management. The design co-ordination approach [17] integrates several models in order to improve product design. It takes into

account, for example, the product development steps, objectives and results, resources, expert skills, tasks and scheduling, and project capitalisation.

New human-based approaches introduce new parameters [7] based on the level of collaboration and communication between actors in order to improve ideas, solutions, innovation and flexibility of the predefined scheduling or the actors' skills. These parameters are still fuzzy and difficult to characterise. The case study that follows (in Section 3) allows the identification of some of them.

Engineering design can be viewed as a system [18] where a decisional sub-system coordinates and controls a technological sub-system which transforms product and process knowledge through an information sub-system. The most recent works demonstrate that it is necessary to integrate product, process and organisation points of view in order to control the performance of engineering design [19]. [20] proposes such an integrated model that we must fit with the needs of the SME in order to allow project manager to control their design process.

2.4 Project management

In an SME, the project manager's task consists of organising and planning the project around an appropriate structure. [21] suggests that task management, scheduling, and planning, together with resource management are the most important issues when it comes to operational co-ordination. The project manager defines objectives and allocates resources (human and material) to the various tasks. He defines milestones to synchronise the evolution of each person's work. However, this implies that the design process can be rationalised and organised using a prescriptive approach. In an SME such a prescriptive approach exists at a global level, but, at a detailed task level, actors have only objectives and milestones and they manage their tasks by themselves. In this case, respecting deadlines is the main performance target. The project manager must ensure that the results of everyone involved in the design phase converge and do not interfere with each other. According to integrated design methodology [22] models, tools and methods must be developed to control the exchange and sharing of data during the design process in order to reduce risks of redundant or contradictory data and to facilitate effective collaboration.

This state of the art shows that complementary dimensions must be studied in order to define the prerequisites for the development and deployment of tools. However, we emphasised the fact that this tool proposal must be defined carefully by taking into account human factors, especially the socio-cultural interactions within companies. For this reason an industrial case study is proposed in the next section in order to provide the first data concerning our work.

3 Case study

The scientific interest in this case study centres around the study of preliminary tasks which must be carried out before the implementation of a product data and process management tool in an SME. In the following paragraphs we first present the context of our SME partner, then the proposed research methodology and finally the actions led in the company. The results of this first step will be used to work on the definition of the requirements for the implementation of a product data and process management tool. More precisely, we will provide some recommendations about its organisational structure, project management process and information management.

3.1 Context

This work results from a study in an SME which, some years ago, developed a new means of manufacturing structures using honeycomb sub-assemblies. This innovation confers lightness and significant vibration absorption on products whilst maintaining similar rigidity to steel. The company has captured several markets with products manufactured using this technology and consequently the number of employees grew from 4 to 40 over 10 years. At the same time the organisational structure and internal processes have not been explicitly revised. The objective of the study is to help the company to reorganise itself and to manage its growth.

In this context, problems of organisation, project management and relationships with suppliers, customers, and subcontractors appear. As a consequence, managers need to implement product data and process management tools which are well-adapted to the company setting. We focus on the analysis of the company's design and industrialisation department: its re-organisation, the processes of development of new products, the management of technical information and of product data, as well as the relationships between actors.

3.2 Research methodology

Our method of experimentation is based on a socio-technical approach [23] and on a reflective analysis. A workgroup has been created in the company to realise the study and its implementation. Our role is to participate in this workgroup by introducing an external point of view and by defining together the new product development environment. Our point of view results from this analysis of the organisation and the design processes of the company as well as from the identification of relevant models and methods. So we focus on the organisation of the company [24], on design project co-ordination [25], on collaboration between actors and on socio-technical aspects.

The workgroup mainly involved the chief manager, the quality manager, the technical department responsible, designers and manufacturers. Previous studies of the sociology of organisations [26] and [27] reveal that actors will more easily accept a new organisation when they find a personal interest in the proposed structure. During our study in the company, we tried to "recruit" the actors as early as possible in the project of reorganisation in order to obtain their support for it. An organisational structure accepted by the actors allows the building of a significant common point of reference to support collaborative exchanges.

The different steps of the resulting study are based on existing methods such as the GRAI ("Groupe de Recherche en Automatisation Intégrée" i.e. Research Group for Integrated Automatisation) Engineering method [28] which proposes a first phase of modelling of the existing design system, then a design phase for the modelling of the future design system. We next present the initial situation of the company and the problems identified.

3.3 Initial organisational structure of the SME partner

Due to the growth of the company and the consequent large increase in the number of employees, it is necessary for the company to manage the integration of new people into new functions in a short time, and to match their skills to the needs of the organisation. So, in this context, actors need to have their roles clearly defined so that they can contribute effectively to projects. The company is made up of 8 departments: marketing, technical: in charge of the product development (design and industrialisation), logistics, buying, production, quality,

financial and the factory. Although informal definitions of functions within the company were established, actors needed a more precise definition of the departments of the company, the functions of each department, in particular within the technical department. The goal of this work was to formalise the general organisation of the company and to position each actor clearly according to their skills and the tasks which each must carry out. This would allow the workload to be managed at the company or department level. It would also allow the definition of the department, the users, the functions, the rights, the future organisation, data and process management tools according to the specific needs of the SME.

3.4   Project process management

Initially, projects were managed by a "chargé d'affaire", a single person in charge of the whole of a project: from the order until shipping of the final product. However, following the growth of the company and the taking on of many new projects, this method of management was not suitable, if only because there were more projects than people to manage them. This kind of management may be appropriate within a small company with few projects, where the "chargé d'affaire" can ensure a reactive link between the customer and project. He can work with all the other people in the technical department in a context of "mutual agreement" [29] where actors help each other in order to satisfactorily complete work through informal collaboration.

Thus there are now too many projects to be managed, the deadlines are increasingly tight, the number of employees has increased and a gap has appeared in the link between the "chargé d'affaire" and the customer and also the technical department. Such problems of communication emerge between actors within projects and are prejudicial to deadlines and the image of the company. Hence it became imperative to rationalise project management and the design processes.

3.5   Product data management

The technical department used 3D CAD, 2D drafting and ERP (Enterprise Resource Planning) software systems. All these systems were used by actors according to their own skills and knowledge of them rather than according to a structured design approach. The company wished to define such an approach and train its employees in order to rationalise information management. Again, the increase in the number of employees highlighted the need to manage the files created by the actors and all project documents better, in order to reduce misunderstandings and time wasted in searching for information. The objective is to identify each element of information, its support, its scope and the person responsible for its validation.

3.6   Conclusion

All these observations show the need for structure in project process development and product data management. Thus, it is essential for the company to study: the organisational structure with the definition of departments and roles; the management of the project process; and product data management in order to be able implement a tool which can be adapted to the new organisational structure of the company. Moreover, a recent partnership with a client in the field of rail transport has encouraged this SME to evolve toward a rationalisation of its organisation in order to respect quality and design standards. However this formalisation must not strangle innovation. So, it is necessary to study how this new organisational structure and

project processes can retain enough flexibility in order to allow actors to keep the necessary amount of freedom.

The next section outlines a global methodology, based both on that existing and on this experience with an SME. The aim is to prepare the company for the introduction of a new information system. This methodology is then applied and the results are developed for the company studied.

4 First proposal and results

The methodology proposed here allows the description of the prerequisite tasks to be carried out before the implementation of a product data and process management tool. These tasks focus on the organisational structure of the company, its design project process management and its product data management.

4.1 Proposed methodology

The GRAI Engineering method [28] aims to improve the performance of product engineering design by modelling the existing design system then the future design system. This method leads to the specification of an information system that will support design co-ordination and control. This method has been applied in a context of large companies and SMEs. First implementation of the corresponding information system [30] shows that both method and information system may be applicable to large companies. However, in the case of the SME studied in Section 3, a method that is more oriented to the way that they manage their product development process is needed. The specification of an information system must also be targeted the specification of a "PDM-like" system to manage product and project data.

As previously mentioned, the proposed methodology is composed of two main phases: an "Analysis" phase dedicated to the study of the existing product development process; and a "Specification" phase dedicated to the definition of the future product development process.

The "Analysis" phase is composed of:

1. Definition of the existing organisational structure (departments, roles, internal links).
2. Definition of the existing design process including project management and design tasks.
3. Identification and characterisation of the information flows.

After having applied the first phase, the different steps of the "Specification" phase can be described as:

1. Definition of the future organisational structure of the company: departments, peoples' functional roles, and then the roles of future project members and their relationships for future collaboration.
2. Definition of the global product development process.
3. Definition of the informational flow with all documents used.
4. Definition of the product development process at a more detailed level with practical guidelines in order to fulfil each task. These guidelines are mainly defined by iterations.

This second phase has been applied and the results for the case study SME are now described.

4.2 Specified organisational structure

Firstly the organisational structure of the company must be defined in order to support the further work on the project process and product data management. This definition could be separated into three sub-steps: definition of the departments' function, identification of each actor's roles, and definition of desired project management context. The function definition includes the characterisation of necessary tasks which must be carried out. For example an organisational chart can represent the place of each person within each department.

For each department we define the internal links (with other departments) and the external links (with suppliers, partners, customers, sub-contractors). We also define the main roles included in each department in order to carry out the different tasks and each role is linked to employees' names. The role identification allows the actors to know their place in the organisation accurately. Then the internal organisation of each department is formalised. We can see, for example, in figure 1 the representation of the organisational structure of the technical department: the main roles involved and their associated responsibilities. This figure describes also the links with other departments i.e. the exchanges between them.
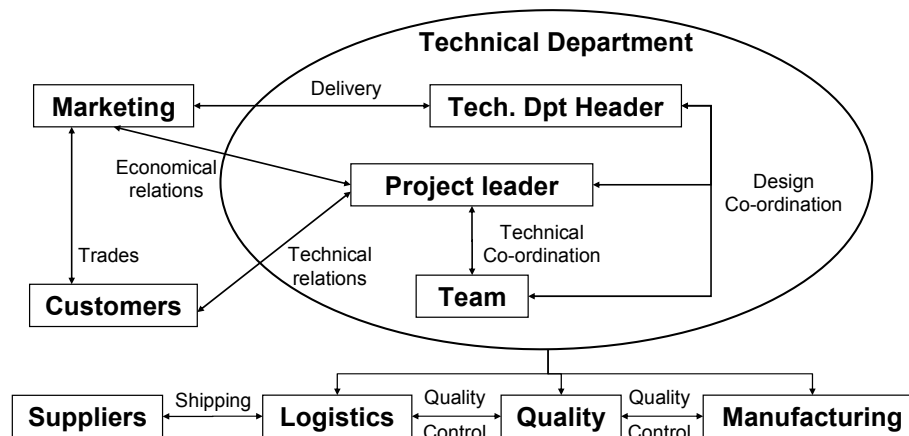

Figure 1. Organisational structure of the technical department

Finally the context of project management is defined by the project leader to manage the product development. The goal is to identify the operational responsibilities and roles that will be used throughout the design project. For example, as previously stated, project management was based on the concept of a "chargé d'affaire": who in fact belonged to the marketing department. This "chargé d'affaire" interacted with the technical department to obtain technical data when required. As a consequence, the role of each person was predefined and did not evolve. With the evolution of the company, this context became unsuitable and we proposed the concept of project leader. A project leader belonging to the technical department is assigned to be in charge of a project's progress, a specific team is selected for each new project, and during the design process tasks are delegated to members of the team. The step is to define how the responsibilities are shared, assigned and built upon from one project to another. This step defines the early phase of a project as building the appropriate organisational structure before its launch. In fact, when the order for a new project comes into the technical department, the head allocates names to roles: the project leader and its associated team according to the complexity of the project and the current workload. So, using a project leader oriented organisational structure we plan to manage the project process by defining tasks and objectives controlled by milestones.

4.3 Embodiment of project process management

After the definition of the organisational structure of the company with the description of the internal and external organisation and the context characterisation before launching the project, we focus the study on the management of the project process at a global level in order to build the basis for a future specification of the document management.

First the main phases of the project development process are defined which correspond to the definition of the product life cycle phases: for example, a classical lifecycle in the company is "feasibility", "design and manufacture definition", "prototype manufacturing", "production", and "obsolete", as shown in figure 2. This decomposition of the development process into main phases is followed by the definition of the sequence of the main tasks for each phase. This leads to the definition of the whole project management process.

Each task is the responsibility of a department. The goal is to define the succession of tasks by considering the different departments and the different phases, in order to identify more easily the different milestones that control the progress of the project. In this company, the internal quality standards are based on a global formalisation presented in figure 2. This representation of the main concepts of the formalised design process is followed by the definition of sub processes which detail who is involved in a task, which documents are used and produced, and what decisions are taken for milestones. Milestones may control the achievement of several tasks and introduce some predefined flexibility for the next tasks. Some milestones may control the achievement of a complete phase. This detailed level is formalised in the company through textual definition and some graphical representation using office software. A more formal representation based on the IDEFØ (Integration Definition for Function Modelling) formalism [31] may be more suitable for providing a better general understanding with a high level of granularity by defining the sub-processes and the elementary tasks.
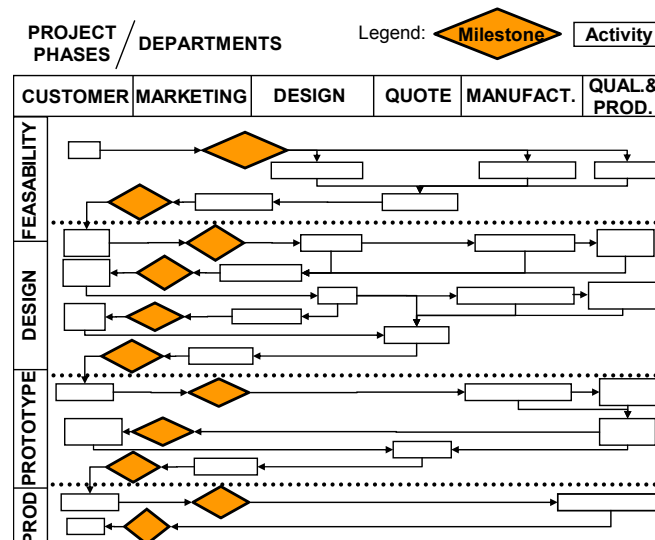

Figure 2. Overview of the product development process

The definition of the product development processes with tasks and milestones is essential to manage the whole product development. Moreover this definition is also necessary if we are to implement a product data and process management tool.

4.4 Specified Product data management

The management of information flow is necessary to manage the new structure of projects. We define each task of the design process with incoming and outgoing information, the associated resources and the associated methods of control. In order to define the information flow we describe the physical or numerical supports and the transformation of each kind of information. We define all documents used during the product development process and especially the documents which represent the product structure. For each document we define a document template, we manage their versions with a letter to identify main versions and a number to identify minor modifications. Finally we define guidelines on writing documents, all these guidelines are summarised in a report accessible to everybody in order to standardise document production.

After the definition of all documents used, we define the links between the documents and the tasks in the process development process, the responsibility assigned to roles, and the manner of validation of each document through milestones.

4.5 Detailed project process management

After the definition of the data management, we redefine the project process management at a micro level. We set out guidelines for execution of each task in the project process. These guidelines define the implementation of the tasks planned in the global product development process by specifying a task sub-sequence. This task sub-sequence is not really scheduled, but proposed to be followed by project members as a generic "best practice". The definition of these guidelines is not easy because they are specific to the company. So we experiment with each guideline in order to compare them with the actual operational work. We make several iterations of defining, proposing and validating the guidelines. In fact, these guidelines define the relation between actors with a suitable form of collaboration, a definition of milestones and tasks management.

At this micro level, for each activity we assign a person in charge of the implementation of the task with total autonomy for its achievement, and with the possibility of asking for assistance from other persons. However the person in charge must reach his objective which was predefined during the last milestone, and fulfil documents for the next milestone. The progress of the project is thus based on the management of milestones with the management of objectives and deadlines. This sort of project management supposes that each actor involved in a milestone produces a preliminary work: the persons in charge of previous tasks must put the relevant documents at the disposal of the other actors in order to validate the milestone. Then the person in charge of the following tasks must evaluate the work carried out. The milestone is either validated and the following activities are launched, or it is refused and corrected tasks are defined in order to solve the problem. For example, during the first activity of the product development process: "customer order specification", the marketing person provides to the technical department the information needed in order to accept or refuse the "customer order specification". During the milestone three events are possible:

- The information provided by the marketing person is sufficient and the requested product is feasible. Then the milestone is validated and the customer's order is accepted.

- The information provided by the marketing person is sufficient, but the requested product is not feasible. Then the milestone is validated but the customer's order is refused and the process stops.

- The information provided by the marketing person is insufficient to make a decision, then the milestone is refused, and further information is requested from the customer. The milestone will be re-planned.

This example shows how the company manages the first task of the development process, and such a study is also carried out for all the activities of the company.

These prerequisites are carried out with the objective that the company specifies a tool to support its organisational structure.

5 Final proposal and discussion

By considering the results of this case study we notice several points to improve the proposed methodology such as definition of new steps, characterisation of sub-tasks, and proposal of more dedicated formalisms. The next section introduces these proposed improvements and then there follows a discussion of the generalisation of this method and its operational use for project managers to foster flexibility, collaboration and innovation.

5.1 Final methodology

The final methodology details the several steps initially identified and attempts to generalise them for SMEs developing manufactured products. For each step a model can be proposed in order to rationalise the documents produced within the case study and to share these representations with every person in a company.

The "Analysis" phase is composed of:

1. Definition of the organisational structure of the company (departments, roles, internal links). The representation of this structure is based on the IDEFØ formalism in order to characterise the functional view of the company: functions, departments then persons, roles and information exchanges.

   – Internal structure: as realised through the case study.

   – External structure in order to take into account collaborations inferred by strong partnerships (links with suppliers, customers, partners, contractors).

2. Definition of the existing design process:

   – Modelling of the product development process composed of design tasks.

   – Modelling of the project management process integrating co-ordination and control tasks.

Both models are based on the IDEFØ formalism to facilitate their understanding by all of the company's employees. They include the identification of information used during the project: transformed information, support information as well as control information.

3. Identification and characterisation of the information flows:

   – Synthesis of information used as product and project data, and identification of their respective structures.

   – Characterisation of existing life cycles (states and actions) for product and project data.

In order to anticipate the future steps of information system specification, we propose to use the UML (Unified Modelling Language) formalism [32]: class diagrams for the synthesis of product and project data structure, and then state-transition diagrams for life cycle description.

The "Specification" phase can be described as:

1. Definition of the future organisational structure including:

− Internal structure.

− External structure.

− Definition of the project context using UML use case diagrams to characterise user needs and tasks that must be implemented before starting the project, as proposed by [33]. The choice of the UML formalism is linked to the future specification of users and roles in an information system.

2. Definition of the future global design process:

− Global definition of the product development process.

− Global definition of the project management process.

− Modelling of the integrated product development and project management process. An IDEFØ model is realised that characterises the different phases, activities and milestones of the project.

3. Definition of the information flows:

− Identification of pertinent information to be managed through the design process and of its structure, using the class diagram formalism.

− Characterisation of correlated life cycles using state - transition diagrams in order to specify tasks, responsibilities, resources, and validation processes.

4. Definition in detail of the product development process based on UML sequence diagrams. This model integrates the information flows with human activities in order to specify detailed activities for team members upon identified information. The aim is to specify the future functions that will be implemented through an information system.

The methodology just described represents the prerequisite steps that can lead an SME through reorganisation before the implementation of an information system. In particular, steps 1, 3 and 4 propose UML based representations directly used for specifications.

5.2 Discussion

In fact, our work highlights the fact that the implementation of a PDM tool requires a prior step of rationalisation of the company work. However, this rationalisation process often leads to a generic model of the organisation that is too limited in some aspects:

− This model tends to simplify the complexity of the socio-technical operations. For example, most of the time human factors are often not taken enough account of in the proposed generic model and yet we saw how this aspect is essential to foster innovation.

− This model is mainly rigid as the proposed architectures are often very stable and predefined.

This paper illustrates the need to develop new methods and tools to be used during the pre-development of the implementation of PDM tools within SMEs.

The final proposed methodology is based on the specific context of SMEs'. Although the main steps are general and can be applied in both the context of SMEs and of large companies, the details of these guidelines are specific to the context of our case study. Moreover it is specific to the document formalisation of the company; it is an internal representation of its organisation and results from several iterations of testing in order to match the guidelines to the reality of the company. The next step for the company will be to translate this internal representation toward a classical representation such as IDEFØ or UML in order to become understandable by everybody (inside and outside of the company), and to match these representations with administrative standards.

It is already clear from the results of the case study that some further areas need to be addressed, for example: actors and skills management, triggering events, and also the ability to reuse and build on the planned/realised/modified process. The implementation of the task concept is not satisfactory: it is not clear how input and output information may be defined other than through deliverables and the decisional elements cannot easily be formalised. The proposed attributes of process elements, tasks or milestones do not exist given the inadequate status/level of the concept of realisation. At the global project level, the structure is too sequential. It is not possible to handle convergent links between tasks or alternative task sequences, whereas it is possible to implement this in a workflow context.

During our case study we noticed the importance of skills management during a project. Through this it is possible to manage the workload of the company and define a policy of skills improvement and training. In our methodology we define a global organisational structure to formalise each department's objectives and related functions, the main design process activities which are assigned to a specific function and not necessarily to an identifiable expert in the company. This means that human resources must be managed considering people skills. Specific criteria must be defined in order to promote cross-competencies sharing and skills acquisition by experience, apprenticeship and training. As a consequence, the project manager's role must be extended. The project manager has to assign actors whilst considering these criteria and making the best compromise between the best skill for one job and the desire to build up skills for future projects.

This last point highlights the necessary flexibility of a design process in a SME, especially in this case study where innovation is a constant concern. In an SME the formalisation of the organisation is a critical point for the optimal management of resources. If the process is predefined at a global level, actors from all departments work daily in a context of "mutual agreement" but this organisational aspect is rather incompatible with PLM functionalities. When establishing specifications in a SME it is an important issue to identify what must really be controlled and so predefined through a workflow, and what must be encouraged and not detailed. For example collaboration between actors cannot really be defined through existing project plan or workflow concepts. The cooperation processes are quite unstructured and the confrontation of the various project teams' points of view leads to informal and unofficial information exchanges [34].

Our methodology formalises many organisational aspects but in order to not stifle the emergence of innovation we must keep in mind the flexibility factor. The introduction of flexibility could be made during the definition of the design process in our methodology and

during the implementation of the tool. During the definition of the global process, we can authorise the definition of short cuts by project leaders according the design situation (product, customer, problems) in order to have various "ad-hoc" sub-processes which increase the flexibility level of the global process. In our case study we introduced the possibility of defining these "ad-hoc" sub-processes in the milestones. During the implementation of the tool, integrators can carry on in a similar way by the introduction of flexibility in the processes of document validation, for example, and also through any other possibilities available in the specific tool.

Nowadays both the implementation of this methodology and the necessity of traceability, of norms, and administrative requirements lead to a significant volume of document management. So it is almost indispensable to implement a tool in order to aid actors in data and process management. At this step the question appears of what sort of tool is more convenient for the company situation, a specific or generic one? A specific tool is burdensome in term of resources: the IT skills must be present in the company otherwise the company must hire a computer scientist. It takes a long time to implement such tool and a person in charge of its maintenance is indispensable, both in order to solve problems which occur during its daily use and to customise the tool according to the specific situation of the company. However, such a specific tool is certain to have the desired functionalities adapted to the specific context of the company.

Implementing a generic PDM tool is burdensome, difficult, and expensive. In the case of SMEs the costs may be reduced, but generally the match between company needs and the configuration of the PDM tool is not complete. Moreover, a PDM tool cannot manage the global process of a project because it only manages documents and their validation. It is possible to add extra specific tools linked with generic functionalities fulfilled by the PDM tool, we could quote, for example, a specific tool to manage the development product process from the project manager's view.

As we saw in previous paragraphs, the prerequisite tasks are indispensable before implementing product data and process tool. So, during the implementation of the prerequisites we must keep enough flexibility in processes and foster collaboration between designers in order to not stifle the emergence of innovation.

6 Conclusion

In this paper the importance of the prerequisite tasks for the successful implementation of a new product and process management tool have been demonstrated. The identification of these prerequisites came from a case study in an SME which wished to implement such a new tool. From this case study we also identified generic prerequisites useful for any SME.

All these prerequisites could be done before the implementation of a product data and process management tool, but managers must keep in mind the matter of the flexibility in order to not strangle the emergence of innovation and the assimilation of the tool in the company. Flexibility can be introduced before and during the implementation of the prerequisites and later during the implementation of the tool. As an example - flexibility can be introduced by a PDM tool through management of the validation processes of documents.

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