Integrating Competence Management into a Coupled Project-System Design Management

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Abstract. Competence management has recently become an important issue in companies. Closely related to knowledge management, it considers the capacities of an individual to perform by using his/her knowledge. This knowledge management becomes a tool for companies to manage human resources in the long run. The ability to characterize useful competences, to evaluate how they are improved through past experience and successive jobs occupied, and thus to select project team members according to fully or partly existing skills are some of the concerns that business managers have to tackle. This paper focuses on the coordination of design activities in order to propose a tool dedicated to project managers on an operational level to manage skills for better team building. The aim is to improve team performance in the short and long term while preserving a link with the human resources department. Our work is based on the results of the ATLAS project which studies the coupling between systems design and management. We propose an initial tool to manage skills in a design project.

Keywords: Collaborative design, skills, design management, project management, forecasting management of employment.

1 Introduction and context

Many studies have examined the human and social dimensions of product design [Lorino, 1996, Perrin, 1999, Boujut and Tiger, 2002]. Indeed, the peculiarity of the design activity is that it is an essentially human activity, not an automated one. [Merlo and Girard, 2003] show that man is both a resource and an actor-engine design process. This is a resource that needs to be controlled, usually by assigning a set of tasks contributing to the overall development objective.

In the context of product development, the logical project [Cleland and Ireland, 2006] and the need for collaboration between several partners [Kvan, 2000] make this an even more important human dimension. Often managers see people as resources having mostly technical knowledge but do consider them mobilized too often in terms of skills. The concern that associating a person and a set of tasks in a logical short-term, may present a number of limitations such as: experts required, beginners repre-

sentatives on low-value activities, a significant turnover between each project, and even during long term projects.

As part of product design, especially for complex systems, our work has led to various proposed models, methodologies and prototypes to integrate the dimensions of the product, as well as process and organization into a common logic of design coordination [Robin et al., 2007]. This integrated approach has helped reconcile the technical and human dimensions of driving design activities through the structuring of projects and performers, planning activities assigned to the actors, the design itself and the performance evaluation of these three dimensions.

One of the areas for improvement proposed here is to study how to include performers in structuring and planning teams based on their competence. Our goal is to integrate management skills as part of an integrated product-process-organization driving the design. In the first section, we describe the ATLAS project, which forms the basis for our thinking. In the next section, we develop our vision of management skills and we make an assessment of what has been implemented in the demonstrator software developed in the ATLAS project. Finally, in the last section, we consider recent developments in management skills for businesses.

2 ATLAS Project

The work presented here is based on the ATLAS project, which represents an important step in our work on the conduct of the design. The scientific basis based on the GRAI R & D approach [Girard and Doumeingts, 2004] is formalized by the GRAI Engineering methodology [Merlo and Girard, 2003] to deploy the principles of design steered by the integration of product - process - organization.

The ATLAS project *(Aides et assisTances pour la conception, la conduite et leur coupLage par les connAissanceS – Help and support for design, coordination and their coupling by knowledge)* includes six French academic institutions and two French companies which propose an instrumentation design activity based on the coupling of product design and project design

Started in 2008, one of the major objectives is the implementation of a demonstrator software to implement mechanisms to ensure the coupling of the object of design (the product or system) and the process of realization (project) in a collaborative environment for concurrent engineering [Prasad, 1996]. The desired result lies behind more consistent and efficient decision-making, as based on information drawn from these two dimensions and consolidated by the aggregation of information from the detailed structuring of the projects and the system.

The different models developed to achieve the objectives of coupling have been presented in [Aldanondo et al., 2008]. The mechanisms that implement them are based on knowledge modeling concepts such as system, reuse, and performance evaluation in the form of variables, constraint programming and feedback.

The demonstrator program targets two categories of users: users involved in system design (designers responsible for these designers) and users responsible for

project planning. It has two main modules: The system design module and the project management module.

Each system and each project have associated variables. These variables specify the indicators on which the system will be evaluated (and therefore each subsystem) and the project (and each sub-project). Performance targets to be achieved and constraints can be set by managers (both system and project) and then be checked all along the progress of the design.

A third module focuses on the "management", that is to say on the overall management of this dual system design and project evaluation is used to summarize the performance achieved by going back with the values of variables and offering a synthetic scoreboard, combining variables systems and projects. This module centralizes the exchange between project managers and system by integrating an internal messaging system. It keeps track of the decisions and their justification.

The coupling is provided by various mechanisms built directly in the demonstrator, either independently or integrated in the modules implemented.

The overall architecture of the demo can be described through (Fig. 1), in order to illustrate the interactions between modules. A configuration module completes the architecture of the demonstrator to show the flexibility that can be introduced in relation to the technical assumptions that were retained.

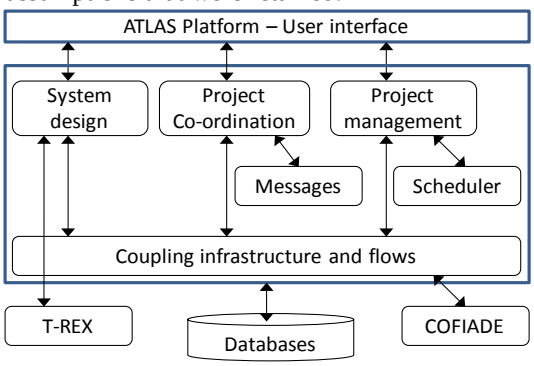

Fig. 1. Architecture of ATLAS prototype

In these modules to which are added up additional external tools, in particular: a management tool for feedback *(T-REX, proposed by ENI of Tarbes)* and a constraint propagation engine *(COFIADE, proposed by the Centre Génie Industriel from the Ecole des Mines d'Albi-Carmaux)*.

2.1 ATLAS control design

As part of ATLAS, there are three people in charge of the project: The system and planning managers are at every level, and the project manager that launches the project and appoints the heads of the first level.

This control mode is one of the couplings to manage the coordination of the design. Based on the organizational model of the PPO model (Fig. 2), each level beyond the first is identical and is repeated for each new sub-project.

The coupling is designed to facilitate the impact of decisions made in each of the two-dimensional system and project, and the exchange of relevant information to make a decision comprehensive, relevant and justified, and possibly in a collective context. Different coupling modes have been identified [Aldanando et al., 2008].

For these different coupling modes, the program director (PD), then system manager (SM) defines the design goals for his/here team and deploys them in the form of constraints that apply on the variables he/she selected. The planning manager (PM) does the same with the project-specific objectives such as budget, available resources, and schedules processes and activities. Both must work together to describe the activities that detail the predefined process and validate the allocation of adequate resources. Each of these individuals or stakeholders may rely on a team to assist him in making his decision, not shown in Figure 2.

Everyone then monitors the progress of the design, first overseeing design activities of design and the satisfaction constraints for a system design, and then checking the progress of the schedule, costs and other project constraints. The couplings used (alerts and scoreboard) facilitate the identification of gaps and non-compliance constraints, leading to a collaboration to make new decisions.

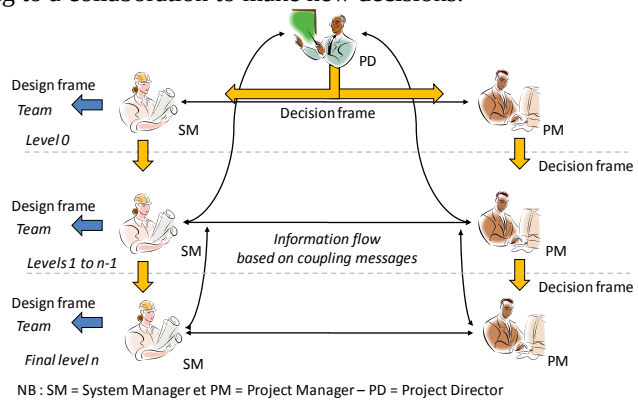

Fig. 2. ATLAS organizational Module

The following section discusses the issue of competence management and its implementation in the ATLAS demonstrator.

3 Management of resources by competences

Questioning the management of resources requires competences to clarify the concept of competences before considering their integration into the control design activities.

For [De Witte, 1994] competences don’t have a definition but it is necessary to agree on a common definition to be able to understand. According to Le Boterf, elevator cannot be taken without resorting to a competence [Le Boterf, 2008]. This idea highlights the fact that competence "is never given directly to see: For [De Witte, 1994], competences have never been observed in a microscope.

Even though today there is no clear definition adopted by all, we can see it as a sum of knowledge, know-how and skills. [Le Boterf, 2010] declares that competences are not a state and they are linked to action. For him, competences are a result of three factors: knowing how to act which implies the ability to combine and mobilize relevant resources, the act of willing which refers to the motivation of the individual and a more or less motivating context, and finally the power of acting makes it possible to take responsibility and risk taking of the individual.

[Masson and Parlier, 2004] identify four defining characteristics of competence: it is operative and finalized (it is inseparable from an activity), it is learned (one becomes competent by personal or social building), it is structured (it combines knowing how to act, willing to act and the power of acting), then it is abstract and hypothetical (you cannot directly observe the competence but only its consequences).

[Michel, 1993] considers a competence as an ability to solve problems in an efficient way and in a given context. For our part, we will retain the definition proposed by [Boumane et al., 2006] that involves the definitions of the other authors. “Competence is the ability of a person (actor) to act and react with the required relevance to perform an activity in a work situation”. The actor is at the center of the process of selecting, combining and mobilizing their knowledge, skills, abilities and behaviors on the one hand, and environmental resources on the other hand, in order to accomplish a mission defined by the company. "

However, it seems important to add to this definition the notion of "social recognition" developed by [Le Boterf, 1994], provided that the competence is a "knowing how to act".

While it is clear that competence, as we have seen, is an individual behavior, which should be supplemented by the collective dimension of competence. It is inconceivable to separate these two dimensions, as they are interdependent in the design processes that involve, and they call for a many actors.

Based on inputs from Le Boterf [Le Boterf, 2010], we consider that the collective competences are a combination of individual competences. "In the collective design situations, the aim of the process (the intended purpose, the" thing "to do ...) and the process itself (how each one is relevant to the other ...) are built by mutual influence" [Hatchuel, 2008]. In the process of cooperation that arise in the course of work [De Terssac, 2002] during the design activities, other learning rules direct exchanges among the concerned actors: "Learning is therefore necessary at any time and requires exchanges between performers and makers."

3.1 Competences management in companies

Competences management is an approach that mainly concerns the human resource management, and which tends to replace the traditional management based on position and functions related to this position [Retour, 2002]. In fact in small and middle-sized companies, the establishment of a project team will depend on a single person, the entrepreneur, the technical director or the head of research department, for example. The size of the team will also be reduced, and the choice of assignments does not really arise, because the nature of the tasks will be directly related to the position of

the person in the company. Management competences rely on the concept of "versatility" which is reduced to a simple availability management for the actors.

The notion of performance is also very present in this competence approach, as far as decision makers are considered [Defélix and Retour, 2003].

This work shows that competences management is applied here for team building projects and the allocation of some team members on specific tasks, since competences are associated with an activity and a level of competence [Gilbert, 2002]. In a company of a certain size and which has genuine human resources, competences management is divided among people from different backgrounds. Technical managers ask for people around them depending on the qualities or experience they have already established or on which they were advised. Planning or financial project managers are also interested in problems of availability, recruitment based on knowledge or level of competences to be determined. The Human Resources function manages the needs of people as profiles of knowledge / competences, through internal or external recruitment. Beyond the management competences and operational management, the long-term management of these design competences is too often the initiative of the project manager or management when starting a project and does not appear systematically in the primary concerns of the company. Experience accumulated in various projects, but also in various functions throughout the career, can then be taken into account to formalize training schemes in the short term, but also manage the long-term career. Practices are based primarily on mapping competences in 4 distinct levels [Veltz and Zarifian 1994]: Competences required for a specific position; the competences used by the employee in this position; the actual competences gained by the employee; the potential employee's competences, allowing the employee and the company to consider a career development.
Our experience with companies of all sizes in all sectors, we found that competences vary greatly from one company to another.

4 Conclusion and Discussion

In the field of project management, and in particular project management product development, the consideration of human resources is recognized as an essential element of project manager activities. Focusing on issues of allocation and availability, these operational concerns are not always in tune with the concerns of long-term human resource departments, for which competences management is an essential tool.

By relying on the results of the ATLAS project, involving the coupling between system design and management of design projects, we have proposed a first pragmatic mechanism for extending the simple assignment management and availability by including the dimension competences. Competences classified by types of competences thus become the milestone between the characterization of an individual by his competences and the ability to select a resource through competences needs. The organizational model of decision making among managers or project leads can oversee the process of decision which transforms this need competences in a planned and validated allocation against indicators performance of the project.

This demonstrator deserves to integrate a concrete management of competences in the design process, but it has some limitations.

First, it would be interesting to incorporate more accurately the situations that mobilize certain competences. For example in Figure 3, the situation in which the person is able to adapt themselves is not specified. As we have seen, a competences that can only be measured in a given situation:

"Adapt to the environment" does not specify the personal and external resources that the person is supposed to mobilize [Le Boterf, 2010]. Furthermore, the notion of competences level is necessary but absent from this first prototype, as we have seen in Section 3, in order to consider a competences planning. In this way it would be possible to evaluate the level required to complete an activity, the level mobilized by an actor in this activity, or the potential level reached by this actor on terms to be defined (eg training). In this way the project manager can master more expected performance by the employees he selects, which directly impacts the performance expected in the project itself.

Thirdly, an inherent difficulty to the complexity of the competence lies in identifying informal competences. They often refer to "embedded knowledge" often implicit, reflected in the speech with "you can see," "you feel good" reflecting for the person the difficulty or the impossibility of accessing such of the type of competence.

Finally and more broadly, if this demonstrator is only a tool, it could be very useful as a source of practical information for planning of jobs and competences.

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