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SHARED UNDERSTANDING: THE INFLUENCES OF DIFFERENT RATIONALITIES MANIFESTED IN ACTIVITIES CARRIED OUT THROUGHOUT THE NEW PRODUCT DEVELOPMENT PROCESS

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Summary: During the process of developing new products, problems arise and must be overcome through alternatives that reconcile the different disciplines involved through compromise solutions that, by definition, would be negotiated between the agents. The perspectives and representations constructed about a given object are intensely influenced by the agent's training discipline, their experiences, and ultimately by the object-world in which this agent inhabits. We show that the product development activity is full of moments where an evaluation and selection among several alternatives is necessary. At these moments, each agent's choice will certainly reflect a good deal of their personal preferences, as well as paradigms and stereotypes linked to their specialization discipline and training. Such differences can make it impossible to create shared understanding and make it difficult to obtain the expected results in the development of new products. Intermediate objects can help create the shared understanding that is critical to project success. Furthermore: The activity configuration model, as proposed by Engeström, when applied with the intention of revealing and characterizing the activity system to be transformed, functions as an intermediary object of fundamental importance in creating a shared understanding about the activity itself in analysis.

1. Introduction

The most competitive companies are those that can align innovation and speed while presenting an intra-organizational relationship that enhances synergies and can efficiently translate customer needs. The product development process (PDP) emerges as a driving element for competitiveness since it takes account of shorter product cycles that, additionally, incorporate the diversified and particular demands of a market segment increasingly oriented towards the end customer.

Completing the picture is the growing complexity of products, which intensifies the meeting of multiple disciplines. A new product, when designed by a project team (that is, collaboratively), ends up materializing the conciliation of alternatives proposed by different disciplines that are normally present throughout the conception and development process, making the exercise of designing a large stage for negotiations and commitments that are made and assumed by the different participants (agents). Additionally, the degree of complexity can grow as we understand that a product development project tends to be linked to a portfolio with several other projects that compete with each other for the organization's resources. Each of these agents develops a particular perspective, a point of view, a proper understanding of what the object in conception/development is. The object may have, for each of those involved, a different meaning. Objectively, the different perspectives and meanings are confronted from the initial decision to proceed with the project and continue to do so during conception/development. The reconciliation of these perspectives – the construction of a shared understanding – is fundamental to the success of product development.

The objective of this work is to confirm the existence of different rationalities and discuss their impacts on obtaining a shared understanding and present proposals for paths that can lead to the reconciliation of these differences throughout the product development process (PDP).

It is assumed that product design and development is a process that involves the transformation of various representations, from technological and social perspectives. Thus, we reaffirm a context of mutual transformation of the object, of the collective involved (agents), which places activity theory as a consistent approach for analyzing the product development process. From the study of the activity, the historical and cultural characteristics of the social organization of work, as well as the tools used in addition to the political and moral perspectives articulated in the development team, can be considered in the construction of the necessary understanding so that the process can be transformed. aiming for better performance.

In the following sections we clarify our understanding of the product development process (PDP) and its multidisciplinary (multiprofessional) nature and we will present the methodology used. Subsequently, we substantiate the different perspectives present in the collective analyzed from the perspective of object worlds proposed by Bucciarelli.

2. The product development process through multidisciplinary teams

GARRIGOU et.al (1995) characterized the design process as a fragmented, iterative and complex coordination process, permeated by multiple social interactions and with decision-making conditioned by multiple constraints.

Béguin (2003) described the process of designing, from the perspective of phenomena, as being both an individual and a collective process, to this end it is based on the principles of differentiation and interdependence: While the principle of differentiation reduces complexity within the scope of the activity while that the principle of interdependence increases it, as it links the result to the perspective of necessarily collective action, of conciliation of different representations. The importance of the PDP is reaffirmed when we assume that it is

throughout this process that the functional performance characteristics of a product are defined, as well as its performance and cost drivers.

The new product development process based on a simultaneous approach has become a popular method to accelerate development and support companies in the search for competitive advantages (RAUNIAR and RAWSKU, 2012). According to Adler (2011), there are many defenders of the thesis that success obtained through rapid innovation and customer satisfaction (achieved with lower costs and greater efficiency) can only be achieved through the bringing together of different functions in a collaborative environment. , for example, through teams in which several disciplines are necessary and coexist. Thus, the work of designing and developing a new product remains of interest to several study groups because it is in this work that we find the focal point where technical and social aspects are negotiated and transformed into a new artifact (HYYSALO, 2002) . Representatives of these varied disciplines (functions) normally carry different (and sometimes antagonistic) representations and rationalities (EDMONDSON and NEMBHARD, 2009; BÉGUIN, 2007).

During development, problems arise and must be overcome. For greater efficiency, projects of any nature are subject to the adoption of compromise solutions that are imposed by the real situation (SWINK et al., 2006; SIMOES et al., 2012). To find creative solutions to the usual multifaceted problems of development, specialists from different functions are called upon to work in an environment of high multidisciplinary interaction (OLSON, et. al, 1995). Multidisciplinarity brings with it the tendency to increase the team's absorption capacity, thus increasing their creativity and speed in solving problems. On the other hand, the diversity of interpretations and, consequently, different understandings about the activity increase (LAKEMOND and BERGGREN, 2006).

The different agents involved in the product development process use different instruments, have different skills, abilities, responsibilities and interests and, therefore, live in different worlds (BUCCIARELLI, 2002). Each of the different agents acts in different object worlds constituted from individual experience, training, resources and responsibilities. Individuals are trained and educated in different ways according to the discipline, with different accumulated experiences and each of them brings with it its own variety of models and paradigms (BUCCIARELLI, 2001). The author also states that the challenge becomes the harmonization of the different perceptions and meanings constructed about the new product. The challenge becomes building a shared understanding.

2.1.   The activity theory perspective
 Human activity materializes in the intentional modification of a natural or social reality. Any activity carried out by an individual encompasses the objective, the process of changing the object and, clearly, its result. Activity theory is a dialectical theory where the concept of contradictions plays a fundamental role. Here, contradictions are seen as tensions between the components of the activity with a history of evolutions and developments that can be revealed and addressed (ENGESTRÖM and SANNINO, 2010). Engeström (2000), stated that these disturbances originate in significant systemic contradictions as well as potential for change within the activity. At the same time that the object and the reason give the actions coherence and continuity, due to the fact that they are internally contradictory, they also keep the activity system in a state of instability. Such contradictions will be used in understanding the activity or activity system, in other words, in how the activity evolves and transforms. The object connects the actions of different agents under the same motive in the same way that it creates a horizon oriented towards this object. This horizon is not fixed, it changes throughout the course of action (HYYSALO, 2002).

3.   Methodology

We use the human activity model proposed by Engeström to reveal the different perspectives found applied in a decision event of a project under development. Engeström presented a model for the analysis of human activity, expanding Vygotsky's traditional singularly mediated act (Individual → Tools/Symbols → Object) to include two other mediators (Rules and Division of Labor). This expansion accounted for the inclusion of the work collective and emphasized the contradictions between elements (and in the elements) as generators of tension and drivers of change. Figure 1 shows the triple mediation model proposed by Engeström.
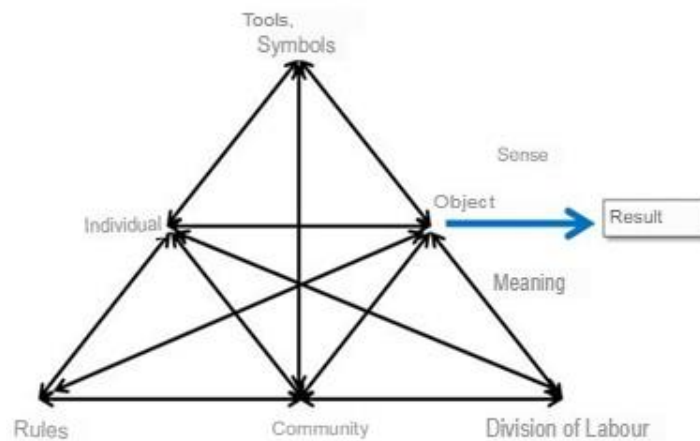

Figure 1: Structure of Engeström's human activity system - ENGESTRÖM, Y. "Expansive Learning at Work: toward an activity theoretical reconceptualization", Journal of Education and Work, Vol.14, No 1, 2001 p. 135

Based on the elements of the model, we put together a semi-structured questionnaire to guide a set of interviews carried out with the collective of agents involved in the activity under analysis. We thus configured a data collection instrument that aimed to reveal the configuration of the activity system in use and which sought;

      a.   Tools/Symbols: what are the means used to carry out the activity
      b.   Object: What is the purpose of the activity? Why is it executed?
      c.   Individual/Community: How the individual is involved in the activity and who else is involved. Someone is missing? Who? Why?
      d.   Division of labor: Who does what and how;
      e.   Rules: What conditions the execution of the activity: Formal rules, informal agreements, etc.

From the perspective of a more comprehensive project collective, the first multidisciplinary assessment/decision made throughout the new product development process is addressed, even before the team that will actually develop the project is formed: the decision to start or not the development of a new product and which is also formatted based on contributions from professionals from different areas and backgrounds.

4.   Analysis of results

Here we analyze the initial decision to release the acquisition/definition of the concept (called G0): The business opportunity is presented to a steering committee that evaluates the proposal comparing it with the organization's strategic objectives. The risks are preliminarily listed and assessed. There is permission or not to continue the study, which includes that of a project team.

The following dynamics were revealed by the agents involved: From a document called 'Cycle Plan', a set of business opportunities is identified that could be transformed into a project. With this plan in hand, and according to the temporal perspective, the sales representative (key account manager) formulates the business opportunity to be presented for evaluation. This formulation takes into account a pre-evaluation of the resources to be used in the project as well as its technical complexity: These two parameters will define the direction of the team of project/project manager to be designated in case of approval. The opportunity is launched in the management system using the "SOF" form and is then consolidated and detailed in the "Opportunity Presentation" slide set. The "SOF" registration " generates, for the group of agents involved, an automatic call to a meeting where the opportunity must be discussed based on the information in the "Opportunity Presentation".

It is up to the "key account manager" (KAM) to present the opportunity to the community made up of the General Manager, R&D Manager and Sales Manager. The argument about the strategic framework boils down to: "if it is in the cycle plan, it is strategic for the company". Likewise, sales representatives present the classification of the project according to its complexity - which guides the formation of the project team.

There is a set of formal rules that must be followed and are related to the procedure that governs the New Product Development Process (PDP), technical adherence to the product portfolio. Furthermore, the specific guidelines for project approval, as well as the condition for approval by a collegiate body, also appear with formal rules. Other rules of courtesy such as discipline regarding attendance and schedules were verbalized. An unspoken rule, expressed by the entire community involved - with the exception of the General Manager - is that every project presented must be approved. Table 1 shows the different perspectives on the fundamental objective of the decision event (G0) according to the different agents involved.

Perspective	Product Engineering (R&D)	Project office (PMO)	Sales	General manager

Table 1: Different perspectives on the initial decision event G0

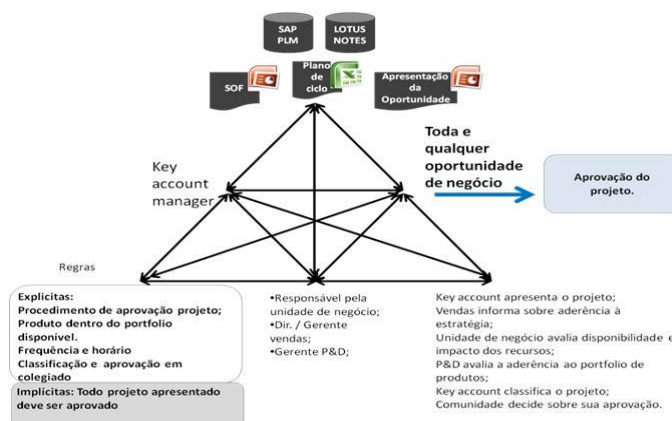Thus, the activity system can be configured as shown in figure 3, below:

Figure 3: Initial characterization of activity in the initial decision event (G0)

Different perspectives ended up generating tensions that could be characterized as follows:

1. The cycle plan is seen as a hermetic artifact, with an understanding restricted to the sphere of sales and engineering;
2. The assessment of strategic adherence is perceived as shallow: Every project is strategic, therefore every project must be approved;
3. The project classification is previously defined and is understood to be contaminated with bias from the sales function;
4. External environment changes and average volumes fall: The evaluation of resources does not favor projects with low production volumes - This rationale conflicts with the tacit rule of releasing every project for quotation.

In this case, the product is the target object of the activity system. The historical and cultural perspective of each of the agents proves to be decisive in the form of design and development action. By using Engeström's activity model we understand that these different characteristics can be revealed, understood and finally used to leverage the transformation necessary to obtain the expected results.

Finally, it is worth highlighting that the activity system model proposed by Engeström also worked as a meta-tool that dissected the current activity system. Used as a backdrop for understanding the activity, the model proved to be a relevant intermediate object for the implementation of a real social construction, fundamental for the production of shared understanding. During the application of the model, moments were provided in which the procedures, rules and actions of the collective were discussed, which can lead to the formation of a shared understanding.

5. DISCUSSION

The development of a new product cannot be limited to just the dimensions and disciplines necessary for its creation. Developing the product goes much further - its integration into production lines must be considered - the moment in which the product actually comes to life. The activity is modified and enriched when we come into effective contact with the objective reality. And it is in this enriched form that the activity crystallizes in the product. Furthermore, the new product also has representation and meaning for other spheres in the organization (e.g. finance) - such spheres, although not directly linked to the development process, influence the decisions taken throughout the development. They modify the target object of the development process at the same time that they are also modified by this object.

The product development activity is full of moments where an evaluation and selection among several alternatives is necessary. At these moments, the evaluation of each of the agents will certainly reflect a good dose of their personal preferences in addition to paradigms and stereotypes linked to their discipline of specialization and their training, as suggested by Bucciarelli (2002). If there is no convergence, the polarization between different representations will increase the tension generated which can result in inaction by the parties involved or in endless discussions where each pole maintains its position to the detriment of the needs of the project. In either case, the achievement of the final objective is jeopardized. The coordination efforts required to achieve this articulation will take place in an environment of increasing uncertainty and where the level of anxiety of those involved is high. It is in this environment that crises, manifested in the form of temporal, budgetary contingencies and understanding/meeting the requirements proposed by customers, frequently occur.

In this way, we suggest for future research the extension of the evaluation of the product development process, analyzed from the perspective of the activity and using the model

proposed by Engeström. Thus, an effective transformation can be assessed in successive and expansive learning cycles based on an understanding of the activity system in place.

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