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KNOWLEDGE MANAGEMENT IN THE PROJECT SECTOR IN THE AUTOMOBILE INDUSTRY

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Abstract

With the increasing technological advances and high competitiveness in market nowadays, there is great interest of companies for knowledge management. Managers seek in knowledge management for a help to make human capital - in its broadest sense – central point of analysis. In this context, this study aims to understand the mechanisms of knowledge generation, in the process of technical changes of the project area in a company of the automotive sector. The study showed that the process selected is in advanced stage of mapping and knowledge consolidation, but poor in terms of implantation time control. This gap was solved by creating a report, which begins to be used by the areas involved. This report also aims to facilitate and encourage the use of the historical information on new projects, thereby creating a learning curve.

Keywords: Knowledge Management; Knowledge Generation; Automotive Industry.

1. Introduction

With the great advances in information technology and the increasing use of intellectual capital, it can be seen in the last decade a significant increase companies' interest in knowledge management. Indeed, the most important in the knowledge-based approach to business is that, in fact, it enables completely new ways of understanding problems (SPENDER, 2001).

Simply installing software or storing information does not guarantee a resolution for this problem. Knowledge management is effective only when it occurs in association with a behavioral, cultural and organizational change (ONOSAKI, 2004).

For Gao *et al.* (2008), the fundamental issue of managing knowledge in organizations is to identify resources and offer processes that facilitate the flow of individual knowledge within organizations, communities and societies for a particular purpose.

In this context, this study aims to understand knowledge generation mechanisms in the process of technical changes in the project department of an automotive company. There is actually, in this studied firm, a study to understand what can be learned from the technical modifications projects management.

The product design throughout its development requires technical changes management of its variants of cost, timing and quality during the phases of planning and roll-out. Product engineering presents a study of the required technical change to the areas of interest, Product Planning, Purchasing, Manufacturing, Quality, Finance and Logistics in order to analyze the opinions regarding investments and product variable costs. In this forum, if changes are approved, they are released to suppliers.

Today, these changes management is done per project. The responsible person for each area has to inform his approval or disapproval, and this information is stored in a system,

however, there is a control deficiency of the planned date due to delays in the implementation of technical change.

When a new project starts, the history of previous projects changes stored in this system is not used, so for a new project, engineer and the areas involved have to start the process all over again, instead of improving and expediting the process by identifying in advance a number of modifications needed, since there is no management information available, preventing a process following a learning curve.

In order to improve this situation, company created an activity to understand, map and monitor the process of technical change management by better using information already available in the system in order to gain better results in their projects management.

This article is divided into five sections. The next section presents a summary of the theoretical discussion on knowledge management. Next, it is presented the methodological approach used in this research. Section 4 contains case study analysis. Finally, section 5 provides the study conclusions and limitations.

2. Knowledge management: theoretical review

In general, knowledge management refers to ways of organizing and managing organization´s intangible resources, directing them to serve as basis for the strategic objectives to be defined and achieved.

For Probst et al. (2002: p. 31) "Knowledge management are methods to influence the organizational intellectual assets and guide its development." In general, it refers to the systematic effort made by companies to identify, capture, share, acquire, create, organize, use, improve, maintain and measure their knowledge (TERRA, 2000).

Gao et al. (2008) argue that the concept of knowledge management is much more complex than the terms and knowledge and management. Given the different perspectives on which it is addressed, it can be divided into two groups, ‘hard track’ and ‘soft track’. For hard

track, knowledge comes from information, which comes from the data extracted from events. Thus, generating knowledge implies in the perceptions generation by extracting information from data. In this approach the key words are: capture, summarize, code, organize, store, distribute, reuse, transfer and transform. Instead, the view soft track methodologies and approaches are focused on people, tacit knowledge and creating an enabling environment for the generation of knowledge. In this approach, knowledge differs from information, because it is in people, thus knowledge creation is associated with social interaction processes.

With technological advances in many different Information Technology (IT) applications, communication technologies and information systems, the processes of knowledge generation, transmission and storage in organizations have been affected, maximizing its performance. However, it is still considered essential the human contact and the tacit knowledge for the organizational learning processes, as well as a suitable environment for the generation and dissemination of knowledge (CHIAVENATO, 2000). In this sense, Terra (2001) states that the main companies' competitive advantages are grounded in human capital or tacit knowledge of its employees. Knowledge Management is linked to the firm's ability of developing specific skills and innovative capacity through the use and combination of various sources and types of organizational knowledge (NONAKA and TAKEUCHI, 1995), generating new products, processes, systems management and market leadership.

2.1 Knowledge

According to Gao *et al.* (2008) the meaning of the term "knowledge" can be interpreted in different ways depending on the context and relates to the concepts of data, information, intelligence, skill, experience, expertise, ideas, intuition or perception. Following this idea, Spender (2001) argues that knowledge is a fluid term and difficult to define.

Some authors, however, present a more objective definition for knowledge. Nonaka and Takeuchi (1995) define knowledge in the organizational context, as "a dynamic human process of justifying his belief in the truth." And Boisot (1998) argues that knowledge is a set of expectations that one observer claims in respect of an event.

Knowledge can be defined as subjective or objective; or implicit and explicit. Nonaka *et al.* (2000) define explicit knowledge as the one that can be expressed in formal and systematic language and may be shared in the form of scientific formulas, data, manuals and specifications. It is possible to store, process and pass it relatively easily. To Terra (2001) tacit knowledge is both individual and collective; it takes time to build and is difficult to be transferred. It is a knowledge based in actions, procedures, routines, ideas, commitment, values and emotions, and it is difficult to be verbalized and communicated to others.

In organizations knowledge is usually embedded not only in documents or repositories but also in routines, processes, practices and norms (DAVENPORT and PRUSAK, 1998). Thus, Gao *et al.* (2008) show that the main issue of managing knowledge in an organizational context, is to identify features and processes that facilitate individual knowledge flow within organizations.

2.2 Knowledge creation

In order to understand knowledge creation process, it is firstly necessary to distinguish it from the terms data and information. Thus, the understanding of this process becomes easier, allowing the identification of the organization needs in respect to these concepts.

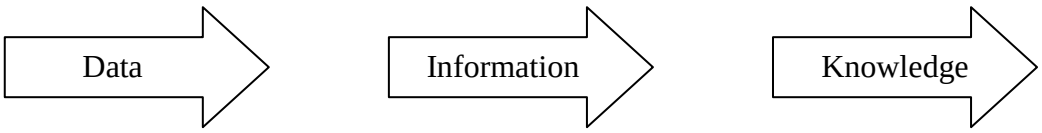
Data is defined by a distinct set of facts and goals, relating to events (DAVENPORT and PRUSAK, 1998). In an organization, they are described as structured transactions records. They are independent of interpretations, because they present a particular picture of a specific situation.

Information is endowed with a particular meaning, whose purpose is to change the perception of the receiver on something. It relates to a specific situation, and could impact on the conduct and trial of persons.

Knowledge, as presented in the previous section, has a more complex and involves the interpretation of information in a specific context, and this process depends on experience, values, skills and other factors related to individuals.

2.3 Knowledge generation

Knowledge can be generated in different ways depending on the means that stimulate data transformation into information. Figure 1 shows some of these forms.



Data Transformation into Information	**Information Transformation into Knowledge**
⇨ Background: indicates to what purpose data were collected; ⇨ Categorization: explains data essential components; ⇨ Calculation: mathematical analysis or data statistical; ⇨ Correction: data errors elimination; ⇨ Condensation: data summary in a more concise way	⇨ Comparison: Comparison of this event with others previously known; ⇨ Consequences: implication of this information for the decision making; ⇨ Connection: links between this information and the accumulated knowledge; ⇨ Conversion: people's views with respect to such information.

Figure 1 – Transformation flow: Data, Information, Knowledge. Source: Adapted from Davenport and Prusak (1998)

Nonaka and Takeuchi (1997) argue that the process of knowledge creation depends on the interaction between tacit and explicit knowledge, encouraging its quantitative and qualitative development. Figure 2 shows the knowledge conversion process that can happens in four ways: socialization, externalization, combination and internalization (SECI).

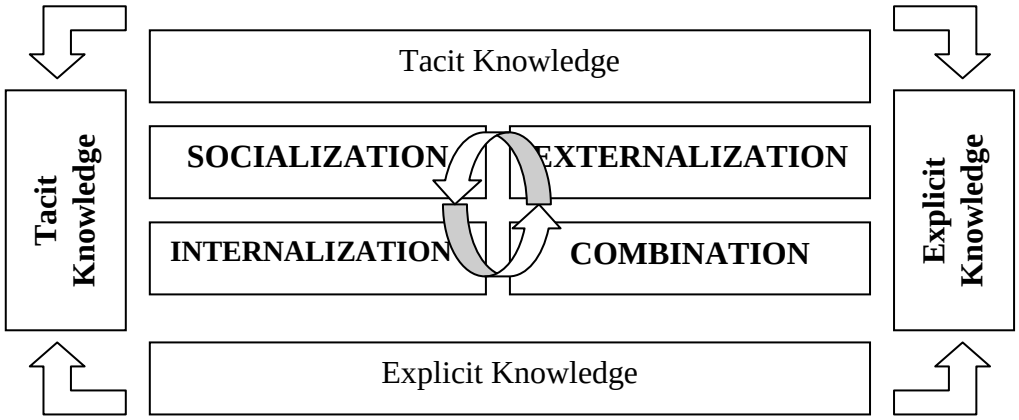


Figure 2 – Four Modes of Knowledge Conversion. Source: Adapted from Nonaka and Takeuchi (2003)

- The process that transfers tacit knowledge in one person to tacit knowledge in another person is **socialization**. It is experiential, active and a "living thing," involving capturing knowledge by walking around and through direct interaction with customers and suppliers outside the organization and people inside the organization. This depends on having shared experience, and results in acquired skills and common mental models. Socialization is primarily a process between individuals.
- The process for making tacit knowledge explicit is **externalization**. One case is the articulation of one's own tacit knowledge - ideas or images in words, metaphors, analogies. A second case is eliciting and translating the tacit knowledge of others - customer, experts for example - into a readily understandable form, e.g., explicit knowledge. Dialogue is an important means for both. During such face-to-face

communication people share beliefs and learn how to better articulate their thinking, though instantaneous feedback and the simultaneous exchange of ideas. Externalization is a process among individuals within a group.

- ⇨ Once knowledge is explicit, it can be transferred as explicit knowledge through a process Nonaka calls **combination**. This is the area where information technology is most helpful, because explicit knowledge can be conveyed in documents, email, data bases, as well as through meetings and briefings. The key steps collecting relevant internal and external knowledge, dissemination, and editing/processing to make it more usable. Combination allows knowledge transfer among groups across organizations.
- ⇨ **Internalization** is the process of understanding and absorbing explicit knowledge in to tacit knowledge held by the individual. Knowledge in the tacit form is actionable by the owner. Internalization is largely experiential, in order to actualize concepts and methods, either through the actual doing or through simulations. The internalization process transfers organization and group explicit knowledge to the individual.

2.4 Difficulties in creating knowledge

The knowledge creation depends on some variables, such as relationships between people, availability and accessibility of information, culture, the context in which they live and organizational structure. These variables create barriers to knowledge creation, that can be classified into structural and behavioral. The first one refers to hierarchical levels, functions and access information infrastructure. Probst *et al.* (2002) present a scheme that represents the hierarchical and functional barriers within an organization, as shown in Figure 3.

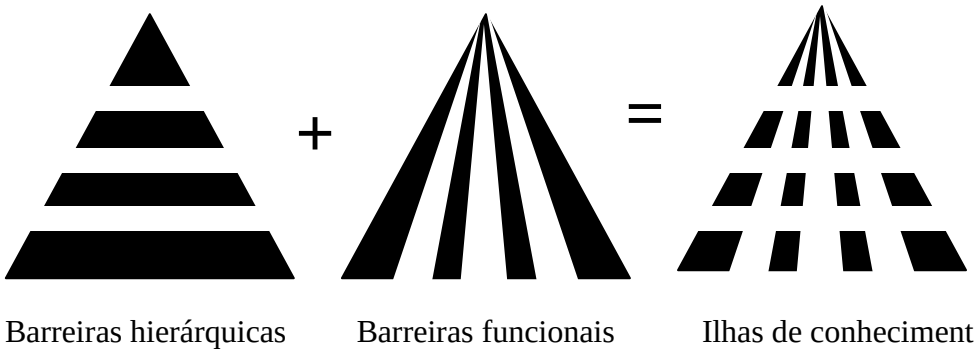


Figure 3 – Knowledge barriers. Source: Adapted from Prost *et al.* (2002)

There is also the structural barrier that is characterized by difficulty to access information due to poor organization or lack of information systems which makes the generation of new knowledge slow or nonexistent.

Structural barriers in conjunction with cultural aspects can lead to behavioral barriers formations that are related to the individual capacity of sharing knowledge and willingness to do so.

3. Methodological approach

The most common researches in production engineering and operations management (FILIPPINI, 1997; FILIPPINI and Voss, 1997; BERTO and Nakano, 2000) are case study, survey, modeling and simulation, action research and literature review. For this work it was adopted the case study approach, because it seeks an empirical investigation of a contemporary phenomenon within a real-life context, following the definition proposed dust Yin (2005). It was developed an exploratory study with a qualitative approach, carried out in a single automobile company, located in the city São Bernardo (Brazil). The criteria used for choosing the company to be studied were the importance of knowledge management for the organization and the existence of specific investments in systems to support information management.

The unit of study selected was the process of generating, planning, execution and control

technical changes in the project pre-series phase, as the this process, although being well structured, was under improvement. For this work it was considered only approved changes. Data were collected through personal interview with the responsible person for managing the process of technical changes.

The interview consisted of a six questions questionnaire as follows:

1. How does the process of generation, control and implementation of project technical changes work?
2. Which are the areas involved?
3. Where is stored changes information?
4. The record generated is used in new projects?
5. How it was identified the need for controlling the implementation date of these changes?
6. What was the outcome for this problem?

4. Case study analysis

The initial part of the research sought to deepen the understanding of the process of generation, control and implementation of technical changes to projects. So it was identified that the process starts in the product engineering area that identifies the need of a product technical modification and draw up a provisional documentation with technical, design, cost and time of such modification. The responsible engineer presents the change in a special forum composed by a participant of all involved areas, where technical change request is approved or not. After final approval, the change request receives the opinions of involved areas relating to costs and deadlines, which must be analyzed and validated.

During the review process, change goes through the status of ‘technical approval', 'commercial approval' and 'final approval', and this status is controlled by a system and it is

areas' responsibility to monitor its implementation. Changes are classified as 'mandatory' or 'running change', first are those which must necessarily be approved and implemented as soon as possible. The so-called "running change" are those whose implementation may occur on time, or within three months after production start.

This process involves Product Engineering, Product Planning, Technical Information, Quality, Manufacturing, Purchasing, Logistics and Finance areas.

Changes history is stored in a corporate system with global platform that is connected to engineering systems. This corporate system stores information related to areas opinions and approvals and all process related documentation as cost and time study, E-mails, meeting minutes and others.

Asked if the history generated is used in new projects the respondent reported that the information is available in the system, with all changes history, but it is a difficult and complex process to access it due to the high volume and complexity of projects.

Logistics area identified the need for controlling these changes deployment date, because during the process of launching a new vehicle, it was found that many parts arrived without modification or that the modified part arrived after vehicle assemble, generating thus, car rework out off line. This scenario led to financial losses, thus, logistics decided to create a function to manage the deployment dates and deadlines of this process, since the areas involved had their internal controls, but none related to this issue.

To address this deficiency, first step taken by Logistics staff was take part in the change process meetings in order to better understand the process and the possible failure causes.

Data analysis indicated that in order to minimize information gaps the beginning should be the creation of a report with information from engineering and logistics system. Thus, it was created a new report whose layout as presented in Figure 4.

Engineering system	Logistic system
– Modification number – Modification title – Changed parts and new parts lists – Status and approval date	– Suppliers information – Part(s) description – Part(s) data – Draw(s) dates

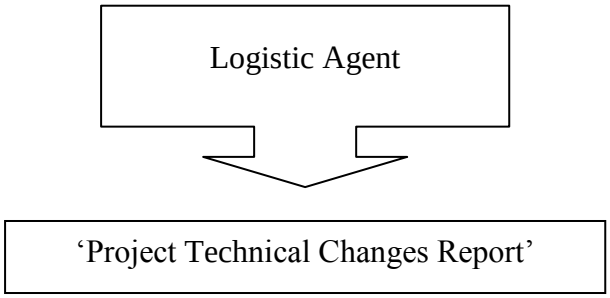


Figure 4 – Process combination scheme held by Logistics

This new report was called 'Project Technical Change Report (project name)' and is distributed to Product Engineering, Product Planning, Technical Information, Quality, Manufacturing, Purchasing, Logistics and Finance areas.

According to the interviewed professional, this new process is under implementation, and new report has been sent weekly via e-mail to the areas involved. The next step will be the increasing of its coverage, making it a permanent tool in the forums and thematic meetings.

5. Conclusions

According to data collected, it can be noticed that project technical changes process is advanced in knowledge mapping and consolidation, but there was a deficiency in date deployment deadlines control. This gap was solved by what is called in the theory as the knowledge conversion process through combination (NONAKA and TAKEUCHI, 2003), where explicit knowledge is converted into a more complex and systematic explicit knowledge itself, through the creation of a report, which begins to be used by the involved

areas. This report also aims to facilitate and encourage the use of historical information on new projects, thus enabling the development of a learning curve.

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