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Experience feedback in product lifecycle management

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A B S T R A C T

Given the popularity of industrial enterprises for Product Lifecycle Management (PLM) information systems capable of supporting the entire product development process, we see the emergence of new needs and new research directions in the operation of these dynamic complex environments. Reference standards are applicable to the services and industries which bring innovation and technologies to a fast-growing and demanding market. To obtain perfect control of business risks and performance and to ensure "zero defect", standards specific to the fields of transport, emergency (IRIS IN 9100 . . .) and generic standards (ISO 9001 . . .) are more restrictive. They involve full transparency and rigor in flawless quality management processes and monitoring products. In this field, knowledge management is paramount; it helps improve overall performance of industrial systems by structuring the information assets acquired by the company stakeholders. In a way, it is the substantive development of our research. We detailed the approach adopted to implement the Experience Feedback (EF) system dedicated to the product in the PLM business. We presented a first action with the objective of formalizing the implicit experiences generated following the response to a triggering event. In this work, we mainly considered negative events for which the information to be collected are clearly identified. We propose an approach combining Problem Solving and EF adapting the level of commitment to the criticality or importance of the problem addressed. To instantiate this approach in PLM, we have chosen to rely on the Change Management Process (CMP) because, firstly, it involves changes in product data and, secondly, it usually concerns driving developments for correction or improvement of the technical specifications related to the production process.

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1. Introduction

The consideration of Experience Feedback (EF) to different levels of the company's activities is one of the safest ways to increase the quality of its products and services. Many companies wishing to capitalize or enhance their intellectual capital have adopted EF processes in their continuous improvement plan. If the general principle of EF in the enterprise is readily accepted by all, the implementation and conduct in daily life of an EF system is much harder to ensure. Indeed, despite the accession of the actors to the principles of Application of EF, many barriers appear in their implementation, mortgaging, often dramatically, the success of this approach. We are interested in these problems and try to define an action strategy for the effective implementation of PLM (Product Lifecycle Management) in the company. Many companies which lead reflection on the continuous improvement of processes and product performance have adopted or are deploying PLM solutions to support their process development. Based on this observation, the proposed work tries to ensure the proper use of functionalities and implementation of activities associated with the exploitation of the PLM tool and, above all, structured framework of its application to develop and implement an EF system.

The presented work focuses on the deployment of an EF System in a manufacturing company through capabilities of PLM software. The paper is organized as follows. We start by defining the experience feedback systems. Then, we present current practices and business barriers and highlight some industrial needs. Then we describe the principles of the solution that we implement. The conclusion presents the findings of the study with some indications of the possible action prospects.

2. Experience feedback systems

2.1. Presentation

To be competitive, companies need to develop the best economic and technical conditions, top-quality products that meet the

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requirements of customers, and which comply with applicable regulations. Both are customer-specific and therefore external and internal to the company. To achieve this challenge, product development cycle management is paramount and reuse of knowledge and know-how is a determining factor in the effectiveness of performance. An intermediary challenge to enterprises is to be able to capitalize on experiences carried out during the product development to create knowledge and to make them available in order to help the different stakeholders involved in the development processes of new achievements. The management of EF systems is one of the key issues related to knowledge engineering to achieve this ambitious, but considerably significant, goal.

EF is an initiative engaged to enhance the value of experience gained when processing a proven event or a previous situation to draw lessons for developments or future actions [1]. Among the knowledge management approaches, the EF is part of the “Continuous Knowledge memorization” that focuses on the structuring and accessibility of collected experiences. Indeed, the EF is a spontaneous approach and is rooted in efforts to achieve a comprehensive and durable actions, and the registration process of experiences is performed in the relevant context.

EF emerged about thirty years ago, to address the problems of “losses of technical memories, choices, expertise or practices” [2]. We can cite, for example, the case of transport companies (automobile, aeronautic or shipping industries), where the retirement of human resources working in the methods and quality services has considerable impact on the business's overall fundamental knowledge [3]. Today, this theme brings together a broad scientific industrial community, including a comparative analysis of approaches as proposed in [4,5]. From these works, there are four main types of EF:

- For statistical processing: system focused on collection and formalization of events,
- A cycle of Knowledge Discovery from Data (KDD): Data is collected and analysed to develop knowledge in the form of decision rules,
- Through knowledge management process: method which aims to clarify and enhance the business knowledge and technical expertise,
- By case-based reasoning: system based on knowledge building from operating experiences from problem solving processes.

Even if they have specific characteristics, these four types of EFs can fit into a global model. Indeed, the differences mainly lie in the phases of development constituting the precision of the Experience Feedback approach. EF models used in this paper integrate these four types. It consists of three phases, described more specifically in the following paragraphs.

2.2. Definition

Amongst the various definitions available in the subject literature, we selected the one proposed by [6]: “*The Experience Feedback is a structured approach to capitalization and using information from the analysis of positive and/or negative events. This approach implements a set of human and technological resources which must be managed for the assistance of reducing errors and promoting some rehearsals good practices*." Thus, the Experience Feedback is based on the development of mechanisms, processes and specific software tools to locate, capitalize, store, create, formalize and distribute experience and knowledge in order to improve business processes and eliminate previous errors [7].

The purpose of EF is to build knowledge from the generalization of one or several experiences. Experience can be defined as the set of elements that permit us to construct and implement the response to the occurrence and the treatment of a positive or negative event. EF process consists of three main phases (See Fig. 1):

- The capitalization phase, to locate and store (experiences base) the relevant data to characterize an experience,
- The treatment phase is intended to transform these experiences into rules and knowledge usable by actors (managers, technicians and/or operators) in business processes,
- The operational phase, to facilitate and promote employment of documented experience and knowledge, in business processes in order to improve performances.

Depending on requirements, an EF system can be engaged to identify and develop:

- Good practices: positive EF,
- Errors found: negative EF.

Similarly, it may be designed to be applied locally or globally. Locally, the information is used by the activity or process triggering capitalization. This is called source activity/process. In total, capitalized information is used by other activities or business processes. The source activities and the information-consuming activities are then different. The shared experiential knowledge can be incorporated in lessons-learned processes and systems deployed in military, government and commercial organizations. In the following paragraphs, we summarize the essential characteristics of Experience Feedback. For more information on

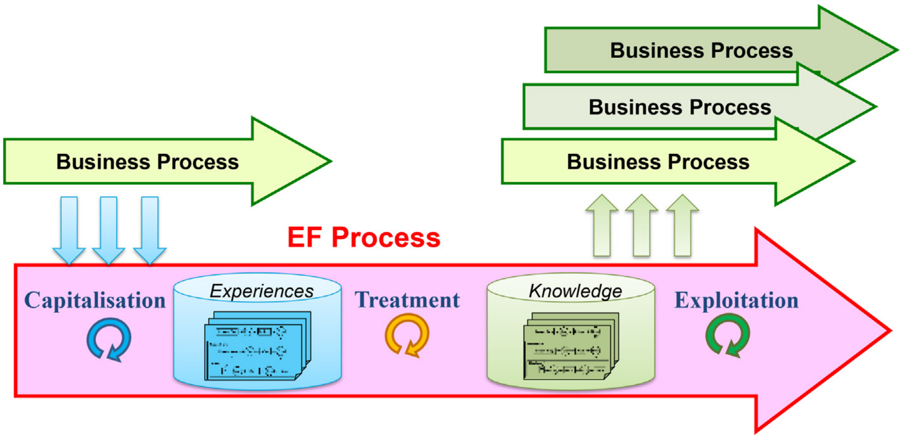

Fig. 1. EF process.

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