Support to Continuous Improvement Process in manufacturing plants of multinational companies through Problem Solving methods and Case-Based Reasoning integrated within a Product Lifecycle Management infrastructure

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1 Introduction to problems addressed by research

The aim of this research is to capture and reuse efficiently knowledge at shop floor level of multinational companies during the resolution of manufacturing daily problems (e.g. scrap rate, quality issues, breakdowns, and in general any Continuous Improvement Process (CIP) activity). We want to provide production technicians and operators with a friendly and low time consuming Knowledge Management (KM) tool to get their engagement and collaboration, avoiding negative impact in productivity, and promoting the knowledge share across plants overtaking language, nationalities, and competition barriers.

We propose the Problem Solving (PS) method 8D as structured process to guide the knowledge share. A Product Lifecycle Management (PLM) system will be the logical infrastructure to store all product, process, machinery, and users information. This PLM system will host also the database of a Case-Based Reasoning (CBR) system. This CBR system will be the KM tool in charge of capturing and reusing the knowledge [1],[4],[5],[6]. FMEAs of Design, Process and Machinery will be used to populate initially the CBR System [3].

The CBR cycle [1] would be though as follow:

- User introduces basic description of de problem (new case).
- Based on this description the CBR system collects additional information related product, process, machinery or users from the PLM. It proceeds to calculate to find similar cases.
- The system proposes containment actions and different root causes (retrieved cases). The user checks these root causes in the line and gives feedback to system.
- Based on the corrected list of most similar cases the system performs adaptation and proposes a solution (solved case).
- Solution is tested by user (tested/repaired case) and implemented together with its associated preventive actions.

– The learned case is stored in the database of cases.

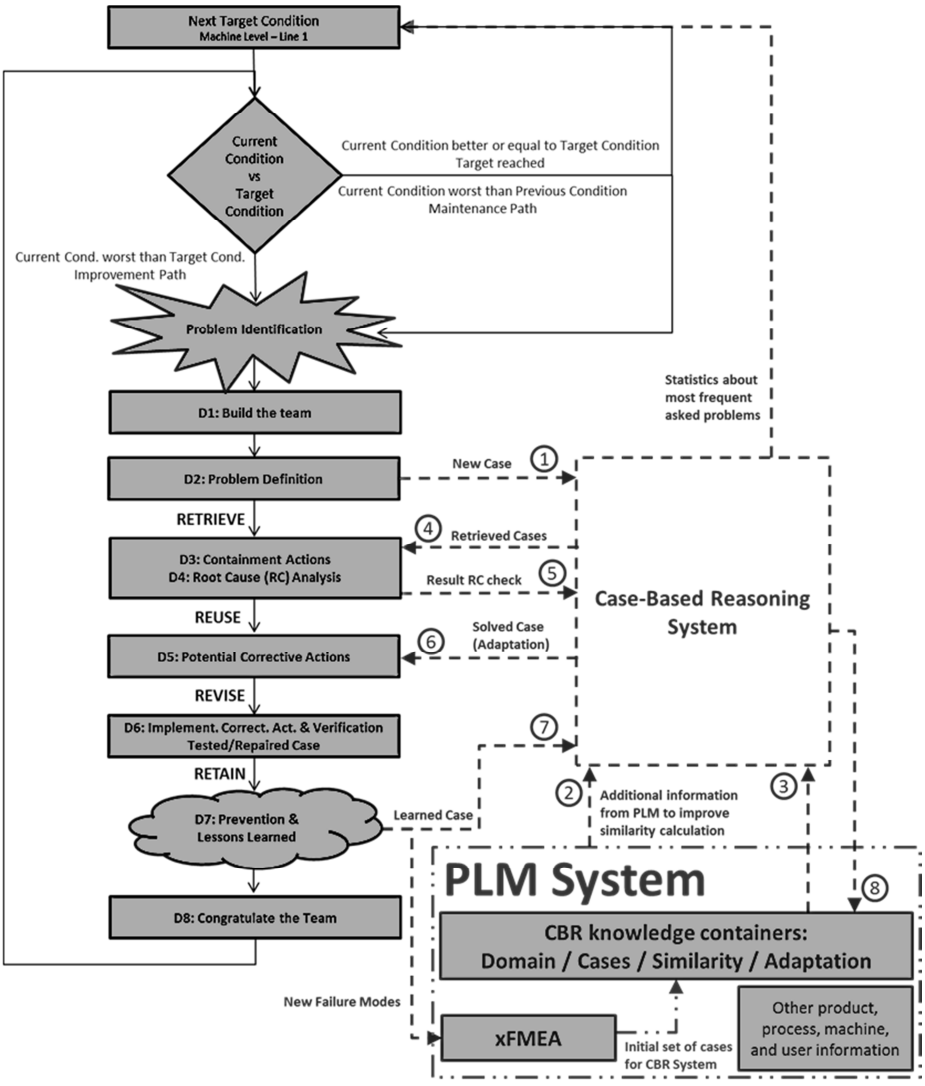

Fig. 1. – Proposed model for supporting CIP through PS, CBR and PLM

Expected contributions of this research:

– Combination in a single model of PS methods, as process for guiding the share of knowledge, CBR, as KM tool, PLM as global infrastructure to contain information and control information flow, and FMEA method, as the tool to define manufacturing problems in a formalized way and to populate initially the CRB System.

- Based on minimal data introduced by the user (low time consumed) we propose to get from the PLM extended information that will be used to calculate similarity.
- Bring this type of KM tool not only to designers or to engineers, but direct to blue-collar associates working at production lines.

2 Description of progress to date

Currently we are developing the Model that has to support the knowledge capture and reuse (see fig. 1). For the case study, two open source applications have been selected: Aras as PLM software (www.aras.com), and myCBR as CBR software (www.mycbr-project.net) [2]. For the implementation, a multinational company of the electrical batteries branch was selected. To get the benefits of knowledge sharing between two teams with very low interaction until now the system will be installed in two manufacturing plants located in two different countries. It will focus only on one of the production steps of batteries in order to get consistent results in a limited period of time.

3 Proposed plan for research

After the review of the state of the art in the fields of CIP, PS, CBR, and PLM, we are currently designing the initial knowledge containers of domain, similarity and adaptation of the CBR system [6] that will be used to test our concept initially in a single production line. This task has to be finished by the end of May 2016. The experience from this initial test will be used to improve our KM tool in order to do a second test loop at whole plant level. Finally a third test loop will be performed between the two plants until end of 2016. The presentation of the PhD Thesis is planned in May 2017.

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