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Industrial intelligence - a business intelligence-based approach to enhance manufacturing engineering in industrial companies

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Abstract

Flexibility, resource efficiency, and time-to-market are key success factors for industrial enterprises. Essential settings are set during early phases of product development as well as manufacturing. In later product lifecycle phases, the responses from the market (e.g. complains or the amount of damage cases) show the maturity stage of the products. Quality methods like TQM or EFQM pursue the goal to permanently learn from this information. Therefore it is necessary to have an adequate information supply. This article focuses on this problem in the context of maturity stage management in manufacturing engineering. The research therefore first identifies a huge gap between the theoretically discussed information supply, based on encompassing data bases, and the real existing heterogeneous IT landscapes, which have grown in history. On basis of empirical findings, industrial businesses lack in concepts that put them in a position of adequate information supply. Therefore, a generic Business Intelligence concept, developed through research activities, seems to be a promising approach. It is thus possible to combine information from product features and manufacturing information with the traditional dimensions of managerial analysis, in order to identify impacts of engineering decisions on the product lifecycle.

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Keywords: Business Intelligence; Maturity Stage Management; Information Demand; Feature Technology.

1. Introduction

Manufacturing enterprises are doubtlessly one of the mainstays of economic power in many countries. Especially excellent products and manufacturing processes determine the global success of this industry [1]. Flexibility, resource efficiency, and time-to-market are key success factors to thrive in the market. Through developing the digital product model (Digital Mock Up (DMU)) and the production concept essential courses are set, which determine the maturity stage of the products.

The development of DMUs in connection with production concepts is usually a very complex process in which different people and organization units are involved. The people in charge, e.g. designers, product managers, component managers and quality experts have to make various decisions, regarding the maturity stage. Therefore maturity stage managers are permanently collecting information about loss claims from the market and try to provide relevant information in order to enable the decision makers to increase the maturity stage. But as a matter of fact, the information supply of maturity stage managers is not sufficient so far.

The research question therefore is how the information supply of lifecycle-orientated decision makers (maturity stage managers) can be improved by new IT-based concepts. The goal of this research is to develop and validate a framework, which enables a sufficient information supply and advanced decision support for maturity stage managers.

Therefore this paper is structured as follows: After an introduction of the research design, it will first address the use case “maturity level management”. Secondly, the information demand of maturity stage managers will be explained. Thirdly, it will introduce a Business Intelligence based framework.

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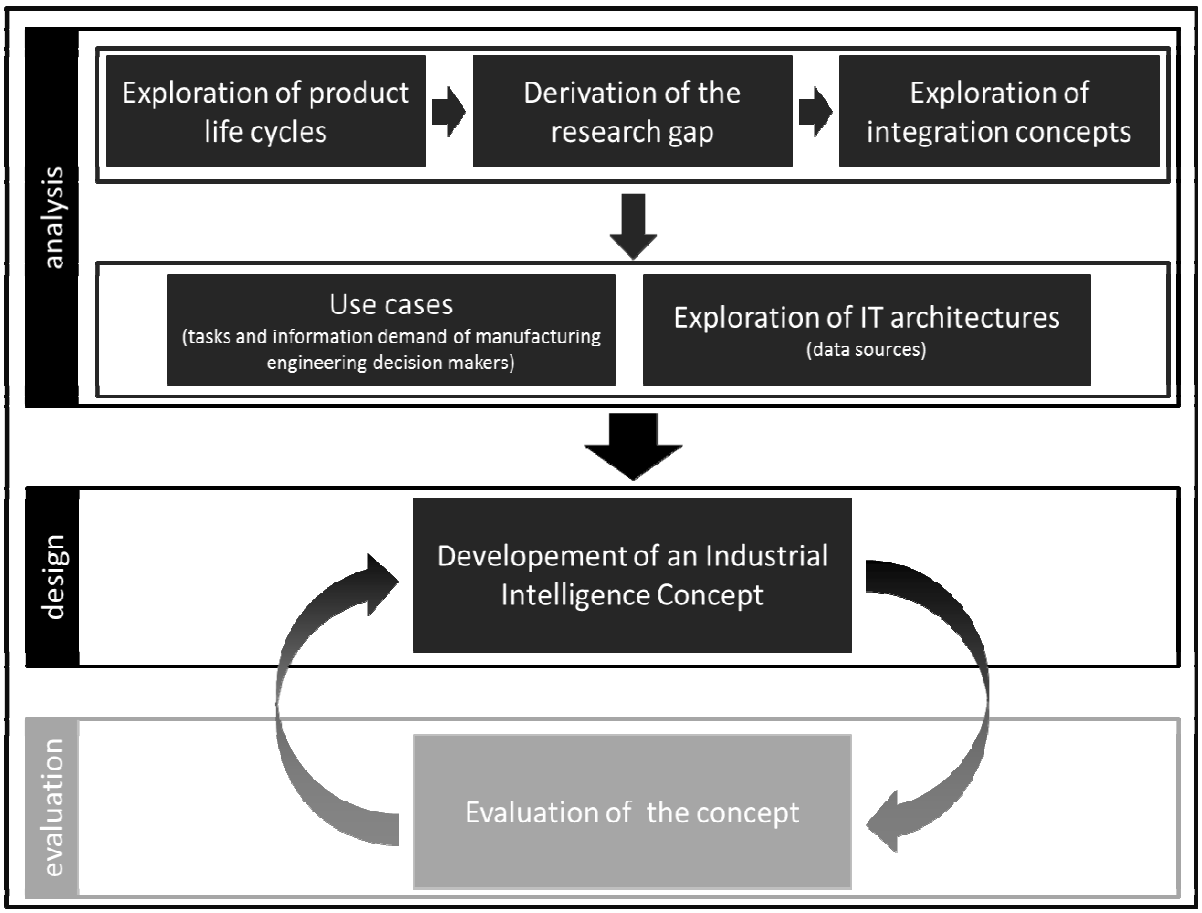

Fig. 1. Research Design

2. Research Design

The object of the present research is the use of information systems in manufacturing engineering. The goal is to derive normative means-end statements (that can be applied in practice), concerning design and use of information systems in industrial companies. Thus, action design research methodology is advised. The study is designed as a multi-level exploration. The research design therefore complies with the phases of analysis, design and evaluation of the 'action design research' process, see Fig. 1 [2][3].

Based on literature work, an exploratory qualitative study, in form of nine expert interviews, was carried out to capture the product lifecycle in industrial companies. These interviews took place in German medium-sized engineering and construction companies, in 2006 and 2007, with interview partners who had an IT and engineering background. All these interviews took between 90 and 120 minutes.

In a next step, the insights concerning the information demand in R&D as well as in manufacturing engineering were analyzed and the research gap (information supply with integrated technical and financial information) was identified and evaluated. Based on the results, another four interviews with experts of four other companies (medium sized companies in the machinery and tools industry) were conducted, in the 2nd half of 2009 (also 90 to 120 minutes). This was necessary, in order to evaluate whether existing concepts like PLM could close the detected research gap.

On the basis of the finding that a satisfactory concept was non-existent in theory as well as in practice, four use cases were conducted within the 2nd half of 2010 and in 2011. These use cases consisted of 15 expert interviews, in 10 companies. Each interview took between 60 and 180 minutes. Goal of the use cases was to examine the information demand of important lifecycle decisions. Thereby one of these use cases was identified to play an important role in lifecycle-orientated decision making: "maturity stage