

Linking innovative product development with customer knowledge: a data-mining approach

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Abstract

In today's digital economy, knowledge is regarded as an asset, and the implementation of knowledge management supports a company in developing innovative products and making critical management strategic decisions. Product innovation must link technological competence such as engineering and process know-how with knowledge about the customer, so that the product will meet the customers' needs, in order to secure market acceptance. Even though the importance of knowledge management in the technological innovation of a product has long been recognized, its potential for customer knowledge management has not been widely researched.

To address the importance of the need of customer knowledge in innovative product development, this paper proposes an E-CKM model with a methodology for precisely delineating the process of customer knowledge management for innovative product development. In the knowledge management domain, an important task is the conversion of tacit knowledge into explicit knowledge, allowing information technology, such as web-based surveys and data mining to extract customer knowledge from different market segments. An empirical study applying the E-CKM model has been carried out, and it meets the evaluation criteria in a multiple-assessment scheme for showing a satisfactory result. The result is used in the decision making for innovative product development in order to reduce project risk and secure commercial success.

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1. Introduction

Technological innovation allows us to cope with increasingly intensive competition when facing challenges from a rapidly changing market situation. Most companies make efforts in knowledge management (KM) to enhance their competitive advantage in product innovation in order to ensure market success. An important component in knowledge management is knowledge creation. Knowledge creation is supported by two key factors: (1) converting tacit knowledge into explicit knowledge, and (2) translating this tacit knowledge of customers or experts into a comprehensible form (Nonaka and Konno, 1998). Elaborating on knowledge work can have innovative outcomes, such as

the discovery of new technologies for the development of new products and new processes. For an innovative product to be successful, the product innovation for a company must link technological competence, such as engineering and process know-how, with customer competence such as knowledge of customer needs (Danneels, 2002). The importance of knowledge management in the innovation of product technology has been duly recognized, however, the potential for customer knowledge management has not been studied in any great depth (Grover and Davenport, 2001; Soo et al., 2002), and little discussion has been devoted to the outcomes of knowledge application (Gold et al., 2001; Plessis and Boon, 2004). Thus, among many types of knowledge in a company, product knowledge and customer knowledge fall into the 'crucial' category, because they directly contribute to the competitive advantage and financial performance of the company. Therefore, any study on knowledge work improvement should focus on making products/services more attractive in order to increase value (Davenport et al., 1996).

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In the digital economy, customer relationship management (CRM) is a contemporary management tool. It manages the relationship with customers by employing up-to-date information technology (IT) such as on-line data analysis, data-mining and database management in order to understand, communicate with, and to attract them. Its objective is to satisfy and retain customers (Dyche, 2002). Increasing the productivity of knowledge work and managing customers' knowledge so as to understand their needs and wants, enables a company to gain a competitive advantage in the market. Recently the 'customer knowledge management (CKM)' model has drawn much attention by the combining of both the technology-driven and data-oriented approaches in CRM and the people-oriented approach in KM, with a view to exploit their synergy potential (Davenport et al., 2001; Garcia-Murillo and Annabi, 2002). The expectation from this endeavor is to more articulately delineate knowledge 'for' customers, knowledge 'about' customers, and knowledge 'from' customers, so that a more beneficial product can be delivered to the right group of customers, to prevent product failure and to ensure commercial success.

With this background and the objective of addressing the essentiality of customer knowledge in innovative new product development (NPD), this paper presents a methodology to support the argument that in order to ensure business excellence, a product's features must meet the needs of specific customer groups in the market. This is accomplished by a target marketing-oriented customer-knowledge management-model implemented by information technology (E-CKM model). With the introduction of a web-based survey approach and a data-mining technique for observing the outcome of customer knowledge, the customer knowledge management process is as follows. First, the features of a product are transformed into 'benefits that customers need', paving the way to understanding the response of the customer toward the benefits those features bring them. Next, a customer's needs toward the perceived product benefits are taken as a basis for forming market segments. In other words, by converting tacit customer knowledge into explicit knowledge, a company can develop different products for various customer groups having a similar attraction.

Market segmentation, market targeting, and market positioning are the three major tasks to be carried out in target marketing (Kotler, 2003). To be successful in market, market segmentation is certainly a very important task. In order to prove that the E-CKM model is applicable in the field, three criteria are employed for its evaluation: (1) Does the customer accept the web-based survey approach and does he render a sufficient response for data mining? (2) Can the data mining techniques successfully extract the customer knowledge in order to facilitate NPD? (3) If multiple data mining techniques are all qualified to cluster customers into segments, then which one is the most appropriate?

The remaining part of this paper is structured as follows. In Section 2 we review the literature on knowledge management regarding innovation, new product development and the customer in the market place. We provide a detailed description of the E-CKM model implementation for managing customer knowledge in innovative product development in Section 3.

In Section 4 we present an empirical study of the E-CKM model methodology for an innovative Telematics product development project. The satisfactory outcome in meeting the evaluation criteria confirms the feasibility of this model in the real world business environment. We have shown how the outcome of customer knowledge management can be applied to make product variants for different market segments, with a view of reducing project risk, meeting customers' satisfaction and improving business success. Finally, we discuss the limitations and contribution of the E-CKM model in Section 5, and we draw our conclusions and indicate directions for further research in Section 6.

2. Knowledge management for innovation, new product development and the customer in the market place

Perter Drucker defines innovation as 'The effort to create purposeful, focused change in an enterprise's economical or social potential' (Drucker, 1998). He indicates that most successful innovation stems from seven areas of opportunities, three of which are: 'industry and market change', 'changes in perception' as well as 'new knowledge'. Knowledge-based innovation requires not merely one kind of knowledge, but many, and the innovation that creates new users and new markets should be carefully aimed at the specific application. Betz (2003) defines technological innovation as: 'Both the invention of a new technology and its introduction into the marketplace as a new hi-tech product, process, or service.' Technological innovation allows us to cope with increasingly intensive competition in a rapidly changing market place. Therefore companies should use their knowledge for improving their competitive advantage in product innovation for market success, by enhancing their capability to manage that knowledge so as to convert it into useful products and services.

Researchers have since defined knowledge category using the concept of explicit knowledge and tacit knowledge (Polanyi, 1966). Nonaka has used a SECI model (SECI: Socialization, Externalization, Combination and Internalization) to depict knowledge creation as a spiral process of interaction between explicit knowledge and tacit knowledge. The 'externalization' step which takes place at 'interaction ba' plays an important role in knowledge creation, and is supported by two key factors: (1) converting tacit knowledge into explicit knowledge and (2) translating the tacit knowledge of customers or experts into comprehensible forms (Nonaka and Konno, 1998). Investment in knowledge work can lead to innovation efforts such as

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