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Managing technology intelligence processes in situations of radical technological change

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Abstract

For established companies, radical technological change is not only a challenge, but it also constitutes a major source of failure. By establishing effective technology intelligence processes, companies may react to radical trends in time which is a prerequisite for coping with technological change. Therefore, this study analyzes the technology intelligence processes in 25 multinational companies in the pharmaceutical, telecommunications equipment and automobile industries in the context of radical technological change. In the three industries, the technologies combinatorial chemistry, dense wavelength division multiplexing (DWDM) and fuel cell are used as settings to analyze these processes on the technology level against the background of the company-level perspective. By applying this complex view, which allows to take into account interactions between different organizational mechanisms and between different hierarchical levels inside a firm, three types of organizing technology intelligence processes can be identified: the participatory, the hybrid and the hierarchical technology intelligence process. The organization of the technology intelligence process according to the three types is influenced by the corporate culture and the decision-making style of the companies. Furthermore, industry differences are identified which may be explained by different rates of radical technological change in the industries. This study suggests that more complex and differentiated views on radical technological change, on corporate technology intelligence processes and on the variety of organizational structures involved in these processes are required.

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1. Introduction

The management of technological change in companies is of high interest to both theory and practice [1]. Incremental technological change introduces relatively minor changes on the existing products, exploits the potential of the established design and often reinforces the dominance of established firms [2]. Radical technological change, in contrast, requires a new set of engineering and scientific principles and can open up new applications and market segments which may challenge the position of established firms [2–4]. Many studies show that the insufficient reaction of established companies to radical technological change can lead to their demise [2,5–10]. As main reasons for the limited learning capability of established companies, researchers have identified insufficient information on technological trends and managerial incompetence [11–13].

In order to identify technological discontinuities in an early stage and to increase the effectiveness of technological decision-making, many authors [14–17] have called for a more systematic observation of technological trends already in the early 1970s. In the literature, many terms are used for this process of systematic acquisition, assessment and communication of information on technological trends in order to detect opportunities and threats in a timely manner. The expressions range from technology monitoring, technology assessment and technology forecasting to technology intelligence. In this paper, the term technology intelligence is used because it has been increasingly used in recent years by both researchers and practitioners.

Besides the great importance that is attached to technology intelligence, existing research is contradictory on how this process should be coordinated in situations of radical technological change. Therefore, the present study seeks to deepen our understanding of technology intelligence by analyzing such processes in the context of radical technological change. Regarding theory, the study derives further insights into the reasons for the failure of companies. Regarding practice, it identifies different forms of organizing the technology intelligence process which might help to reduce the probability of organizational failure through managerial action. In Section 2, past research on technology intelligence and on related research fields, such as technological change and informal information flow in R&D, is discussed. In Section 3, the research design is outlined. In Section 4, the results of the empirical study of technology intelligence in the context of radical technologies are presented. Section 5 describes implications for research and management, and Section 6 draws a conclusion.

2. Past research

In prior works, many reasons have been brought forward to explain why some companies master radical technological change and others do not. The most often cited are managerial incompetence, organizational inertia, insufficient financial resources, a rigid organizational culture, and insufficient technology intelligence [7,10–13,18–25]. As many existing studies treat companies as one entity, which reacts too late to relevant trends, the black box of technological information gathering, assessment and decision-making has not really been opened in many cases [8,12,26,27]. Furthermore, a detailed analysis of studies that were carried out in different industries shows that the authors come to different conclusions concerning the ability of companies to master radical technological change.

While Utterback [28], Tushman and Anderson [9] and Henderson and Clark [2] see only a low ability of companies to manage radical technological change in their studies in mature industries, Christensen and Rosenbloom [18] show in their study of the disk-drive industry that companies can manage

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