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Exploring the market for breakthrough technologies

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Abstract

In this article, the gap between futures research (long term) and market research (short term) is closed in two ways. Firstly, by describing methods of market exploration that can be used earlier on in the process of development and diffusion of breakthrough technologies, so market research can be applied along with futures research. Secondly, the gap is closed by actually combining futures research and market research. We start the article from the perspective of the market research discipline and describe the problems in market research that require new approaches. The validity of market research results is often low when breakthrough technologies enter the market. To investigate this problem, assumptions for valid market research results are presented. In some cases, when breakthrough technologies first enter the market, these assumptions do not hold and market research becomes problematic whereas in other cases customers' needs and preferences are not an issue at all and attention focuses on technological issues. Potential solutions to explore the market in the former cases are suggested. Four approaches are distinguished: (1) adapting existing methods; (2) combining consumer research with market structure analysis or futures research; (3) using theoretic models; and (4) probe and learn approaches. These approaches require different subsets of assumptions and are therefore applicable in different situations. © 2007 Elsevier Inc. All rights reserved.

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1. Introduction

Commercializing breakthrough technologies turns out to be a very risky strategy for companies. On the one hand, there are potential high gains like achieving a competitive advantage that can contribute

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significantly to a firm's growth and profitability [1–3]. Breakthrough technologies have been the source of new product categories, new markets and industries [4–8]. The history of the American company Raytheon, for example, is intimately connected with the radar, Xerox with xerography technology and The Bell Company with the fax and the transistor. On the other hand, it is remarkable how many companies involved in the invention of breakthrough technologies lose out when the technology is applied on a large scale [5,9]. A high (47%) failure rate is shown for market pioneers and it is claimed that only a small percentage (11%) of these market pioneers remains in a leadership position [10]. Examples of pioneering companies that vanished are Chux (disposable diapers), MITS (personal computers), the Stanley Brothers (automobile) [5,10].

Market research is meant to reduce the risk of commercializing technologies by providing essential information about future market developments. However, the validity of market research results is often low when breakthrough technologies enter the market. Or, to put it differently, when market research is needed most, valid results are most difficult to obtain. Scientific research is needed to solve this problem. We will focus on this problem and look at which methods result in valid market research under which conditions. To be able to do so we have to define breakthrough technologies and describe the process of the development and diffusion of breakthrough technologies.

1.1. Defining breakthrough technologies

Breakthrough technologies represent either an advance in technology that is so significant that attainable price/performance ratios are altered dramatically or entirely new kinds of applications are possible that change the behaviour patterns of end users [11]. Examples of breakthroughs that shifted price/performance ratios are dynamite (in comparison to nitro-glycerine) and strong fibres like Kevlar (in comparison to contemporary fibres). Examples of breakthrough technologies that enabled entirely new applications, at the time of their invention, are laser technology and communication technologies like telegraphy, television and mobile telephony.

1.2. Breakthrough technologies and product innovations

Breakthrough technologies are at the heart of several product innovations. Some of these technologies are basic technologies: they are applied in completely different types of products. Laser technology, for example, is applied in audio equipment, industrial cutting equipment, and in military weaponry. Other technologies, like mobile telephony, are more applied technologies and are almost synonymous with a product category. In this article, breakthrough technologies refer to basic or applied technologies. Both technologies can be applied in products that constitute a shift in price/performance or enables new applications.

1.3. The process of development and diffusion of breakthrough technologies

The diffusion of products incorporating breakthrough technologies is described in the introduction to this special issue [12]. The most important conclusion in the introduction is that there are three phases after the invention of a technology: The innovation phase (from invention to first market introduction), the market adaptation phase (from first market introduction to large-scale production and diffusion) and the market stabilization phase (from large-scale production and diffusion to complete substitution of the

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