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Technological Forecasting & Social Change 73 (2006) 937–949

**Technological  
Forecasting and  
Social Change**

# Technology mining for small firms: Knowledge prospecting for competitive advantage

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Received 25 April 2006; received in revised form 13 May 2006; accepted 25 May 2006

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## Abstract

Successful small businesses effectively use outside information. High tech small firms are designed to be flexible and innovative. They are often built upon a successful innovative product. These organizations are challenged to remain innovative in a fast-paced competitive environment. However, they face constraints due to the costs associated with the development of continuous innovation. This paper presents technology mining as a method to aid small firms in remaining knowledgeable about innovative ideas. In doing so, the authors present findings from a small high tech company whose issues are typical of other small high tech firms. Areas for improvement and recommendations to address those areas are also presented for review and further reflection.

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*Keywords:* Small business; SME; High tech; Innovation; Technology mining; Information flow

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## 1. Introduction

While there is some debate over the impact of firm size on innovation, it is clear that the high technology industry is defined by innovation and small firms are an essential part of the innovation landscape [1]. There is a "...growing appreciation, amongst academics and policy-makers, of the importance of innovation to the competitiveness of national and regional economies and of the

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particular role played by small- and medium-sized (SMEs) enterprises in this process [2].” A substantial part of technical innovation comes from small firms. In actuality, research has found that small firms have a higher rate of innovations per employee, patents per employee, and output per dollar spent over large firms [3,4]. Small high tech firms may be formed around an innovative product spawned from university research; alternatively, small high tech firms may be a spin off from a large firm unable to incorporate the necessary changes in the organization brought about by the “spin off’s” new and disruptive technologies [5,6]. While large firms have a resource advantage, small firms are better able to respond to unexpected developments in the field. Rapid technological advances require the prompt decision-making, internal flexibility, lack of bureaucracy, and entrepreneurial spirit typical of small firms in order to maintain or develop competitive advantages [4,7,8]. The challenge for small firms is to remain innovative as they grow. They must not only remain flexible and thus better able to respond to a changing environment, but must have the information regarding that environment available in order to know how to respond most effectively and efficiently.

In the high tech industry, small firms may take on one of two primary roles in the innovation landscape. Some small high tech firms are the research and development (R&D) arm of other companies. Fairtlough [8] reports that many large companies are using a combination of research and small company alliances as a means to spread their risk and therefore maintain their interests in areas that they may not want to put all their resources. This shift allows, for example, some of the major drug companies to move from drug discovery towards marketing and patient care, areas in which small firms do not have the resources upon which to focus [8]. Other firms are developing and providing products and services in which they must remain ahead of the competition. Either way, small firms must have the knowledge to enable them to remain at the forefront of technological advances. Effective R&D is essential for small firms to remain competitive and it is also imperative that the R&D in small firms is more efficient than larger enterprises [7]. More innovative firms conduct more R&D; however, small firms are often limited by resource availability, particularly cash. For some projects, the likely ultimate return limits the spending that is possible [8,9]. Effective R&D requires foresight to enable a small firm to effectively invest limited R&D funds or to benefit from potential outside sources of R&D where internal R&D funds are not available. These pools of knowledge, related to new product and process technologies, changes in market dynamics, and competitor activity, is critical to the ability of small firms to advance their technological capabilities in preparation for meeting future market needs [10].

In this paper, technology mining is presented as a method that allows small firms with limited resources to benefit from the research of others at the early stages of innovative development of products or processes. Additionally, technology mining constitutes a way to provide small firms with the information necessary to make the most effective strategic business decisions. Small firms cannot rely solely on internal resources [10]: identifying sources of information and determining associated meanings are a difficult and time-consuming task for small firms acting independently. This paper addresses the need that high tech small firms have for advanced methods of information acquisition and, using the example of one high tech small firm, presents a method for such firms to meet that need. Further discussed are the importance of external information and the typical weaknesses of small firms in keeping abreast of external innovations. Finally, the ways in which technology mining can be utilized to benefit a small firm are reviewed with interface to the particular example depicted in the case study presented here.

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