



# Industrial research as a source of important patents

Holger Ernst \*

*Institute for Research in Innovation Management, Kiel University, Olshausenstrasse 40, Kiel D-24098, Germany*

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## Abstract

It has been recently observed that in the light of concepts like lean management, shortening of development times, business reengineering or shareholder value, companies have substantially cut down their expenditures for research. Since research is by definition primarily aimed at the broadening of technological knowledge rather than the development of products or processes which find immediate commercial applications, the benefits of research are not apparent and hence, the allocation of funds to research appears to be unjustified. Based on data from 25 European and Japanese electronics companies, we examined the relationship between corporate spending on research and patenting output. Since patent applications only measure the overall level of R&D activity, they were differentiated according to their quality in order to assess the technological and commercial impact of R&D activities. It is found that those companies, which spend a high share of their R&D expenditures on research, hold patents of relatively higher quality. Furthermore, differences between European and Japanese companies with respect to research spending and patent positions are identified. The results lead to the conclusion that research obviously serves as a base for those inventions, which are of higher technological and commercial importance. Thus, the investment in research appears to be of great value for the competitiveness and should therefore not be neglected. © 1998 Elsevier Science B.V. All rights reserved.

*Keywords:* R&D; Research; Patents; Electronics industry; International comparison

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## 1. Introduction

Industrial research (in the following referred to as research) is by definition primarily aimed at the broadening of technological knowledge rather than the development of specific products or processes which find immediate commercial applications (National Science Foundation, 1959; OECD, 1994). Therefore, the benefits of research are not apparent and the allocation of resources to research may not appear to be justified. According to Brockhoff (1997), the adoption of short planning horizons by R&D

managers, the lack of full appropriation of results obtained by research, the high risk involved in research activities and the reliance on public institutions engaging anyway in research reinforce the temptation to refrain from investment in research. In fact, the upcoming of concepts like lean management, the shortening of development times, shareholder value or business reengineering has recently led to the redirection and/or downsizing of research laboratories in many companies (Brockhoff et al., 1997; Detz, 1996; Rosenbloom and Spencer, 1996). A survey by the National Science Foundation came to the conclusion that “in large companies, effort is shifting away from central (R&D) laboratories toward divisional-level effort with greater emphasis on

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\* Corresponding author. Tel.: +49-431-880-3614; fax: +49-431-880-3349; e-mail: ernst@bwl.uni-kiel.de.

risk minimisation to meet the needs of today's customers" (p. iii of National Science Board, 1992). Since decentralised units tend to have shorter planning horizons than centralised units this will further strengthen development efforts at the expense of research (Brockhoff, 1997). Rosenbloom and Spencer (1996) reported examples, where companies have substantially cut down their expenditures for research. Interestingly, they quote the example of Kodak, where the CEO had been replaced for the reason that "he spend too much on R&D without getting results." This move has been welcomed by investors, which urged the company to "become an aggressive follower by capitalising on rivals' inventions instead of mostly developing its own" (pp. 4–5 of Rosenbloom and Spencer, 1996). As Brockhoff (1997) has observed: "Competitive pressure and impatient stockholders may exert pressure to reduce what appears to some of them as an expenditure only, and to some others as luxurious. Such short-term views are considered dangerous not only because they can undermine competitive positions in the long run and because they reduce potentials that could be used by further generations" (pp. 15–16 of Brockhoff, 1997).

The second part of the quote already points at potential dangers for the long-term competitive position of companies, should research be neglected. This is well demonstrated in the case of Alcoa by its former chief technical officer. Summarising Alcoa's technology policy since the beginning of the 20th century, Bridenbaugh (1996) remarked that "... we have learned that there is a price to be paid for abandoning the pursuit of fundamental understanding.... We have learned that there are a few good reasons to abandon (basic new) product development in the face of short-term pressures, that it takes a decade or two to feel the full impact of such a decision, and that it is then difficult to rebuild this capability" (p. 159 of Bridenbaugh, 1996). This observation helps to explain, why, in contrast to the above discussed general downward pressure on research, companies are identified that either maintain or even increase their percentage of R&D expenditures devoted to research (Rosenbloom and Spencer, 1996).

From these observations it becomes obvious that the decision to invest or not to invest in research

should receive high priority by top management, since the full impact of today's action may eventually become visible only after many years. Strategic differences in corporate R&D policies become even more interesting, if they are compared with each other at the international level. It has been observed that growth of corporate research has been much higher in Japan in comparison to Europe and the US (Brockhoff, 1997). As Hamilton (1992) has observed: "Since 1985, just about every major electronics corporation in Japan has opened independent, and often somewhat freewheeling facilities in the suburbs of Tokyo that are devoted to fundamental studies in materials, computing, electronics, and, oddly enough, biology" (pp. 570–571 of Hamilton, 1992).<sup>1</sup> Therefore, possible benefits of research need to be identified in order to be weighed against the previously mentioned problems associated with research. This allows management to select appropriate R&D strategies with respect to its research orientation.

It has been argued that research can perform various functions besides its main task, which is to support the future development of new products or new processes (Eggers, 1997). According to Stine of Du Pont, e.g., research increases prestige within the scientific community, it eases the recruiting of highly qualified personnel, it allows external exchanges of technological knowledge and it leads to practical applications (Hounshell and Smith, 1989). Table 1 gives an overview about several studies, which have identified different functions that can be performed by research.

This line of thought is particularly worthwhile, since it broadens our perspective of possible benefits that can be derived from research and are not apparent in the first place. However, we want to focus on possible output measures of research success.<sup>2</sup>

In this paper, we use patents as an immediate outcome or result of R&D activities. Major support for the use of patents as a measure for R&D out-

<sup>1</sup> It has to be noted that the lack of a basic science tradition in public research institutions has had an impact on the growing share of private research expenditures (Brockhoff, 1997).

<sup>2</sup> For a comprehensive discussion of studies on functions of research, see Brockhoff (1997).

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