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Technical entreprenenurship in high technology small firms: some observations on the implications for management

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Abstract

There is much current interest, both in the encouragement of entrepreneurship, and in the formation and growth difficulties encountered by high technology small firms. This paper seeks to inform these concerns by offering a number of conceptual insights on the role of the technical entrepreneur in the high technology firm formation and growth process. Since many new high technology firms are founded by technical entrepreneurs (often from university backgrounds), an understanding of the factors that influence the behaviour of such individuals is highly pertinent to future policies aimed at encouraging this key type of high technology enterprise. By exploring aspects of the strategic approaches adopted by these individuals, this paper seeks to provide guiding principles for such policies.

Keywords: Entrepreneurship; Innovation; Motivation; Introspection; Strategies

1. Introduction

The technical entrepreneur is an acknowledged key catalyst in the process of industrial formation and growth (Cooper, 1970; Rothwell and Zegveld, 1982; Cardullo, 1999). Commencing in the eighteenth century, the Industrial Revolution was dependant upon technical entrepreneurs who, although originally trained as professional engineers, instinctively taught themselves to become expert business managers (e.g. James Watt; Isombard Kingdom Brunel; Robert Stevenson). Such industrial history confirms that the birth of new industries have usually depended upon the revolutionary skills of one or more of these key technical innovators, who make the critical pioneering scientific discoveries (and/or innovations in management) that trigger the birth of new industrial sectors (Schumpeter, 1934; Schmookler, 1966; Freeman, 1982).

However, these powerful historical examples of past success should not obscure the fact that technical entrepreneurship remains important today, and that there is a common heritage shared between the above early entrepreneurs and their modern counterparts. For example, the relatively recent development of the computer industry is an instance of how technical entrepreneurs continue to create new industries. From the initial exploits of Hewlett and Packard, through the contributions of Jobs and Wasniak at Apple Computers, to the Software-empire of Bill Gates at Microsoft, it is clear that technical entrepreneurs have played key roles in the birth, growth and consolidation of this new family of software and hardware computer-related activities. Moreover, the computer industry has subsequently delivered "knock on" efficiency gains across a wide range of other industrial and service sector activities (Freeman, 1982). Clearly, technical entrepreneurs continue to be a major force within industry and commerce.

None the less, although technical ability has often provided the scientific knowledge *necessary* for an individual to become a successful technical entrepreneur, it is important to stress that *sufficiency* to ensure success lies in an ability to develop additional business management skills with which to exploit such expertise. Indeed, there are recent examples of technical entrepreneurs who, although of critical importance in scientific terms to the birth of a new sector, *were not* ultimately successful because they were unable to develop effective management skills. Perhaps the best example of this phenomenon (of key relevance to this paper on high technology technical entrepreneurship) is that of William Shockley,

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the man generally credited with invention of the point contact transistor, the technical basis for the modern semiconductor industry (Saxenian, 1985). Although forming Shockley Transistor in Palo Alto in the early 1950's, and giving the Silicon Valley industrial complex its core product, he did not instinctively have (nor was he able to develop) the business management skills necessary to allow his company to grow. This led, despite strong technical success, to a break up of his company from which eight engineers, led by Gordon Moore, "spun off" in 1957 to form the Fairchild Corporation, and later Intel (Cardullo, 1999). Most significantly, while it might be argued that such a failure is evidence that the management skill components of technical entrepreneurship is instinctive and cannot be taught, this paper will take the counterview that technical entrepreneurs *can* gainfully acquire management skills, principally through management education.

Problems resulting from unbalanced technical and business skills notwithstanding, effective technical entrepreneurship, when *balance* is achieved, continues to account for many successful "leading edge" high technology firms (Cooper, 1970; Oakey, 1995). Indeed, such balance is critical because, as noted above, although technical ability alone will rarely deliver commercial success, it is also true that high technology businesses based on entrepreneurs *without* technical skills (i.e. that he or she "buys in") rarely succeed (Rothwell and Zegveld, 1982; Oakey and Mukhtar, 1999). This is because, in order for entrepreneurs to be fully committed to new technical ideas, ideally they should have *intimate* technical knowledge of the product development concerned, and an almost "evangelical" belief in its market potential (Oakey, 1995). Significantly, this key quality often convinces external investors to invest since, when venture capitalists claim that financial projections are secondary to "the people" involved in a business proposal, it is frequently this entrepreneurial belief in the core technology driving the business idea that they find most compelling.

Major candidates for high technology technical entrepreneurship are scientifically qualified staff that have "spun off", either from public sector research establishments (including universities) or existing (usually large) industrial firms (Mason, 1979; Freeman, 1982; Harvey, 1994). Thus, given the above observations on the importance to success of balancing business skills, a continuing challenge for policy makers is to develop training that adds balancing business skills to existing technical knowledge. However, the United Kingdom government has only recently accepted that the key to a higher *quantity and quality* of technical entrepreneurial "spin outs" from universities is improved business training for new and prospective faculty and student technical academic entrepreneurs (Cm. 2250; Cm. 4176: Mukhtar et al., 1999; Oakey et al., 2002). Previously poor provision for the management needs of technical entrepreneurs is illustrated by the fact that those charged with the development of university science parks in the United Kingdom over the past twenty years have strongly promoted the *technical link advantages* that new high technology firms might enjoy when located adjacent to university science departments on a university science park (Cambridge Science Park Directory, 1985) (which have often not materialised (Oakey, 1985; Westhead and Cowling, 1995)). However, given the obvious initial technical skills bias evident in most technical entrepreneurs, the potentially far more useful management skills locally available in university business schools have rarely been "sold" as a key reason for a university-based Science Park location, with which to *balance* previously acquired technical skills (Oakey and Mukhtar, 1999).

Part of the blame for this rather illogical uncoordinated approach to the promotion of technical entrepreneurship derives from the attitude of senior physical scientists towards social science in general, and management science in particular. For these individuals, management science is often considered a contradiction in terms. This attitude derives from the somewhat irrational view that "social science" is either not real science, or that it is a rather intellectually sub-standard "poor relative" of physical science (Popper, 1966; Harvey, 1973). A sense of this rift between intelligence as represented by "literary intellect" on the one hand, and mathematics-based physical sciences on the other, was observed by C. P. Snow in the 1950s, when he tellingly noted a widening gulf emerging between physical scientists and "other literary intellectual forms of reasoning" (Snow, 1959).

A belief in the superior value of the physical sciences can be more practically observed in the way that many heads of university physical science departments continue to be reluctant to surrender space in their curricula for management teaching, an activity to which they often accord an almost *extracurricular* status, similar to language teaching or sport. Indeed, in the past, management education frequently has been seen as almost irrelevant. The tendency to believe that management training is of marginal importance also stems from an assumption that management skills are "instinctive" or can be "picked up as you go along". Although this paper will accept that successful management is *partly* instinctive, there is a growing body of management research to confirm the importance of management education in *improving* entrepreneurial performance, particularly for those academics and industrial researchers previously with only physical science expertise (Reitan, 1997; McMullan and Gillin, 1998; Cosh et al., 1998). In most cases, effective entrepreneurship by scientists and engineers is not possible without use of management skills involving personnel management, financial accounting, marketing knowl-