# 5 University Technology Small Firms

*"What we become depends on what we read after all the professors have finished with us."*

THOMAS CARLYLE (1795–1881)

**Chapter contents:**

- Introduction
- Factors Influencing University Technology Small Firms
- Conceptualising University Technology Small Firms
- Conclusions

## 5.1 Introduction

This chapter relates the formation and outcomes from university-based technology small firms (UTSFs) through examination of the genesis of Further and Higher Education spinout companies which add value to their existence by their owner-managers who network, share experiences and update knowledge in areas such as management, finance, marketing and selling. Universities are seen as crucial components by regional and national governments in developing and transferring knowledge to the commercial market place. As a result, there is increasing evidence that the university sector can undertake a variety of roles in developing the technological and industrial potential of a region. These can range from the transfer of technology to smaller firms to the development of a technologically skilled workforce that can attract inward investing multinationals. However, the European Commission has recognised that one of the more direct ways of developing a technological base from academia is through the creation of new firms from the university sector. This is not surprising, as higher educational institutions contain a high proportion of scientifically sophisticated individuals within regions who have the ability to generate innovative ideas and technological knowledge which can be channelled and diffused by new ventures established by academics or students from a university department. As Downes and Eadie (1998) have demonstrated, UTSFs have been recognised as one of the primary routes to the commercial exploitation of university research. Supporting the creation and development of UTSFs through networks can yield medium to long term returns for the dynamism and competitiveness of the local economy (although this process is not an automatic or natural consequence of the existence within a region of a strong university base).

For many regions, the current industrial base consists of manufacturing plants established by inward investors, and small and medium-sized indigenous companies. The multinationals tend not to undertake research or development activity, and their R&D decision-makers are located elsewhere. In addition, many small firms do not undertake research activities, which can lead to a low incidence of industrial R&D. As a consequence UTSFs can make an important contribution to the indigenous company base, increasing the levels of R&D activity in a region, as well as the number of technologically skilled workers. Various regions of Europe have successful networks of UTSFs, usually based on technologies developed within universities. There is an important role for universities to play to support economic growth and development within their local economies, particularly through encouraging networking activities.

Many university-industry linkages in the UK, Europe and globally are focusing on UTSFs to help generate industrial growth. This calls for academic entrepreneurship applicable to the range of institutional and regional settings to overcome the barriers to success. In many cases, universities, usually supported by regional and national government, are adopting a direct entrepreneurial role in supporting these new ventures (Kinsella and McBrierty, 1997). There is therefore a strong potential for developing UTSFs if the right policies are instigated. In particular, given the current circumstances, there is a need for a radical approach involving strong drivers to support UTSFs in a region to keep pace with higher education activities in other regions of the UK and Europe, for example.

## 5.2 Factors influencing University Technology Small Firms

A number of factors will influence the ability to establish and develop UTSFs. Some of these arise from the priorities and views of university researchers and the characteristics of academic culture. Others are from the wider business environment and the ability of the academic-industry infrastructure to promote and support the development of UTSFs. Important factors will include the business background, skills, relevant experience and access to finance, of the founders/co-founders of the UTSF and the research intensities of universities.

The main purpose of this chapter is to focus on the specific needs of UTSFs making a case for their particular contribution to an economy, and why their needs may not be provided for at the present time. Related to this the chapter considers the economic development potential of UTSFs which has been given insufficient attention and notes the contribution of UTSFs, the lack of support and lack of policy towards them.

The methodology described in the chapter involved interviews with owner/managers of UTSFs. Pertinent findings from detailed interviews that took place with a wide spectrum of university-based technology small firms are reported. These ranged in age from over forty to under one year of existence and were based off and on-campus. They were mainly formed by academics wishing to commercialise their own research, although for most of the larger firms the current 'manager' tended to be a non-academic. The experiences and in many cases grievances of the owner-managers towards their own academic institution and in more general terms towards the 'business support' sector are also considered.

## 5.3 Conceptualising University Technology Small Firms

The last two decades have witnessed a growing enthusiasm for entrepreneurs as catalysts for economic development and change, with increasing attention paid to the role of small technology-based companies as contributors to wealth creation, technological innovation and employment in high technology industries (Autio, 1997; Jones-Evans and Klofsten, 1997; Jones-Evans and Westhead, 1996). As a result, there has been considerable academic and policy interest in examining the process of entrepreneurship within such organisations. Early studies identified the research-based academic environment – universities, non-profit research institutes and government research centres (Schrage, 1965; Roberts and Wainer, 1966; Wainer and Rubin, 1969; Cooper, 1971).

UTSFs have played a major role in the development of specific industries. The growth of the biotechnology industry is linked directly to the development of small firms set up by academic researchers who transferred basic research activities into innovations (Dodgson, 1993). During the 1970s, the biotechnology industry influenced universities to give more attention to control over intellectual property by their researchers and professors (Kennedy, 1986). Financing institutions, especially venture capital companies, became interested in academic research, and this led to a shift in the boundaries between non-commercial basic research and commercial research (Mansfield, 1991, 1995). As suggested by Rosenberg and Nelson (1994), commercialisation was possible, since funding in the biomedical field had created a reservoir of knowledge from which the biotechnology industry developed new products. In the 1970s, participation by universities in commercialising biotechnology research not only led to new knowledge but also academics starting their own enterprises by maintaining or leaving their academic tenure. As a consequence UTSFs play a central role in the growth of new industrial sectors and the innovation process. It must also be remembered that there are new sectors where universities play no role – the 'new coffee shops' are an example.

UTSFs have their roots in university research through at least one of the founders working in an academic research establishment before inception of a firm (Jones-Evans et al, 1998). These enterprises are established to commercialise a product or service developed in a university. They usually occur when a new enterprise is formed by university scientists seeking to develop further the commercial possibilities of their research (Garvin, 1983). In one of the first studies of small technology-based businesses, Schrage (1965) considered the establishment of new ventures by scientists emerging from their organisations. Since then most studies have related the development of UTSFs to two main criteria. First of all, the business must be related to technology developed at the university and secondly, the founder must be a former employee or student of the university who has worked on developing that technology. For example, Cooper (1971) defined high technology small firms as those that have their roots in a research organisation i.e. at least one of the founders worked in a research establishment before starting the firm and was established to commercialise a product developed in a research organisation.

Olofsson and Wahlbin (1984) defined a university technology small firm as having at least one founder employed at the university when the company was formed and a business idea which is aimed at commercialising knowledge and technology developed at the university. A wider definitional approach by Giannisis et al (1991) considers three types of UTSF models, which are, based on the origins of the business itself. The first – the entrepreneurial model – is a new firm which has been established as a result of a combination of the expertise and independent motivation that the entrepreneurial faculty member has brought to the commercialisation process. The second type – the traditional model – is where the commercialisation of a university-based technology is pursued by an outside business entity. Finally – the institutional model – is where the university through an organisation such as the Industrial Liaison Office (ILO), or a wholly owned not-for-profit subsidiary of the university, manages the commercialisation process.

Other Swedish researchers (McQueen, 1990; McQueen and Wallmark, 1988) have referred to a UTSF as based on a product or service resulting from university research, and founded (or co-founded) by a person (or persons) from a university research group where the founder moved directly from the university to the firm (McQueen and Wallmark, 1985; 1991). This definition has been adopted for this chapter.

As has been demonstrated, various studies have recognised that a significant number of new technology-based businesses have been established by scientists emerging from different types of academic-based organisations, such as non-profit research institutes, government research centres and universities. However, despite the increasing interest in the development of businesses from academic research, there are only a few studies, which have attempted to consider the economic impact of such organisations.

In the USA, a variety of studies have demonstrated how various regions have developed university small firms (Saxenian, 1994; Roberts, 1991) although these have tended to concentrate on Route 128 in Boston and Silicon Valley in California as the main examples for small firm developments from universities such as MIT and Stanford. However, as Malecki (1991) points out, the presence of an outstanding university within a region in the USA does not necessarily lead to the development of an entrepreneurial climate in which UTSFs are created.

In Europe, there are only a few studies, which have examined this phenomenon, and only in limited regional settings. Linköping – one of the fastest growing regions of Sweden – contains a strong high technology industrial environment, which includes the presence of Saab's Aircraft Division, Ericsson Radio and the Swedish Defence Research Establishment, and is at the forefront in the creation and development of new technology-based firms in Sweden. Academics and students from Linköping University have played a leading role in this. Over 450 small technology-based firms emerged directly from academic research activities at the institution (Klofsten and Jones-Evans, 1996), with a high number of the others using or developing university research findings as the basis for their products or services.

In the UK, the most famous study of UTSF activity is that of the 'Cambridge Phenomenon', which found that nearly all of the 350 high technology businesses in the area had ultimately been generated from Cambridge University, especially the departments of physics, engineering and computing (Segal, 1986). Similar clusters have been identified at other universities, for example Imperial College, Heriot Watt and Aston, although these have not been developed to the same extent, and the research on successful UTSFs is limited.

Whether these approaches are the right way to develop entrepreneurial businesses is still open to debate. The role of universities in creating these milieux of innovative firms within different regions has led to a proactive approach by universities, usually supported by regional or national government, in adopting direct entrepreneurial roles. However, these can range from the establishment of university-owned holding companies to the promotion of fledgling academic entrepreneurs (Gibson and Smilor, 1991) to the development of specific centres of research and training which promote and assist the process of academic research into a network of industrial firms and business ventures (Klofsten and Jones-Evans, 1996). Although there is no recommended model for the creation of UTSFs on UK university campuses, there are individual university models and this has resulted in the establishment of a variety of commercial infrastructures on campuses, often alongside the development of incubators and science parks.

## 5.4 Conclusions

The causes of financial market failure can arise for many reasons and these may take the form of tax problems, late payment, administration burdens, lack of finance and information provisions (Storey, 2002). These are not only related to SMEs but also university spinout ventures in particular. With spinout companies market failures may be associated with R&D and learning through experience. This will especially be the case when R&D from universities may be too expensive to recreate under market conditions or is not appropriate to the market situation. Also, there may be little experience of learning by doing from the academic environment as evidenced by the spinout founders leading to naïve market approaches with consequent market failure. There is therefore the need for identification of market failure by policy makers with appropriate government intervention to make things 'better'. This is especially evidenced in programmes derived from public policies to support small businesses.

In these terms the approach described by Storey (2002) to evaluate the impact of public policies to support small businesses in developed economies is appropriate.

This chapter has assessed the existing knowledge, detailed information and recommendations for future action for supporting UTSFs. These businesses are companies whose activities are based on technologies developed as a result of academic research programmes. Such companies are significant in a local economic development context, since they are likely to lead to the commercialisation of research in fairly close proximity to the HEI involved. This has benefit for both the local economy and the HEI itself. Risks and problems in forming and growing UTSFs must not be underestimated, and it is important to recognise that they represent a significant route to the commercial exploitation of new ideas and technologies. In appropriate circumstances they can make an important contribution to regional and national prosperity. A critical challenge for HEIs is to ensure that where a firm is an appropriate vehicle, it is properly managed and there are structures to enable its true potential to be realised.

A myriad of factors affects the attractiveness and viability of UTSFs. University research and consultancy environments do little at the moment to encourage academics towards commercialisation of their research work. As a result academic researchers considering the formation of a business from their research see the process as difficult. This perception is borne out by the experience of those who start-up. Factors, which have a bearing on this situation, are rooted in the existing academic culture and university resource allocation. Change is needed prompted by the fundamental reappraisal of the higher education system by the Dearing Report (1997) and aided by other initiatives.

Finance has emerged as a constraint on the development of UTSFs and comparisons with the United States experience are illuminating. For example, effective interaction between the financial and academic communities in the Boston Area (Downes and Eadie, 1998) has produced a greater degree of understanding and communication. In order to achieve this there is a need for a radical approach to university businesses involving strong drivers to support developmental start-up change as expressed in the introduction to this chapter.

A clear finding is that insufficient attention has been paid to the economic development potential of UTSFs. The overwhelming evidence from other developed regions and countries is that vibrant university business activity has significant positive multiplier effects. With so many HEIs housing advanced scientific and technological expertise the woeful number of successful new businesses created either by or for the academic community only serves to emphasise how much work remains to be done by policy makers.

With regard to policy recommendations a single factor likely to bring about change is the recognition that UTSFs not only have a role to play in creating and sustaining a dynamic and prosperous economy they also represent attractive opportunities for venture capitalists, and may show considerable financial and other returns for the HEIs from which they emerge. There is a market for the future development and encouragement of UTSFs from university campuses, particularly amongst undergraduates, postgraduates and academic staff. Informed experience in starting up businesses from universities is not prescriptive and flexibility is required for the various university environments. Although there are support services and specific programmes available for UTSFs, there needs to be proper co-ordination in terms of the help and advice provided. This is based on evidence indicating that spending tax payers' money on this type of initiative is welfare enhancing and leads to a net benefit.

## Recommended Reading

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