2 Technology Transfer Policy

"A policy is a temporary creed liable to be changed, but while it holds good it has got to be pursued with apostolic zeal."

MAHATMA GANDHI (1869–1948)

This chapter at a glance

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- Technology Transfer Processes
- Discussion
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2.1 Introduction

Recent studies into technology-based firms (TBFs) have considered innovation and the business ecosystem (RAE, 2012), the nature of growth (Brown and Richmond, 2012; Mason and Brown, 2012), and the role of technology in economic development (Coad and Reid, 2012). A further dimension for TBFs is technology transfer through external sources of technology. Due to the different levels of regional industrial development in Europe there are variations in the importance of external sources of technology to TBFs (Saxenian, 1991). This inequality is considered to be most prevalent within the peripheral or industrially declining regions of Europe, where low technological development can make access to knowledge, technology and human resources difficult. This will affect not only the development of firms in these regions, but also the efficiency and effectiveness of the regional innovation systems. Innovation policy, especially with regard to technology transfer into TBFs, must respond to these variations, and develop programmes and initiatives sensitive to the needs of TBFs within different European regions. In the past, European policies have promoted inter-firm collaboration and technological exchanges with regard to "far-from-market" collaboration (up to and including the pre-competitive stage). Nevertheless, this is better directed to the needs of large firms with dedicated research and development (R&D) functions rather than holistically managed TBFs. Moreover, small firms are often involved in strong "near-to-market" interactions, working on product or process development along the vertical supplier-manufacturer-customer chain. Many existing policies need to be adjusted to reflect the importance of vertical linkages and near-to-market interactions to respond to the formal, and informal, sources of technology accessed by small firms. For example, a review of Research and Technological Development (RTD) programmes (EC, 1995) reported that participants in transnational collaborative arrangements had problems working with small firms since they were too market-oriented. As a result there is a need to propagate and understand "best practice" for technology transfer amongst the different regions of Europe. This approach, according to the Action Plan for Innovation (EC, 1996), is important to small firms, since emulation amongst these firms enables them to compare themselves with the international leaders in their field and is an effective way of encouraging good practice.

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According to EU policy, successful European countries in the twenty-first century will be those that embrace creativity and innovation linked to an integrated enterprise support infrastructure. By doing this it will be possible to respond to the barriers to growth on a regional basis (NAFW, 2003). In fact, the UK has 11 regions for the purposes of the EU benchmarking index (European Trend Chart on Innovation, 2003). Within the 34 countries, which make up the Index, the UK is amongst the top 4 alongside Germany and Sweden, with innovative regions above the country mean. This means that 25% or more of the UK's regions are performing at or above the EU competitiveness mean. Areas such as the Eastern region and the South East region (of the UK) are identified here and the criteria include new science and engineering (S&E) graduates, employment in high-tech services, business R&D, innovation expenditure and high-tech venture capital, for example.

2.2 Views of Policy Makers

The aims of the chapter are to examine innovation and entrepreneurship within the TBF sector, especially the importance of external sources of inputs in the development of successful technological innovation within TBFs. The research strategy aimed to use the most appropriate methodology to address the specific research questions. To test the proposition outlined in this chapter a semi-structured interview approach was adopted since it enabled policy makers' viewpoints to be "teased out" concerning the five main discussion areas of the research (Table 2.1). Eight interviews took place with key policy makers involving the use of an interview guide (King, 1994, Bryman, 1992). For this study a policy maker is defined as "someone who sets the plan pursued by a government or business" (WW, 2005) and as "individuals, especially those in official bodies, who have the authority to make decisions about what problems will be addressed within a particular sector and how these problems will be handled" (EEA, 2005). The justification of the approach was that the interviewees were identified as having knowledge of innovation processes and were in significant positions dealing with innovation policy in their organisations. The respondents were selected on the basis of the researcher's experience of liaising with organisational contacts regarding technological innovation and from contacting the relevant bodies to confirm the participation of the appropriate policy makers. The interviews lasted for approximately an hour and a five page report was transcribed following each interview. Building on earlier findings (Thomas, 2000) as a means of justification four primary areas and one secondary area were discussed during the interviews (summarised in Table 2.1).

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Sequence	Discussion areas	Primary(1)/ Secondary(2) Questions	TBF (T), Regional Industry (R), National (N) Focus
A	External sources of inputs into the innovation process	1	T
B	Importance of external sources in the development of technological innovation within TBFs	1	T
C	Nature of relationships with external sources of innovation inputs	1	T
D	Different mechanisms of transferring inputs into the innovation process	1	T
E	Policy issues involved in the transfer of technology into TBFs	2	R, N

Table 2.1 Areas discussed during the interviews with key policy makers concerning technology transfer policy

The first column in Table 2.1 shows the sequence/order in which the five main topics of the interview were discussed according to the design of the research. The third column in the table shows whether the questions were of a primary nature of direct relevance to the study (relating to the external sources in the development of technological innovation within TBFs). Or whether they were of a secondary indirect nature (relating to policy issues involved in the transfer of technology into TBFs). The fourth column shows the focus of the interview sections whether concerning the TBF (external sources, relationships and mechanisms) or regional industry and national (policy issues).

The methodology described in this chapter involves two distinct stages for the policy study. Firstly, pertinent findings from detailed interviews that took place with key policy makers (although only eight interviews were undertaken these were with policy makers from a wide spectrum of organisations involved with technological innovation and TBFs including regional government, development agency, higher education funding council, TUC and universities) were analysed and secondly recommendations for the provision of future support for technological innovation for TBFs are made. Three of Storey's (2002) six steps for a policy study were utilised. With regard to step I concerning the take-up of schemes the criteria evidenced by the study shows that some TBFs had taken up schemes but others had not. For step II, opinions were obtained through interviews with policy makers. Regarding step III, views of the difference made by the assistance provided, these were reported at interviews. Since the study was concerned with monitoring aspects step IV (comparison of the performance of 'assisted' with 'typical' TBFs), step V (comparison with 'matched' TBFs) and step VI (taking account of selection bias), which would have formed an evaluation, were not undertaken since these were not appropriate to the study. Because the research involved a "supply side" policy study it can be seen to fall short of the more ambitious objectives of larger research projects which consider the particular contributions to economic development of government programmes in some detail.

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2.3 Technology Transfer Processes

A. External Sources of Inputs into the Innovation Process

The external sources of inputs into TBFs include customers, suppliers, equipment, manufacturers, other firms (competitors), universities and foreign sources. These are in contradistinction to internal sources, which include technology development, adaptation, improvement and the use of internal R&D. Internal sources can be directly managed from within the TBF whereas external sources can only be indirectly managed since they involve influences, which may be beyond the control of the firm.

Results from the interviews showed that innovation networks provide TBFs with opportunities for networking and universities appear to be proactive in these networks through their Industrial Liaison Officers (ILOs). TBF innovative activity involves a wider embrace of relevant issues including knowledge transfer from the research side. This is central to the UK Government's policies involved with Technology Foresight (OST, 1997). Key inputs include financial resources and the problem of a lack of finance has been highlighted by venture capitalists (Evans, 1997).

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It was reported that external sources can "motivate and excite" internal sources although they may not quickly affect innovative activity. These sources shape the development of innovation within TBFs and point to possible futures and provide companies with ideas. For example, a company can win a prize for a particular innovation, which influences how other companies perceive technology and innovation activity. This provides "reality" and is recognised by other companies of the same size and sector.

B. Importance of External Sources in the Development of Technological Innovation within TBFs

The different external sources in the development of technological innovation within TBFs appear to have varying degrees of importance. Studies (see Carter and Williams, 1957; Myers and Marquis, 1969; Achilladis, et al, 1971; Jayanthi, 1998) have for some time reported the importance of external sources in the development of the innovation process. These have focused on the source and types of knowledge and technology employed in the development process, neglecting the origins and nature of the relationships that link the sources and recipient of technological innovation. There has been little investigation of the more informal sources of technology, especially the process of transfer from the source to the TBF.

Results of this study indicate that it is important for there to be both an internal and external stimulus. An internal stimulus is stronger and more useful and through a culture of innovation a company can be more receptive to taking advantage of external sources. A question that needs to be answered is how to develop the culture of innovation. The results also show that external and internal sources of innovative activity are intrinsically linked. The policy makers considered that if a firm has an "innovative culture" it seeks external sources of opportunities for innovation. How the external and internal sources are developed in relation to each other depends on the TBF.

C. Nature of Relationships with External Sources of Innovation Inputs

TBFs can be involved in a number of relationships with external sources of innovation inputs. These depend on the source, the type of relationship, and the reason for the relationship. TBFs have different informal and formal relationships with suppliers, competitors and customers, which result in advantages (benefits) and disadvantages (costs). Different relationships include co-operative agreements, affiliations, alliances and partnerships, for example.

It was reported that the main sources of technology are informal networks, and as well as formal networking relationships they played a key role as a means for sourcing ideas and information during the development process. TBFs in these networks are less reticent to share their experiences since respect, trust, personal contact are more important in these networks than the media and technology transfer agencies. Informal as well as formal relationships play a key role as a means for sourcing ideas and information during the development process.

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D. Different Mechanisms of Transferring Inputs into the Innovation Process

There are various mechanisms for transferring knowledge and technology into TBFs. These include patents/licences, publications, consultancy, meetings and conferences, joint ventures, the transfer of people, training and industrial/research services. Studies have argued that different mechanisms are important – some have argued that the re-deployment of people between the source and the recipient organisation is important (Langrish, et al, 1972; Von Hippel, 1988) whereas other studies have indicated the importance of personal contacts or formal literature (Utterback, 1971).

Whether the re-deployment of personnel between the source and the recipient is the most effective mechanism for technology transfer depends on the size of the TBF. For medium and larger TBFs the interchange of personnel who carry "know-how" and knowledge is likely to be recognised. The larger TBFs are more likely to be in the market for personnel with specific expertise. The smaller TBFs (with ten or less employees) are less likely to do this but will benefit more than the larger TBFs if they did and it is therefore dependent on the size of the company. The re-deployment of people between the source and the recipient involves personnel moving from one firm to another, the workings of the labour market, and the owner/manager of the TBF. In this case the TBF has to be receptive and the recruitment process sometimes has to be planned/sometimes unplanned. Trade journals are another important mechanism although there has to be a specific need for smaller firms and they generally do not feel that journals are an important source of information. This applies to smaller TBFs since they are fortuitous and they do not see these as a prime source. Mechanisms such as patents and franchising are less significant since few firms will be involved in licensing. Generally mechanisms include product champions, visiting a major trade show, customers who are a major source of technological innovation, trade publications and TBF owner/managers.

E. Policy Issues involved with TBFs

The European Commission has reported that the SME sector, including TBFs, may be vital to the future development and regeneration of Europe and it has been argued that they are making an important contribution to technological innovation within industries at regional, national and European level. European programmes are seen as a vehicle for technology transfer across industrial sectors to small companies and assistance has been provided in Framework Programmes. Support is also being provided at regional and national levels.

Interviews showed that policy is influencing the selection of existing innovation activities by identifying and addressing problems. European initiatives are also significant in terms of the innovation agenda and they raise the importance of technology as a key dimension of regional policy. With the enlargement of Europe and the accession countries there will probably be less funding available. Although EU initiatives are significant it was remarked that TBFs do not perceive them as being relevant since the genuine small business does not know how to access them.

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2.4 Discussion

The policy makers reported that there should be a balance between external and internal sources in the development of innovation within TBFs. This involved the desire by TBFs to grow the business and to be prepared to take greater technological risks. There should also be the devolution of financial decision making to the regional level regarding the financing of technology including pump-priming investment in technology for TBFs. A positive climate was needed which could be created by policy makers involving support and advisory mechanisms including indigenous support. It was felt that there is a need for TBFs to develop a culture of innovation to be receptive to technological change and to work more closely with higher education institutions in order to benefit from research and development.

Regarding the nature of relationships with external sources of innovation inputs the policy makers answered that TBFs needed to be made aware of innovation services, develop better mechanisms and to forge relationships. This could be achieved by creating a culture in which this happens in a systematic way. TBFs also needed to be more open in relation to enhancing their learning powers.

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With regard to the different mechanisms of transferring inputs into the innovation process policy makers considered that efforts should be made to set up methods for cascading technologies and undertaking new ventures. There needed to be stimulation in the implementation of innovative activities by TBFs being more receptive and thinking about innovation. Also creating a more positive environment for innovation and to define this should raise the innovative base of the economy. There should be policy action not only to identify industries but also to invest people, resources and money.

The policy makers interviewed considered that there were a number of policies that needed to be put in place. Firstly, there was the need to make TBFs aware of the technology gaps in the market by delivering awareness training. Secondly, to provide a modest subsidy to firms to enable them to have science and technology graduates. Thirdly, to enable firms to take on networking abroad more conscientiously in relevant industrial and technological areas to create a culture and environment for spontaneous activity. And finally, to rationalise the plethora of soft support provided.

2.5 Conclusions: Policy Implications

The chapter has considered the presumption that policy makers have a clear agenda as to what technological innovation and entrepreneurship mean. From the policy interviews it is clear that this may adversely affect the effectiveness of economic regeneration if the wrong agenda is followed. For these strategies to be more effective they need to be developed by improving access to innovation and technology support by making services demand led rather than supply led. There needs to be the devolution of financial decision making for the financing of technology. Policy makers should create a positive climate for support including indigenous support. Awareness training should be delivered for TBFs so that they are made aware of technology transfer services. The creation of an innovation culture can influence economic regeneration in a systematic way and methods can be set up to cascade technologies and undertake new ventures.

There are many services, both specific and general, available to the TBF community. The various sources of support need to be co-ordinated to perpetuate improvement in innovation within the TBF sector. Services need to be easily accessible, appropriate and delivery based. The providers should work together to develop provision in order to sustain improvement of technological innovation within the TBF sector. For services to benefit TBFs there is a need to build network relationships and to overcome the reluctance to access these services through innovation delivery mechanisms. The significance of the study, in terms of the policy, practical and managerial implications for universities and government, is that there is an opportunity to improve access to innovation and technology support provided by universities and government by making services demand led rather than supply led.

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