CENTRE FOR THE STUDY OF ECONOMIC & SOCIAL CHANGE IN EUROPE

SCHOOL OF SLAVONIC & EAST EUROPEAN STUDIES

THE PROMOTION OF INNOVATION IN SLOVENIA THROUGH KNOWLEDGE TRANSFER FROM HIGHER EDUCATION INSTITUTIONS TO SME'S

Will Bartlett*
University of Bristol
and
Vladimir Bukvič
GEA College of Entrepreneurship, Ljubljana

Working Paper No. 57

August 2005

*Address for correspondence:
School for Policy Studies
8 Priory Rd
Bristol BS8 1TZ
Email: will.bartlett@bristol.ac.uk

University College London
Centre for the Study of Economic and Social Change in Europe
Senate House, Malet Street, London, WC1E 7HU
Tel: 44(020) 7863 8517
Fax :44(020) 7862 8641
Email: csesce@ssees.ac.uk

Abstract

This paper provides an audit of Slovenian initiatives for promoting innovation in small and medium-sized enterprises (SMEs) through knowledge transfer from Higher Education Institutions (HEIs). The first two sections set out a brief review of knowledge transfer and innovation performance in Slovenia, which shows that the country has managed to sustain a relatively high level of public expenditure on research and development. Slovenia has a relatively high proportion of employees and value-added in high technology manufacturing compared to the EU average. However, innovation among SMEs is relatively low compared to the average of EU member states. The next two sections review the research literature on knowledge transfer from HEIs to SMEs, and describe the Slovenian government's innovation policy framework and the extensive programme to promote knowledge transfer from HEIs to the business sector. The penultimate section presents an audit of knowledge transfer policies in Slovenia, which covers policies towards SME incubators, technology parks, technology centres, technology networks, industrial clusters, financial subsidies for high-technology SMEs, and the mobility programme for young researchers. The audit is based on documentary evidence and interviews carried out in April 2005, and presents case studies of an innovative university-based incubator and a successful industrial cluster in the automotive industry.

The paper concludes that although some of the measures have achieved a degree of success, there are two key problems. The first problem is that knowledge transfer policies are weakened by the strong demarcation between pure and applied research in the HEI sector. Thus, although there is a degree of knowledge transfer from research institutes, there is little knowledge transfer from universities to the business sector. Universities mainly pursue pure research and there are few incentives for academics to commercialize their scientific activities. The second problem is that the knowledge transfer activities that do take place between the research institutes and businesses largely by-pass the SME sector, and are mainly geared towards large companies. Consequently, SMEs fail to benefit from the government's extensive programme to support innovation and knowledge transfer. It is not surprising therefore that Slovenia's SMEs have a relatively weak innovation performance. The final section sets out a set of policy recommendations which we believe are necessary to redress this imbalance and to improve the practice of knowledge transfer from HEIs to SMEs in Slovenia.

1. INTRODUCTION: KNOWLEDGE TRANSFER IN SLOVENIA

Under the socialist system in former Yugoslavia, Slovenia had a strong research capacity within large self-managed companies. Following the break-up of Yugoslavia and the collapse of the self-management system, many of those companies were broken up and their research teams were dispersed. Many researchers and engineers left established industries to set up new firms in the service and consulting sectors. Fortunately, the new Slovenian state succeeded in preserving science capacity in public research institutes and universities. It has managed to maintain a greater research capability in its public research sector than other accession states of Eastern Europe, and Slovenia currently has a relatively high rate of public investment in R&D which is equal to the EU average (EC, 2004a). However, the bulk of research personnel are still employed in the public sector. In 2003 only 36% of Slovenian researchers were employed in R&D units in manufacturing and service industries (MoE, 2003: 127). R&D expenditure by the private sector is relatively low compared to the average in the EU-15 countries (EC, 2004a). The government has stated its intention to increase the share of R&D expenditure in GDP to meet the EU's Lisbon objective to increase gross expenditure on R&D from 1.5% of GDP to 3% by 2010, of which two-thirds is expected to be carried out by the private business sector (MoE, 2003: 136).

The public science research sector consists of two large universities at Ljubljana and Maribor which host 39 research institutes, laboratories and clinics. A third university was established in 2003 at Koper in western Slovenia. There are a further 56 public state-owned public research institutes which employ more than 3,000 R&D personnel who are in effect civil servants. The two largest research institutes are the Chemical Institute and the Jozef Stefan Institute (covering natural and technical sciences, technology and engineering), both located in Ljubljana. The institutes are not institutionally attached to the universities but maintain informal links with then. Universities also have their own in-house research institutes and research centres, but these tend to be relatively smaller units than the established Research Institutes. Critics argue that the disconnection between research and industry is reinforced by the separation of the research institutes and the universities.

Overall, domestic commentators frequently point out the gap between the relatively well developed public research sector and the needs of the business community (Bučar, 2004: 227). A recent government study has argued that there has been too much emphasis on academic research driven by a promotion-seeking race for publications in academic journals, at the expense of applied technology development in industry (MoE, 2003: 132). The study further complains that about 60% of the labour force in Slovenia is employed in low to middle technology production. Domestic R&D activity is concentrated in manufacturing rather than the services sector, mainly in pharmaceuticals, electrical machinery, medical and precision instruments, TV, communication equipment, transport and the rubber industry (MoE, 2003). It is also generally considered that knowledge transfer from HEIs to SMEs is underdeveloped in Slovenia. According to a recent report by the EC Innovation/SMEs programme "knowledge transfer is lacking between companies and universities" and "there is insufficient co-operation between business and universities and other public research institutions" (EC 2004a: 2).

2. INNOVATION AMONG SME'S

Results from the European Innovation Scoreboard for 2004 show that Slovenia has a relatively high proportion of employees working in high technology companies compared to the EU-25 average (9% versus 6.6%) and a higher share of value added in high technology manufacturing (13.3% versus 12.7%)[1]. However, Slovenia has fewer innovative SMEs than other EU member states, even in relation to some other new accession states from Eastern Europe (EC 2004a). Only 18% of SMEs were innovative, compared to an average of 32% in both EU-15 and EU-25. Slovenia also has a poor record in patenting activity and in the commercialisation of research activity (EC 2004b), although patenting activity is improving. An Office for Intellectual Property was established in 1992 which stimulated an increase in patenting activity. The rate diminished thereafter, although the rate of increase of patenting activity was still 30% in 1998 (MoE 2003: 131). Between 1992 and 2001 the share of patents granted to domestic inventors fell from 45% to 35% as foreign companies increased their activity on the Slovenian market

An innovation survey carried out in 1997/8 by the Institute for Economic Research in Ljubljana identified the high level of cooperation between the large public research institutes and the company sector, but that this cooperation was mainly directed towards larger firms rather than SMEs. The cooperation activities between the universities and the business sector was more limited (Koschatzky, 2002). Universities were far more likely to cooperate with the institutions of public administration than with the business sector, reflecting their close relationship with the public sector. Public research institutes in the field of mechanical engineering and natural sciences were the most intensively engaged in industry cooperation activities. The most significant form of cooperation between research institutes and companies was found to be in the development of prototypes. In contrast to research institutes, universities were more oriented towards the activity of market introductions in their cooperation with companies.

Innovation surveys carried out by the Slovenian Statistical Office provide information on the innovative activity in SMEs in the manufacturing sector. The 2004 survey shows that 21% of enterprises are innovation active and had introduced new or improved products or processes (SORS, 2004). However, SMEs are not as innovative as large companies. Whereas over half of surveyed large firms (55%) were innovative, only 28% of medium sized firms and 13% of small firms had undertaken innovative activity.

Innovation active enterprises were asked about their main sources of information. The most important sources are based within the companies themselves, among clients and customers and gained from competitors, fairs and exhibitions. Only 5.2% of innovation active firms report that they consider universities to be highly important sources of information. Medium sized firms appear to gain most from information from universities: 7.9% of them reported that universities were a highly important source of information, compared to 4.1% of small firms and just 2.6% of large firms.

[1] The high technology sector is very broadly defined in the European Innovation Scoreboard methodology, which goes some way to explaining the relatively high share of employment and value added in these industries.

Research Institutes were an even less important source of information. Only 4.6% of firms overall cited them as highly important information sources. Medium sized firms hold a more favourable view than large firms: 6.2% cited Research Institutes as highly important sources of information compared to 4.7% of small firms and just 1.9% of large firms.

Sources of information by share of innovative enterprises, 2001-2002 (%)

	Total	Small	Medium	Large
Sources within firm	51.7	57.6	47.3	49.3
Clients and customers	40.4	40.7	39.4	40.9
Competitors	25.2	22.0	24.9	30.5
Fairs & exhibitions	23.9	20.3	28.6	22.1
Suppliers	21.2	24.6	18.2	20.8
Conferences	10.6	10.6	11.2	9.7
Sources within enterprise group	7.6	8.9	5.0	9.7
Universities	5.2	4.2	7.9	2.6
Research Institutes	4.6	4.7	6.2	1.9

Source: SORS (2004), Table 13.

The survey also provides information about the factors that hinder innovative activity in Slovenian enterprises. The most commonly cited barrier to innovation facing innovation active companies is a lack of finance, cited as a highly important barrier by 24.1% of such companies. Other highly important barriers are the costs of innovation (21.2%), lack of qualified personnel (12.2%) and economic risks (11.4%). These barriers were experienced as more severe by medium sized firms than either small or large firms. A lack of appropriate sources of finance was experienced as a highly significant barrier to innovation by 31.1% of medium sized firms, innovation costs by 26.6% of firms, 15.3% cited lack of qualified personnel, and 13.3% cited economic risks as a highly important barrier to innovation. A similar picture emerges from the analysis of responses of innovation inactive firms.

Barriers to Innovation among Slovenian Enterprises, 2001-2002 (%)

		Innovation Active			Innovation Inactive			
	Total	Small	Medium	Large	Total	Small	Medium	Large
Lack of finance	24.1	20.3	31.1	18.8	25.1	23.8	29.1	22.5
Innovation costs	21.2	19.5	26.6	15.6	23.3	23.5	23.4	18.5
Lack of qualified personnel	12.2	11.4	15.3	8.4	12.0	11.5	14.2	7.3
Economic risks	11.4	11.0	13.3	9.1	10.5	9.9	12.8	7.3
Lack of information on markets	6.8	4.2	8.7	7.8	3.5	3.3	4.6	1.6
Lack of customer response to new goods	6.2	5.9	5.8	7.1	10.1	10.1	11.6	3.2
Organisational rigidities	4.4	4.2	4.6	4.5	4.6	3.5	7.5	4.8
Inflexible Regulations of standards	4.1	6.8	3.3	1.3	8.6	10.5	4.7	2.4
Lack of information on technology	3.0	2.1	4.1	2.6	3.3	3.9	2.3	1.6

Source: SORS (2004), Tables 16 and 18.

An analysis of relative trends in innovation in EU-25 (EC 2004b) shows that Slovenia scores above average in terms of SME innovation cooperation (ranked 13th) and non-technological innovation (6th). However, it performs poorly in terms of in-house innovation in SMEs (16th) and in SME innovation expenditure (17th).

There are relatively few incentives for scientists to commercialise their research and there is little financial assistance for small hi-tech start-up companies. Tax allowances are available for innovative companies within technology parks (Bučar and Stare, 2001: 54), and since 2004/5 investment in R&D and the first six months of a PhD recruits salary became tax deductible. In addition, the 2002 Law on Research and Development allows research teams with pre-competitive research projects to apply for public funding, using the number of pending patents as one of the evaluation criteria (EC, 2003). There is only one significant venture capital fund – Horizonte – but it only has limited capital resources.

A significant obstacle to knowledge transfer from HEIs to industry in general has been the focus on the academic performance measured by publications in academic journals as an indicator for promotion. Involvement in HEI-industry links is not a formal condition for promotion in Slovenian HEIs. Studies carried out by the Institute of Economics (MoE 2003) indicate that links between academia and industry are rather weak in Slovenia compared to Western European countries (Bučar and Stare, 2001). According to a recent influential GEM report "universities are still primarily teaching rather than research institutions…What matters for career progress are publications and citations rather than practical applicability of research accomplishments" (Rebernik et al., 2002: 26).

3. KNOWLEDGE TRANSFER AND INNOVATION

Recent studies of innovation systems have argued that economic growth depends crucially on the ability to innovate, and that this occurs at the level of innovation systems as well as at the level of the individual firm (Braczyk, H-J. et al. 1998). Differences in national economic performance can occur and persist because of differences in capacities for innovation and government polices to promote innovation and knowledge transfer. Attention has also focused on the experience of the countries in transition in Central and Eastern Europe some of which have recently accessed to the EU (Bartlett and Bukvič, 2003; Radosevic, 2002; Bartlett and Bukvič, 2001; Dyker and Radosevic, 2000; Bartlett and Rangelova; 1996; Bartlett and Prašnikar, 1995). In those countries economic growth in the early stages of transition depended largely on reallocation of resources from older large state firms to more dynamic small and medium sized firms in the newly emerging private sector. At later stages of transition when this "easy" source of growth had run its course, further improvements in economic growth which is needed to underpin catching-up with the West European economies depends on the pace of innovation and the development of a knowledge-based economy (Bartlett, 2001; Radosevic, 2004).

Research into national and regional innovation systems has shown that differences in innovative capacities between countries and regions are linked to the institutions which promote learning and technology transfer, activities which in turn depend upon the existence of networks of institutions and firms that permit reciprocal exchange of knowledge and information (Morgan, 1997; Audretsch, 2005). Such reciprocal exchanges are facilitated where the institutional structure is flexible enough to permit interaction between university science departments and industrial enterprises; or where large and small firms build mutually beneficial subcontracting linkages (as in

Japan); or where small firms collaborate in local networks (such as in the Italian industrial districts).

In this paper we are concerned with the first of these effects, namely interactions between Higher Education Institutions (HEIs) and SMEs. Interactions between HEIs and SMEs are beneficial to both sides. Benefits to HEIs come from complementing their own academic research by securing funds for graduate students and lab equipment, and from insights into their research as well as commercialisation. Benefits to SMEs come from increased access to new university research and discoveries (Lee, 2000). Several forms of knowledge transfer from HEIs to SMEs have been identified in the literature. In this section we provide a summary of some of the more important studies in the field.

3.1. Knowledge Transfer through and Spin-off Companies

In recent years universities in many industrialised countries have begun to set up programmes to encourage academics and students to establish spin-off companies to commercialise the results of scientific inventions made within the academic laboratories. Such companies are typically small high technology companies. The commercialisation of scientific research through spin-offs is a direct means of transferring knowledge from higher education institutions to the SME sector.

A number of empirical studies of spin-off experiences in various European countries have begun to identify some key issues for policy makers keen to encourage spin-off activity. Based on a study of spin-outs from Cambridge University in the UK, Druilhe and Garnsey (2004) argue that policy makers should pay more attention to the diversity of spin-outs. As with SMEs in general, only a small minority will have a high growth potential and offer a high return to the originating institution. Degroof and Roberts (2004) studied spin-off policies of the eight largest academic institutions in Belgium and at 47 companies which had been spun out from them. They concluded that spin-off policies involving high selectivity and high support are necessary where the entrepreneurial infrastructure and culture are weak in order to generate ventures capable of exploiting opportunities with growth potential. Otherwise spin-offs are in danger of remaining stuck at a small scale of operations and vulnerable to a "consulting trap". The cost of such policies is however beyond the reach of most individual academic institutions and so a networking approach is recommended involving partnership between institutions to achieve scale effects.

University based start-ups and spin-offs as high-risk ventures face many difficulties. Typically, spin-offs may find it hard to raise outside equity capital or loan funds to finance their activities (Lerner, 2004). Equity investors are reluctant to invest because of information asymmetries between the academic entrepreneur and the investor. Banks may be reluctant to invest because of adverse selection problems (high risk-adjusted interest rates discourage all but the most high-risk borrowers). Because of these risks, investors are unlikely to be attracted to spin-outs if they are unable to control a majority equity stake. Thus the equity stake available to the university will typically be a minority stake, unless the university establishes its own venture capital fund. Moreover, most spin-outs will fail to generate a substantial return to equity, only a minority will succeed and therefore the returns from spin-outs will be limited and uncertain. Spin-outs also typically lack managerial expertise they need to develop the

capabilities to exploit the commercial potential of their technologies (Wright, Vohora and Lockett, 2004). The latter difficulty can be overcome if spin-out companies form joint ventures with established companies.

A further issue is whether research institutions are allowed to retain the right to patents in inventions that they make, and can legally commercialise the invention in the form of an innovative spin-out company. If they are not, and if they are constrained by restrictive regulations and bureaucracy there is even less chance that their spin-out activities will be successful (Lerner, 2004).

3.2. Science and Technology Parks

Spin-off companies are often located in Science or Technology Parks based either within or close to a university or research institute. Siegel at al. (2003) argue that location of a firm in a Science and Technology Park will accelerate the diffusion of new technologies. Lindelöf and Löfsten (2004) argue that proximity between firms and universities in Science and Technology Parks promotes the natural exchange of ideas through both formal and informal networks. Formal methods include licensing of technologies and informal methods include meetings between academic and industrial personnel, and job mobility of scientists and researchers. Some early empirical evidence suggested that the level of interaction between firms in Science and Technology Parks and local universities is generally low (Massey et al. 1992) and that cooperation between firms in a Park may also be less than one might expect (Quintas et al. 1992; Johanisson, 1998) which may be due to the heterogeneity of the firms in a Park (Lowengren-Williams, 2000). Nevertheless interactions between Park-based companies may be greater than among other firms (Felsenstein, 1994). Lindelöf and Löfsten carried out an empirical study of 265 NTBF firms in 10 Science Parks in Sweden, compared with a matched sample of off-Park firms. They found stronger links to universities, higher levels of technological innovation, and higher rates of growth in firms located on Parks compared to off-Park firms.

3.3. Industrial clusters

Industrial clusters have been highly effective as sites of innovation and economic growth in some notable cases such as Silicon Valley in the USA (Saxenian, 1994). Italian industrial districts have become a paradigm for a new form of economic development based upon dense clustering and networking of small firms in specific geographic locations. Networks of firms have been analysed as a potential source of improved competitiveness in transition economies (Franičević and Bartlett, 2001). The influential work of Michael Porter has stimulated a growth of policy interest in the beneficial effects of industrial clusters. Porter has argued that clusters permit the development of relationships between universities and clusters of firms in their locality which facilitates knowledge transfer processes (Porter, 2000). This and other experiences have created a strong interest among policy makers in various countries which have introduced public policies to support the creation of clusters involving both high technology companies and institutions of higher education such as the cluster policy introduced in Slovenia in 2001.

Several commentators have questioned whether clusters can be effectively created as a top-down initiative of government policy. Feldman et al. (2005) argues that

effective clusters are created by entrepreneurs as a part of their strategic business strategy when economic incentives are favourable, and evolve rather than being the product of conscious design. She suggests that clusters are self-organising systems and that "while many seek to emulate the sustained competitive advantage an industrial cluster represents, these dynamic systems cannot simply be imitated but require the temporal development of unique and not easily replicated assets and capabilities." (Feldman et al. 2005: 130). Feldman goes on to describe how local universities in one US example responded to the spontaneous formation of clusters by biotechnology entrepreneurs by setting up branch operations closer to the cluster to offer a Masters degree in Biotechnology for workers seeking additional training and to stimulate industry-funded research. The universities in the area also responded to new opportunities by establishing incubators to encourage entrepreneurial spin-offs. This implies that linkages between institutions of higher education and clusters of SMEs may develop in the absence of government intervention, but require a flexible university sector that is relatively autonomous and decentralised and capable of responding to opportunities to transfer knowledge to the private sector as the demand for such services develops and changes.

Other commentators have stressed the international aspects of knowledge transfer and have suggested that in order to work effectively as institutions of knowledge transfer, clusters need to adopt an outward orientation and link up with international systems of innovation in order to avoid stagnation due to intellectual inbreeding (Simmie, 2004).

4. THE POLICY FRAMEWORK IN SLOVENIA

In the 1990s the technology field was the responsibility of the Ministry of Science and Technology within which the Science area took priority over the Technology area. Gradually funds were shifted from Technology to Science: the proportion of funds allocated to Technology fell from 20% in 1990 to just 8% in 1999. On the positive side, a Technology Development Fund was established in 1994 as a venture capital fund focused on high technology small enterprises. The Fund was later merged within the Slovenian Development Corporation. Two technology parks were established in 1995 backed by research institutions, companies and the Ministry of Science and Technology.

In 2000 a new Ministry of Education, Science and Sport was established, and Technology was transferred to the competence of the Ministry of Economy under the new minister Dr. Tea Petrin. The Ministry of Economy, through its Department for Entrepreneurship and Competitiveness, introduced many new measures to support knowledge transfer in Slovenia through a number of programmes to support entrepreneurship and competitiveness. The "Programme of Measures to Promote Entrepreneurship and Competitiveness 2002-2006" set out three basic programmes which were designed to implement the provisions of a Law on Science and Technology passed in November 2002. These programmes were:-

(i) "Knowledge for Development"
(ii) "Improving Enterprises Competitive Capacity"
(iii) "Promoting Entrepreneurship & Utilising Entrepreneurial Opportunities".

The measures focused on the stimulation of innovation, and investments in knowledge and technological development. The policy envisaged state support for the creation of incubators at universities, the development of technology networks, and joint research projects by enterprises and scientific research institutions. It also envisaged continuing support for the development of industrial clusters envisaged as networks of enterprises, universities and research institutions, and support for technology parks.

The "Knowledge for Development" sub-programme aims, *inter alia*, to improve the flow of knowledge from educational and research institutions to the business sector. It includes a measure to promote the entry of young researchers from the universities into industry, and a measure to promote the establishment of business incubators within universities and research institutions. A third measure designed to support research infrastructure provides co-financing to enterprises for the costs of equipment provided to research institutes for R&D projects. The aim is to promote cooperation between "knowledge institutions" and enterprises to improve the utilisation of research and development capacity, and to speed up the commercialisation of knowledge.

The second sub-programme on "Improving Enterprises Competitive Capacity" supports the creation of industrial clusters involving companies and research institutes, the creation and development of technology centres to ensure the long-term linkage between the enterprises and the research and development sphere; and the creation and development of technology networks to develop new technologies and to widen access to existing technologies.

The third sub-programme on "Promoting Entrepreneurship" has a number of measures specifically geared towards promoting knowledge transfer to SMEs. One specific measure provides financial incentives for SMEs in incubators and technology parks. Another measure is designed to promote the creation and growth of innovative enterprises through subsidised loans, investment guarantees and direct credits.

The National Science and Technology Council is the leading policy-making body for in the field of science and technology. According to the 2002 R&D Law it has six members from the research community and six members from the Ministry of Economy and the business sector. It also has one representative from civil society and one representative of the researchers' union. Its chairman is the Prime Minister. Following widespread consultations, it prepares the "Foundations of the Slovenian Research and Development Programme" which it presents to the Ministry of Education, Science and Technology.

The National Research and Development Programme (NRDP) is drawn up by the Ministry of Education, Science and Technology, on the basis of the recommendations of the Science and Technology Council. It sets out a five-year action plan associated with the 2002 Law on Science and Technology. The current draft NRDP specifies that research institutes will be required to demonstrate financial participation by business partners, in new research projects. This should enhance cooperation between research institutes and the business sector. However, since over 70% of research funding is already committed to established research institutes for academic research a recent report has argued that this "seriously narrows the ability of the new NRDP to refocus

public research in the direction of more applied research and better co-operation of science with business" (EC 2004a, p. 19).

A new law was introduced in January 2004 on "The Support Environment for Entrepreneurship". It provides further financial support for incubators, technology parks, technology centres and technology transfer offices. The new law will make money available for the pre-start-up phase, which has been lacking up to now. It will provide small grants to academics working in universities to stimulate the development of new ideas. Under the law, a Slovenian Venture Capital Fund will be created within the Slovene Enterprise Fund, which is responsible for the provision of subsidised loans to SMEs. The venture capital fund will be established on the basis of public and private co-funding. It will aim to support new innovative enterprises and SMEs. To date the law has not been implemented, since the required implementing acts have not been passed.

A National Agency for Technology Development was established in February 2004 under the R&D law. The aim of the Agency is to offer financial support to development programmes of companies and especially their cooperation with science institutions in Slovenia in projects that would result in the transfer of knowledge. (An Agency for Scientific Research had already been established in November 2003). The European Regional Development Fund has been opened for Slovenia as a new member state of the EU which is able to provide funding for technology parks and new services and infrastructure to support R&D activities.

A new coalition government was elected in 2004. It again reorganised the ministries and created a new Ministry of Higher Education, Science and Technology. There is some concern among Slovenian policy experts that the old problems are likely to re-emerge under this new structure, and that the new measures recently introduced may not be implemented. Although the draft Slovenian Strategy for Development 2006-2013 launched by the government in July 2004 emphasises the importance of innovation and of supporting applied research, it has not yet[2] been released for public debate.

5. KNOWLEDGE TRANSFER IN SLOVENIA: AN AUDIT

5.1.1. Incubators and spin-offs

The Slovenian government promotes the creation of business incubators within universities and research institutes which provide infrastructure and joint consultancy services to new start-ups[3]. Through the "Knowledge for Development Programme" of the 2002 "Programme of Measures" it offers co-financing for the costs of project preparation and for the premises, staff and running costs of spin-off incubators. Under the specific measures for SMEs – "Promoting Entrepreneurship" – of the 2002 "Programme of Measures" the Ministry of Economy provides co-financing for 50% of the costs of one-off consultancy services to enterprises in the initial phase of a

[2] As of July 2005.

[3] The university incubators were initially designed and funded with support from the EU PHARE programme, but due to serious administrative delays, little of what was planned has been achieved.

project start-up within an incubator, and for up to 25% of the costs of equipment land and buildings used for R&D activities of an incubator.

Currently, three business incubators have been established in Ljubljana, Maribor, and Koper, supported by the government programme of measures. The incubator in Ljubljana is based at the university; the incubator in Maribor is based outside the university and supported by few companies and the local city council. These incubators support new companies by providing assistance for the development of their business plans and with other early-stage support. Once the business plan has been developed within an incubator the new companies are supposed to transfer to a technology park.

Up to now the officially supported incubators do not seem to have been very successful. In 2003 the Slovenian Enterprise Fund announced a SIT100m competition for subsidised long-term loans for companies spun-off from universities through the incubators, but no applications were received. The officially supported incubator in Maribor which was established by the municipality and located in Maribor Technology Park is rather ineffective; but an unofficial incubator has been established by personnel from the university Faculty of Economics and Business in Maribor called the "Venture Factory".

Case Study: The Venture Factory.

The University of Maribor does not have an official university incubator, and so in 2000 two enthusiastic academics within the Faculty of Business and Economics established an unofficial incubator known as the Venture Factory. It was set up as a non-profit Foundation (*zavod*) on the basis of funds from a Phare project. Although the Venture Factory is formally a project of the university, the university is only a passive partner, and the incubator depends on the energy and enthusiasm of the individual founders. Currently the incubator is housed within an office space in leased premises equipped with some computers. The Venture Factory provides hands-on advice through a network of experts and partner companies who can provide specialised assistance to new start-ups. It is essentially an awareness-building organisation which focuses strictly on the provision of business services. It organises a business plan competition, advertises entrepreneurship throughout the university, and holds one-day and one-week seminars. Overall, it assists start-up companies from within the university to commercialise innovations.

The Venture Factory has proposed the idea of a Technology Transfer Office (TTO) to take care of property rights and licensing of new ideas and innovation arising from the Venture Factory. While intellectual property rights from research conducted within the university belong to the university, the TTO would be able to licence an innovation to the business sector, or sell it on behalf of the university. The TTO would set out a schedule for sharing the royalties from the licensing of university intellectual property, or for equity shares in spin-off companies. It is expected that the project proposal will be realised soon and that a TTO will be established by the university as a limited liability company.

The Venture Factory is run by a private institute called the Institute for Entrepreneurship Research (IRP). It has been set up as a non-profit association/foundation (*zavod*) which has the advantage that it can employ people. It runs annual conferences on innovation, a joint project with the Austrian Institute for Small Businesses called "Industry Monitor" and a joint cross-border project Innovin with Science Park Graz and business incubator of University of Klagenfurt (Austria)

An agreement has been reached to establish a Technology Centre in Maribor to be called "Inceptum" which will be owned jointly by IRP, the university and by a company called "Prevent" which will have a 60% equity stake. The Technology Centre will employ research workers and will eventually become a research institute. It will aim to attract top-class Slovene researchers who have left the country to work abroad. The proposal for setting up Inceptum still has to pass the university Senate, but otherwise it has been agreed as a new venture.

This example shows how a group of entrepreneurial academics have been able to work around some of the restrictive institutional arrangements in Slovenia which prevent the state run universities from fulfilling their potential for knowledge transfer to the SME sector. Through the imaginative development of new institutions based on non-profit principles they have been able to initiate a process of creating new more flexible institutional arrangements that interact with the local business community and stimulate interest in science-industry collaboration through practical collaborative activities.

5.1.2. Technology Parks

A technology park is a special form of incubator aimed at enterprises with high technology requirements which facilitates the commercialisation of academic research activities. There are three technology parks in Ljubljana, Maribor and Nova Gorica. The basic aim of the Parks is to provide a favourable environment and infrastructure for SMEs which commercialise innovations from research institutes. The Parks are partly funded by the Ministry of Economy and partly through rents earned from their tenant companies. A major problem facing the parks is the dependence on annual financing. The new Entrepreneurship Law is expected to provide a more stable financing base, but as explained above this has not yet come into effect. The Ljubljana Technology Park is considered to be the most successful, while the Maribor Technology Park is less successful and less technology-based. The Nova Gorica Technology Park is still in an early stage of its development. The government provides some support for the activities of companies based in the Technology Parks. Under the specific programme of measures for SMEs – "Promoting Entrepreneurship" – of the 2002 "Programme of Measures" the Ministry of Economy provides co-financing for 50% of the costs of one-off consultancy services to enterprises in the initial phase of a project start-up within a technology park, and for up to 25% of the costs of equipment land and buildings used for R&D activities within a technology park.

The Ljubljana Technology Park supports the creation and growth of new enterprises based on the results of research from Slovenian universities and research institutes. Its

purpose is to create an environment in which innovation, financing and production interact to accelerate the cycle of development of innovative products. It aims to assist the foundation of new high-technology companies in collaboration with students and staff from the various Faculties and Research Institutes in Ljubljana. In addition to the Institute Jozef Stefan the Park has extended its collaboration to other HEIs such as the Faculty of Informatics and other institutions in the field of natural sciences. The Ljubljana Technology Park aims to develop the entrepreneurial spirit among science students and staff, and to encourage them to set up small high-technology companies. Although the collaboration with the science research institutes is strong, the collaboration with the University of Ljubljana is much weaker, partly as a result of the entrenched division between pure science and technology in Slovenia.

The Jozef Stefan Institute established the precursor of the Ljubljana Technology Park in 1992 as a pilot project which had already enabled the creation of nine hi-technology spin-off companies. Three years later, in 1995, the Ljubljana Technology Park Ltd. was founded as a non-profit limited liability company. Its founder owners were the Jozef Stefan Institute which owned 54% of the shares, the Institute for Biology, the Institute of Chemistry, some private companies (IskraTEL, Helios, LEK, SKB Bank), and a state body, the Technology Development Fund. More recently the Municipality of Ljubljana has become a majority owner with 60% of the shares. The Ljubljana Technology Park has a staff of three– a Director, a Business Secretary and a Project Manager. It owns its own premises, covering and area of 4,725 square metres. It provides tenants with professional educational courses, organises participation of tenant companies in international trade fairs and provides consultations on development strategies, financing, participation in foreign markets and placement of products.

Table 1: Evolution of Membership of the Ljubljana Technology Park

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Number of companies*	9	15	17	19	25	39	45	51	54	55
Number of companies in incubation**	9	16	17	22	19	24	28	28	25	27
Number of start-ups	9	10	12	17	22	31	33	39	40	44
Number of spin-offs	9	10	10	11	15	24	26	30	32	34
Number of employees in companies	75	114	120	154	181	224	241	256	299	317
Annual increase in number of companies	n/a	6	2	2	6	14	6	6	3	1
Annual increase in number of spin-offs	n/a	1	0	1	4	9	2	4	2	2

**These figures include both, regular companies (being incubated) and affiliated companies; ** the companies in incubation are considered only those which are regular members (the affiliated members are not included)*

By 2004, the Ljubljana Technology Park hosted 55 active companies of which 44 were new start-ups, and of these 34 were spin-off companies from universities and the research institutes. Spin-off companies have been established in the fields of information systems, energetics, automation, biotechnology, opto-electronics and environmental protection. A few companies have graduated from the Technology

Park and had established their premises elsewhere. The 55 active companies based in the Technology Park have 317 employees of which two thirds have at least two years higher education.

The main problems experienced by the management and professional staff of the Ljubljana Technology Park are the lack of financial support for the early stages of SME development, problems concerning the protection of intellectual property, the difficulties posed by very restrictive and rigid legislation and bureaucracy, and the isolation of high technology companies which generally expect more support than is available. The Park has succeeded in being included in the programme of support through the EU Structural Funds and if carried through this should ease some of the Park's financial constraints. Although the official period of tenure of companies in the Technology Park is four years, it is clear that in practice most companies are able to renew their tenure and remain within the protective environment of the Technology Park for a longer time. The number of companies in the Park, as well as the number of spin-offs, has increased consistently over the years. There was a peak of new company establishment in 2000, since when the number of new annual registrations has diminished.

5.1.3. Technology Centres

A law on Technology Centres was passed in 1999. In contrast to technology parks, the technology centres focus on a specific industrial branch or region. The technology centres are co-financed by the Ministry of Economy. By the end of 2001, thirty one sectoral technology centres and four regional technology centres had been established. The centres provide participating companies with assistance in marketing and legal and technical information, and links with R&D facilities in companies and in research institutes. One such centre is called TECOS - a technology centre for the machine tools sector. It provides services such as computer testing and CAD simulation analyses. The centre receives funding from infrastructure subsidies, the Young Researchers programme, and through funding for applied research projects. Public funding through these different programmes accounts for about 40% of running costs. Other funding comes from membership fees and fees for services. Technology Centres are supported by a specific measure within the 2002 "Programme of Measures" which aims to ensure the long-term linkage between the enterprises and the research and development sphere. Under the measure, the Ministry of Economy co-finances the costs of research and development projects, and the costs of introducing new services and support activities within the technology centres.

5.1.4. Technology Networks

The 2002 "Programme of Measures" included a new measure on "Promoting the Development of Technology Networks". It provides co-financing for the costs incurred in establishing the organisation and initial operation of technology networks, and the costs of preparing long-term research and development projects. The purpose of technology networks is to identify and support investments in the development of new technologies in sectors where there a critical mass of knowledge already exists and a high level of interest in the application of this knowledge. Technology networks are also intended to widen access to new technologies and increase their use other sectors. Technology Networks are intended to involve SMEs, large firms and HEIs.

The best of them is the ICT technology network led by IskraTEL from Kranj, co-financed through the EU Structural Funds. The vice-president of the technology network is the head of the Faculty of Electrical Engineering. Other successful technology networks are in the field of process control, biotechnology, and advanced materials (polymers). However, in 2004 only two technology networks were supported through the government programme.

5.1.5. Industrial Clusters

One of the most successful knowledge-transfer programmes in Slovenia has been the programme to develop industrial clusters involving both companies and research institutes which began with a pilot programme in 2000-2003. One of the aims of the cluster measure is to promote knowledge transfer from research institutes to the companies which are members of the cluster. The programme provides co-financing of the costs incurred during the initial phase of creation of potential clusters, for the preparation of a joint development strategy, and for the costs incurred during the first two years of their operations.

The first three pilot clusters were established in the automotive industry, in transport and logistics and in tool-making. A second call for projects was issued in 2002 and further clusters were formed in wood processing, plastics, information and telecommunication technologies, acclimatisation and cooling and in high tech equipment for services in the tourist sector. The clusters include small companies, but the leading companies are normally medium sized or large companies.

A pre-condition to form a cluster is that at least one third of the members must be academic research institutions (HEIs). The criteria are that at least ten companies and three research institutions must be involved in order to obtain financial support form the ministry. The cluster must provide its own co-finance, and is established through a legal contract. A cluster is developed in three phases: (i) in the first year the ministry provides 100% finance for the pilot stage – to create an atmosphere and to build trust; (ii) in the second stage a non-profit interest association is established with 40% co-financing from the ministry to establish an office and a management team; (iii) in the third phase the clusters are internationalised. The clusters are linked through the "Cluster Network of Slovenia" based at the Chamber of Commerce. According to the Chamber, new spin-offs within the cluster programme have come about mainly as a result of networking activity between the established clusters.

Altogether 36 clusters have been supported by the ministry of which 19 are considered to be successful, and operate on an international level. By 2004, 18 cluster offices were active, and 29 cluster projects were being supported (EC 2004c). These include the three pilot cluster initiatives, thirteen early stage clusters and thirteen developed clusters. They involve 350 companies and 40 education and research institutes, including the Universities of Ljubljana and Maribor. The total budget for the creation of new clusters was around €1.5m in 2003, and increased to €2.1m in 2004. In addition, €1.3m was allocated for existing clusters in 2003. The cluster programme is considered in a recent EC report to represent good practice, judged by the over-subscription of existing measures and positive conclusions from evaluation reports (EC 2004c).

Knowledge and technology transfer takes place between members of the clusters, and includes knowledge transfer from universities and research institutes to SMEs. The first spin-off companies which have been established through the activities of the clusters have been in plastics and engineering. The transfer of knowledge has also gone in the opposite direction – clusters have stimulated the development of new courses in the universities, for example courses on new technologies in the polytechnics. The Institute of Economic Research in Ljubljana is involved in the provision of consultancy advice to various clusters and networks.

The members of the clusters have until now cooperated mainly in the field of joint promotion, joint R&D projects and have taken part in joint education events and in other forms of acquiring knowledge. Cooperation in setting up the joint infrastructure of the cluster and in lobbying for common interests is also important knowledge transfer activities. This reflects the current initial development stage of the Slovenian clusters in which the infrastructure for joint operation is first established after which the cluster members start to cooperate in the fields in which they are not direct competitors, and only later begin to work on more demanding cooperative projects.

A recent evaluation of the cluster measures (Jaklič et al., 2004) indicated that the main reasons for entering a cluster are (a) the financial subsidy from the state, (b) the commercial pressure for a higher degree of linkage and cooperation between companies and (c) improved access to information resources and knowledge transfer through joint projects. According to the study, interviewed companies reported positive effects of clustering, but two-thirds expect that it will take about six years before the benefits in terms of increased sales would begin to exceed the costs. Both value added and exports are expected to increase due to the positive effects on competitiveness of joint projects undertaken within a cluster. The report emphasized the benefits of improved communication, faster knowledge transfer among the actors in the cluster, and the possibility of offering more complex products. Key success factors include the creation of trust among the members, effective leadership of the cluster, and the effective support of top management.

Unfortunately the government plans for future support for the cluster programme are being discontinued. Contracts already signed for financial support for established clusters will not be affected, but there will be no new calls for new clusters to be formed. Despite positive evaluations of the programme, the current thinking in the government is that the formation of new clusters should be based upon the initiatives and resources of the market players themselves. Opinions vary concerning the extent of externalities involved in cluster activity and the consequent degree of market failure in this area. According to the results of the evaluation study reported in the previous paragraph, interviews with the representatives of the clusters have shown that lack of trust is the main barrier to effectiveness at the beginning of the cluster development. Overall, the study found that the government programme triggered off a process which would have never have otherwise occurred. This suggests that new clusters are unlikely to develop in Slovenia in the absence of continued government support.

Case Study: the Slovenian Automotive Cluster

An example of a successful cluster can be found in the automotive industry. At the present time the automotive cluster is in its third phase, and in a stage of growth and deep co-operation among its members. It has been aiming to create a polycentric technology centre as a regional innovation system. The automotive cluster has established strong co-operation in the field of innovation activities among companies and other institutions involved in the development and diffusion of knowledge. This orientation has been supported by the Ministry of Economy which has provided financial support for a "Polytechnic Technology Centre" project within the public invitation for tenders of the European Regional Development Fund (ERDF).

The Polytechnic Technology Centre (PTC) is an international innovation system which incorporates companies, institutions of higher education and research, and the government (Verhovnik, 2005). The realisation of the project should enable a qualitative development of the Slovenian automobile producers at the local, regional, state and international level. It foresees a polycentric development of R&D activities which will also be a base for joint projects and for the further development and improvement of the competitiveness of the companies. The vision of the PTC is to become a reliable development-intensive network of suppliers for the global automobile industry in selected areas based around complex products with high value added. Among the joint projects carried out within the PTC are a development evaluation for new materials and products, an innovative development of the parts and technologies for the automotive industry, and the development of mechanotronic joints.

Several key goals have been set out for the PTC in the period up to 2008. Thus PTC will enable one technology centre and three R&D centres, create almost 300 new jobs, and produce some new innovative materials and technologies, including 30 new high technology products. It is also expected that about 40 joint projects will be undertaken with institutions of higher education and research and that jobs will be created for around 40 new researchers.

In 2002 the Ministry of Economy began an additional programme to develop networks of small enterprises employing up to 50 workers in defined geographical areas. For example, networks of small firms have been established in the construction industry. The government plans to create at least 20 such networks by 2006, and provided a budget of €1.7m for this programme in 2003. The networks are assisted by the Small Business Development Centre of the Ministry of Economy. In 2003, the networks involved more than 550 companies and 50 R&D institutions. Among the institutions involved are faculties within the Universities of Ljubljana and Maribor, private colleges and business schools, R&D institutes, technology centres and the Ljubljana Institute of Economics (EC, 2003).

5.1.6. Financial Support for High-Technology SMEs

The Ministry of Economy provides support for high technology enterprises in their early phases of development through subsidised loans, investment guarantees and

direct credits with co-ownership of risk capital funds. This measure was announced as part of the 2002 "Programme of Measures", within the sub-programme on "Promoting Entrepreneurship". The subsidised loans are provided through the Slovene Enterprise Fund. In 2003 the SEF made SIT300m available for various categories of high technology SMEs. The first category included new companies that are co-owned by private venture capital funds. The second category includes SMEs in information technology and information services. They should be companies which are manufacturing products or services developed on the basis of their own research and development or joint R&D with universities and research institutes, which can display evidence of the marketability of the product. The loans were available with a subsidised interest rate with a 4-year grace period and a 10-year pay-back period. Applicants were to provide at least 30% of the total finance from their own funds. In 2003, the Fund received 23 applications for loans amounting to SIT700m under this heading of which 21 were within the second category which includes university-business collaboration. After evaluation, seven applications were approved for a total of SIT185m of subsidised loans for projects with a total value of SIT460m. The average size of the successful companies was 10.7 employees with plans to increase employment to an average size of 14.7 employees. One half of the value of loans to successful applicants was for companies operating in the manufacturing sector, and 24% for companies in the real estate sector.

5.1.7. Young Researchers Programme

The universities have contributed to the science base in Slovenia by increasing the number of M.A. and Ph.D. holders in the R&D sector, which reached 31.5% by 2001 (MoE 2003: 128). However, relatively few researchers were employed in R&D in the business sector where highly educated personnel accounted for just 12% of R&D employees. The Young Researchers programme aims to address this deficiency.

The Young Researchers programme was initially developed in 1985 in order to support the employment of younger researchers in research institutions, by paying their salaries and mentor's fees to the institution. It also aimed to support the transfer of young researchers from research institutes to employment in industry. The latter aim was not successful, as the best researchers stayed with the research institutions. To address this problem since 2002 the Ministry of Economy has given more attention to the mobility aspects of the programme. The "Young Researchers" measure now aims to promote the entry of young researchers from the universities into industry. It involves co-financing the continuing education of junior researchers employed by enterprises or technology centres for the duration of their studies. Under the programme, the government also pays part of the salary of newly employed post-graduate students. According to a recent report of IMAD this measure has been successful and the proportion of researchers in industry now exceeds the proportion employed in the research institutions. According to government data some 200-300 new researchers pass through the programme each year (MoE, 2003).

6. CONCLUSION AND POLICY RECOMMENDATIONS

This study has shown that there is a well-developed policy package and institutional framework to support knowledge transfer from Higher Education Institutions (HEIs) in Slovenia to the business sector. The National Science and Technology Council issues recommendations to the Ministry of Education Science and Technology on the provisions contained within a National Research and Development Programme and specific laws have been introduced to promote technology transfer. Under the 2002 Law on Science and Technology the government developed a Programme of Measures to Promote Entrepreneurship and Competitiveness 2002-2006 which contained a proliferation of policy initiatives that would support this aim. These have ranged from support for the creation of business incubators and technology parks, the development of technology centres and technology networks, the development of industrial clusters involving collaboration between industry and academic research institutions, financial support for high-technology SMEs and a Young Researchers programme to promote the mobility of junior researchers from R&D institutions to the business sector. Many of these policies have been imported from experience elsewhere and doubts have been raised about their relevance to Slovenia and the adequacy of funding to support them (Bučar, 2004).

In this paper we have carried out an audit of these institutions to promote knowledge transfer between HEIs and the business sector. The study has shown that the policy framework in Slovenia has succeeded in establishing an active programme of knowledge transfer along almost all of these dimensions. Yet, there remain doubts as to the extent to which these programmes are really succeeding in fostering knowledge transfer between HEIs and the SME sector. Many of the programmes involve support for innovation within the large company sector and do not specifically target the SME sector. While medium sized firms may benefit to some extent there are reasons to doubt that small firms are benefiting much from the measures that have so far been implemented.

Recent reports from the Global Entrepreneurship Monitor (Rebernik et al., 2004) research programme have voiced similar concerns. The research findings suggest in particular the following problem areas:

- Linkages between academic institutions and the businesses sector are weak
- The performance of the science parks and business incubators is poor
- Government programmes are often introduced without sufficient preparation
- Government programmes lack sufficient finance for effective implementation

According to the GEM research:-

> "Healthy cooperation between universities, businesses and various support institutions … is still absent. Slovenia's universities are not assuming responsibility for assisting small and medium-sized enterprises in their technological development and the commercial exploitation of innovations. In Slovenia as elsewhere one of the key problems in the linkage of universities and small firms is that small firms are not technologically well developed, have a short research horizon and frequently also lack the know-how for such collaboration. On the other hand academics are

> generally not especially interested in collaborating with smaller firms, as this generates little or no revenue" (Rebernik et al., 2002: 26).

As we have seen, part of the problem stems from the division between the universities and the research institutes. While research institutes are increasingly engaged in knowledge transfer to the business sector through the various measures introduced by the government, the university faculties remain focused on pure research. Promotion criteria for individual academics emphasise academic publications rather than commercialization of research activities. The division between academic science and applied technology has only been reinforced by the government's decision to created separate Agencies for the two fields of activity.

The problem appears also to be deeper in regard to SMEs compared to large firms. For example, as identified above, no applications were made for financial support provided by the government for new start-ups in incubators. The government's programme of subsidies for small high technology firms appears to have disproportionately benefited firms in the real estate sector, and thus not really reached the target group of companies in the high-technology in the manufacturing sector. Moreover, SMEs have not been sufficiently involved in industrial clusters. Greater emphasis should therefore be placed on SME participation in clusters. On the other hand SME network programme has been relatively successful.

Yet available evidence supports the view that knowledge transfer from HEIs to SMEs is relatively low in Slovenia. The Slovenian Innovation Survey has shown that SMEs report that universities and research institutes are a relatively minor provider of information compared to all other sources of information (outweighed by clients and customers, fairs and exhibitions and even their own competitors). A significant minority of SMEs (11%-15%) also report that a lack of qualified personnel is a barrier to innovation. The consequence has been that Slovenia has fewer innovative SMEs than many other EU member states. As shown above, Slovenian SMEs rank 16th in terms of in-house innovation activity among the EU-25, and 17th in innovation expenditure. Our review and audit of the practices and outcomes of knowledge transfer policies in Slovenia suggests that a range of policies and actions are required to boost the extent of knowledge transfer from HEIs to SMEs in Slovenia.

6.1. Policy proposals and recommendations

Recommendations oriented towards the public policy sector

1. The government should accelerate a transition of researchers from the academic sphere to SMEs through a greater emphasis on the mobility aspects of the successful Young Researchers programme.

2. The government should also introduce tax incentives for projects which involve knowledge transfer from HEI to SMEs in order to encourage innovation in SMEs and improve the relative position of Slovenia in relation to EU-25 in respect of the low share of Innovative SMEs in Slovenia.

3. The National Agency for Technology Development should make HEI-SME knowledge transfer a central aim of its activities to promote innovation and boost the proportion of innovative SMEs in Slovenia. It should assist institutions such as HEIs, technology centres, technology networks and technology parks to access EC funds to promote innovation and knowledge transfer activities.

4. The government should establish a joint venture capital fund within the universities to back their academic spin-offs with equity capital rather than relying on commercial venture capital funds.

5. A common Agency for Innovation should be established instead of separate Agencies for Science and Technology (see Mulej and Potocan, 2005).

6. Technology Parks should be encouraged to undertake activities to promote networking between their tenants and end the reported isolation of high technology companies on their premises.

7. Technology Parks should enforce limited tenure for its resident companies in order to promote dispersal of companies to more normal commercial environment, and to make space for new high-technology start-ups.

8. Technology Centres and Technology Networks specifically oriented towards Slovenia's handicraft sector should be established.

9. Industrial Clusters should be encouraged to move rapidly to the third stage of internationalisation so that they develop an outward exporting orientation and link up with international systems of innovation.

10. The government should fund a research project comparing the performance of companies on the Ljubljana Technology Park with matched companies off the Park to identify the advantages and disadvantages of locating companies within such Parks.

Recommendations oriented towards the HEI sector

1. The structure of separate universities and research institute should be reformed to encourage the merger of academic and applied research. Universities should be given a greater degree of autonomy to commercialise innovations and to react to opportunities to transfer knowledge to the private sector which arise through for example the development of industrial clusters.

2. Universities should boost their business incubators to provide more support to researchers to commercialise their research through the creation of new spin-off enterprises.

3. Universities should collaborate to develop cooperation between their incubator activities and share best practice. HEIs should join together to establish a joint venture capital fund to co-finance spin-outs from the HEI sector.

4. Universities should assist and facilitate their academic staff to established non-profit associations and foundations that will operate as vehicles for knowledge transfer and commercialisation of innovation, learning from the experience of the Venture Factory in Maribor.

5. Universities should establish Technology Transfer Offices to handle property rights issues and the licensing of inventions and innovations created in university laboratories and to encourage patenting and licensing of technology to SMEs. Intellectual property regulation and protection for researchers in HEIs should be reformed, and the Agency for Technology should support patent applications by HEIs.

6. Since spin-offs typically lack managerial expertise, university spin-off SMEs should be encouraged to form joint ventures with established companies.

7. Universities should include applied research activities and a record of collaboration with SMEs in their staff promotion criteria.

8. Universities should permit researchers to take sabbaticals to create spin-off companies with a guaranteed right to return to their previous post.

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Acknowledgements

An earlier version of this paper was presented at the OECD conference "Fostering Entrepreneurship: The Role of Higher Education", University of Trento, 23-24 June 2005. We are grateful to Maja Bučar, Marko Jaklič, Mateja Mešl, Miroslav Rebernik and Petar Stanovnik for providing useful information in the preparation of this paper and for commentary on the original version. Responsibility for any errors or omissions is, however, our own.