

INNO-Policy TrendChart – Policy Trends and Appraisal Report

LIECHTENSTEIN

**2008**

## PREFACE

Innovation is a priority of all Member States and of the European Commission. Throughout Europe, hundreds of policy measures and support schemes aimed at innovation have been implemented or are under preparation. The diversity of these measures and schemes reflects the diversity of the framework conditions, cultural preferences and political priorities in the Member States.

**PRO INNO Europe** is a new initiative of Directorate General Enterprise and Industry which aims to become the focal point for innovation policy analysis, learning and development in Europe, with a view to learning from the best and contributing to the development of new and better innovation policies in Europe. Run by the Innovation Policy Directorate of DG Enterprise and Industry, it pursues the collection, regular updating and analysis of information on innovation policies at national and European level.

The **INNO-Policy TrendChart** serves the 'open policy coordination approach' laid down by the Lisbon Council in March 2000. It supports organisation and scheme managers in Europe with summarised and concise information and statistics on innovation policies, performances and trends in the European Union (EU). It is also a European forum for benchmarking and the exchange of good practices in the area of innovation policy.

### The INNO-Policy TrendChart products

The INNO-Policy TrendChart, previously TrendChart on Innovation, has been running since January 2000. It now tracks innovation policy developments in all 27 EU Member States, plus Iceland, Norway, Switzerland, Liechtenstein, Croatia, Turkey, Israel, Brazil, Canada, China, Japan, the USA and India. The INNO-Policy TrendChart website <sup>(1)</sup> provides access to the following services and publications, as they become available:

- a database of innovation policy measures across 39 countries;
- a news service and related innovation policy information database;
- a 'who's who' of agencies and Government departments involved in innovation;
- annual policy monitoring reports for all countries covered;
- an appraisal of the Lisbon National Reform Programme (NRP) and innovation by Member State (new separate publication in 2008);
- an annual synthesis report bringing together key points in the INNO-Policy TrendChart.

This document has been prepared within the framework of an initiative of the European Commission's Enterprise and Industry Directorate-General, Innovation Policy Development Unit. Official responsible: Cesar Santos ([cesar.santos@ec.europa.eu](mailto:cesar.santos@ec.europa.eu)).

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The report covers the period from September 2007 to September 2008. This year's report provides an overview and analyses on two focus themes: (1) policies in support of creativity and innovation, and (2) support of innovative start-ups including gazelles.

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<sup>1</sup> See: <http://www.proinno-europe.eu/index.cfm?fuseaction=page.display&topicID=52&parentID=52>

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## Executive Summary

### 1. Introduction: Main Recent Trends in the National Innovation System

Liechtenstein's economy recorded strong growth for 2007. After three years of significant growth, the economic forecast for 2007 projects a continued strong expansion, with an estimated GDP growth rate of 5 %. Export trade grew exceptionally strong. Nominal direct exports reached CHF 4.182 billion in 2007, increasing 16.1 %. Nominal direct imports reached 1.471 billion Euro, 11.7 % higher than the previous year. Total employment in Liechtenstein grew by 4.5 % with a positive outlook on 2008. GDP growth should be significantly weaker in 2008 (estimated at 2 %). Medium- and high-tech companies have benefited from increased international demand, resulting in increased investment in innovation and further market expansion.

In terms of national innovation performance, Liechtenstein is ranked among Europe's innovation leaders. Fuelled by strong private investments, the R&D quota of Liechtenstein was estimated at 4.27 % of GDP in 2006. In contrast to the high R&D expenditure of private business, public R&D expenditure of 0.05 % of GDP falls short of the 1 % recommendation of the Lisbon Strategy. Besides private R&D investments, the national innovation performance of Liechtenstein is driven by intensive innovation activity across firms of all sizes and industries in the secondary sector. All manufacturing sectors (with the sole exception of construction) are performing above the EU average in innovation activity and sales of new-to-market products. High business R&D expenditure and innovation activity are being reflected in high output data. Employment in medium-high and high-tech industries amounted to roughly 26 % of the total workforce in 2004. With 3156 European patents per million inhabitants, Liechtenstein is the most patent intensive country in Europe. Holding 59.1 patents per one million inhabitants, Liechtenstein is also very patent-intensive in high technology (in comparison to the United States [47.6] and Japan [53.5]). Finland (125.6) and Sweden (62.8) are the sole European countries ahead of Liechtenstein.

Despite high innovation performance and efficiency, there are barriers to innovation that might pose a threat to future dynamics. These have been identified as access to capital by small and medium-sized enterprises (SMEs), low intensity of knowledge and technology transfer, and overall low public expenditure on education and science. Recent developments have thus spurred political debate on innovation. To date, Liechtenstein has no explicit innovation policy in place but promotes innovation activity by means of a general liberal economic policy, low taxation and targeted measures towards individuals and SMEs.

### 2. Major Innovation Challenges and Policy Responses

Creating an overall positive climate for innovation, correcting identified barriers to innovation and increasing public expenditure on education, science and innovation are the main challenges for innovation policy in Liechtenstein.

In the past, the liberal economic policy combined with comparatively low taxation was instrumental in supporting business innovation activities. However, in consideration of taxes, high tech corporations are offered very attractive financial packages by other federal governments in Europe. In contrast to being generously welcomed to these other regions, corporations are often confronted with local considerations in Liechtenstein. Scarce land and environmental concerns are reasons for objecting to their local expansion. Industrial companies have also suffered collateral damages from past financial scandals. One of the challenges for policy makers is thus to create a general positive climate for innovation and industry.

Another main challenge is the corrections of the hampering factors to innovation. Finally, comparatively low public expenditure on education, science and innovation, in combination with soft

factors (such as a lack in urbanity and social openness) could have a long term negative impact on national innovation performance.

### Challenge 1: Improving access of SME to capital for financing innovation

Financial markets are failing to procure founders, as well as young and growing companies, with necessary funds. Market failure occurs because of the small size of the country that prevents the establishment of venture funds. Furthermore, financial institutions in Liechtenstein strongly specialised in private wealth management have little incentive and competence to offer solutions for corporate finance. Constraints in financing innovation are intensified by a lack of financial management skills in SMEs and traditional values by family-owned businesses objecting to risk capital or mezzanine funding schemes.

### Challenge 2: Intensifying local knowledge and technology transfer

Information asymmetries between investors and entrepreneurs are further aggravated by general low levels of networking and local transfer of knowledge and technology. There is no public institution, agency or platform for promoting the exchange of information between the different actors in the national innovation system. Low levels of knowledge transfer increase risks of market failure due to asymmetries in information, and prevents the exploitation of the common science base for commercial and social purposes.

### Challenge 3: Increasing public expenditure on education, science and innovation

Low public expenditure on education and science, in combination with a strategy of free riding on Switzerland and Austria, bear the risk of under-investment in the form of human capital. Strategic decisions by these neighbouring countries on relocating educational institutions away from the borders of Liechtenstein might put further pressure on a labour market that is already in short supply of qualified engineers and managers. Finally, as more industrial corporations need to have their R&D capacity close to production and marketing in target regions, they might shift R&D abroad with significant impacts on the national R&D quota.

### Summary table: innovation challenges, policy responses and impact

Challenge	Relevance of policy response	Evidence of impact
Improving access of SME to capital for financing innovation	1	3
Intensifying local knowledge and technology transfer	1	3
Increasing public expenditure on education, science and innovation	2	3

Policy response ranking scored from 1 to 5: (1) No specific measures addressing the challenge (possibly a debate but no evidence of any real policy development); (2) Policy development under way to respond to challenge (policy debate or design launched, e.g. announced in National Lisbon Reform Plan, etc.); (3) Specific measures existing for some time but insufficient to respond fully to challenge; (4) Existing measure plus one or more newly launched measures (during last 18 months); (5) A comprehensive set of measures which potentially responds fully to the challenge.

Evidence of impact scored from 1 to 5: 1. Trend for indicators has worsened since measure(s) introduced; 2. No observable change in trend since measure(s) introduced; 3. Too early to appraise (measures introduced in last 24 months); 4. Trend for indicators has improved since measure(s) introduced; 5. Evaluation or study indicates measure(s) has clearly contributed to improving performance of country.

### 3. Innovation Governance and Policy Trends

Since the last report in 2006, there has been no change in the innovation governance system. In short, the Minister for Economic Affairs drafts proposals for policy measures targeted at the promotion of business and innovation in general. Proposals of the ministers are considered by the Government and subsequently presented to the Parliament after a public hearing. Approved measures are then implemented and managed by the Government and offices in charge.

The most striking change in general economic policy is that the Government has started a series of studies and expert consultations to assess the needs and strategic options for an explicit national innovation policy, and will report findings to the Parliament for further discussion in October 2008.

#### 4. Conclusion: Future Actions and Opportunities for Innovation Policy

In the past, general economic policy measures have responded effectively to innovation challenges. However, the policy measures in place might not be sufficient to work against increasing shortages of qualified labour supply and identified factors hampering innovative activity. Without further policy measures, these trends might jeopardise the positive dynamics of the existing national innovation system.

One of the key questions to be answered by the Government will be if further political action is needed, and if an explicit innovation policy needs to be put in place. Generally speaking, any policy measures promoting innovation more intensively should build upon past success, in combination with experiences and good practices observed in other small and innovation-intensive countries, such as Ireland, Luxembourg and Denmark. Furthermore, taking into account the high heterogeneity of the industrial base and the small size of the country, Liechtenstein does not seem to be apt for a high degree of specialisation in promoting science and innovation. High degrees of specialisation versus the implementation of horizontal programs and functionally oriented instruments could easily lead to the distortion of competition.

Liechtenstein has thus the potential to establish an interesting case study for small states and regions in establishing new solutions for governance, institutional settings and policy learning practices based on the experiences of other nations (since the early 1980s). Analysis of the future path of Liechtenstein could provide fresh insight into the emerging third generation of innovation policy and how governments are striving to make innovation policy more coherent.

## 1. Main Trends and Challenges in the National Innovation System

### 1.1 Recent Trends in Macroeconomic and Market Developments

The highly industrialised economy of the Principality of Liechtenstein is characterised by a broad diversification of industry and services. Despite its international image as a banking centre and tax haven, Liechtenstein is more strongly industrial and less service-oriented than is generally assumed.

Liechtenstein's economy is currently in a good state. The National Institute for Economic Research (KOFL) again recorded strong growth for 2007. The outlook for 2008 is somewhat more muted, with a projected slowdown of productivity growth.

Economic forecasts for 2007 indicate a continued strong expansion of macroeconomic production. The growth rate of the real GDP is estimated to be about 5 % relative to the previous year. Based on assessments of the global economy and its impact on Liechtenstein, a slowdown of economic dynamics is expected for 2008. Growth of real GDP relative to 2007 will hardly exceed the 2 % mark. According to this estimate, real GDP will increase to CHF 5.186 billion. About 39 % of GDP is covered by added value in industry and manufacturing, 29 % in the financial services sector and 25 % in general services including ICT and other company services, retail, tourism and real estate, and the remainder of 7 % in agriculture and households.

One of the most important engines of Liechtenstein's economy are exports driven by products and services from mechanical and automotive engineering, plant construction, precision instruments, dental technology and food-processing. Supported by a positive international climate, export trade grew exceptionally strongly in the past year. Nominal direct exports, not including exports to Switzerland, reached CHF 4.182 billion in 2007. The growth rate of nominal direct exports, which amounted to CHF 3.604 billion in 2006, is therefore 16.1 %, while the growth rate in the previous year had already been 11.6 %. Imports also increased strongly in 2007 relative to the previous year. Nominal direct imports in the past year reached CHF 2.416 billion, 11.7 % higher than the previous year. In 2006, with CHF 102 500 of exports per capita Liechtenstein's export outweighed total exports of Austria (CHF 20 200 per capita) by five times.

High-tech and knowledge intensive niche products are primarily exported to the European Economic Area, Asia, and North America. According to the export statistics of the Liechtenstein Chamber of Commerce and Industry (LCCI), a share of 44 % of goods reached EEA countries in 2005, while 23.8 % went to Asia and 18.1 % to the United States. The Swiss Customs Administration, which gathers the data on exports outside Switzerland pursuant to the Swiss-Liechtenstein Customs Treaty, registered shipments of CHF 2.2 billion to Western Europe in 2006. Germany, France, Austria, and Spain top the list of destination countries. Exports to Central and Eastern Europe reached an above-average growth of 41.7 % to CHF 171 million, with Poland, the Czech Republic, Slovakia, and the Russian Federation as the main purchasers. Even higher was the growth in the Middle East region, namely 75 %: Saudi Arabia, Israel, Kuwait, and especially the United Arab Emirates ordered goods in the amount of 106.2 million francs. Exports to Northeast Asia — China, Hong Kong, South Korea, Taiwan, and Japan — grew by a lower rate, namely 17.7 %, but were at a higher level in terms of total absolute value, namely 213.4 million. A similar picture emerged for North America, with a growth of 6.5 % to CHF 579.4 million: The largest share went to purchasers in the United States, while Canada remained at a relatively modest level.

Total employment in Liechtenstein grew by 4.5 % to 32 472 full-time and part-time workers in 2007 with a positive outlook on employment growth of an estimated 2.5 % in 2008. At the end of 2007, 472 people were unemployed, a decrease of 123 since the beginning of the year. The unemployment rate thus sank to 2.7 % by the end of 2007.

Overall, the macroeconomic employment trend in Liechtenstein has been very strong for the past 25 years. The number of workers more than doubled from 15,323 in 1982 to 31 074 by the end of 2006. About 15 100 people from the region (Austria, Switzerland and Germany) commute daily to their workplace in Liechtenstein. This is about 45 % of the total employment.

In comparison to other countries such as Switzerland, Germany and Austria, Liechtenstein has only slowly gravitated toward the tertiary sector. Although the share of workers in the manufacturing sector decreased relative to other sectors, the total number of manufacturing jobs increased substantially. The number of manufacturing jobs grew from 8 448 in 1982 to 13 569 by the end of 2006. The growth in manufacturing jobs during this period was therefore 61 %. In the service sector, jobs increased from 6 500 to 17 101 over the same period, an increase of 163 %. As of December 2006, 55.4 % of all jobs in Liechtenstein can be attributed to services, 43.5 % to industry and manufacturing and 1.7 % to agriculture and forestry.

## Exhibit 1: Comparable indicators of economic performance

Indicator	National performance		EU 27 average	
	2002	2007 <sup>^</sup>	2002	2007
GDP per capita in PPS (EU27=100)	(:)	(:)	104.6*	103.8*
Real GDP growth rate (% change previous year)	-0.35	5.6 <sup>^</sup>	1.2	2.9
Labour productivity per person employed (EU27=100)	(:)	(:)	100*	100*
Total employment growth (annual % change)	0.11	4.5	0.3	1.5 <sup>^</sup>
Inflation rate (average annual)	0.6	2.0	2.1	2.3
Unit labour costs (growth rate)	(:)	(:)	-0.5	-0.8
Public balance (net borrowing/lending) as a % of GDP	(:)	(:)	-2.5	-1.6 <sup>^</sup>
General Government debt as a % of GDP	(:)	(:)	60.3	61.4 <sup>^</sup>
Unemployment rate (as % of active population)	1.4	2.7	8.9	7.1
Foreign direct investment intensity	(:)	(:)	1.3*	1.9* <sup>^</sup>
Business investment as a percentage of GDP	(:)	(:)	17.3	18.2 <sup>^</sup>

Sources for Europe Eurostat - Structural Indicators and Long-term Indicators.

Sources for Liechtenstein: Office for Economic Affairs Liechtenstein (Dept. of Statistics) with the following exception. Total Employment Growth 2007: Economic Forecast 2008 by National Institute for Economic Research KOFL.

Note: Unemployment rate fro 2002 is not comparable to EU because of different calculation methods. 2007 is based on international standards.

Key: (\*) EU25 average, (<sup>^</sup>) latest data available for 2006; (: ) not available

The strong industrial basis has benefited from the international positive business climate for the past three years leading to increased investment in innovation and further market expansion. Positive dynamics of the national innovation performance have been primarily driven by private investment in the medium and high technology industries of Liechtenstein.

## 1.2 Recent Trends in the National Innovation Performance

In Liechtenstein, the first National Innovation Survey was conducted in 2007. The survey covered the period of 2004 to 2006 and was limited to technological product and process innovation in the secondary sector. No data was collected on other forms of innovation or innovation in the primary or tertiary sector of the economy. Thus, the data base for evaluating the national innovation performance remains small in comparison to other European countries, the US and Japan. Being aware of this limitation, results from the first innovation survey rank Liechtenstein among the top innovation performers in Europe.

Fuelled by strong private investment, the R&D quota of Liechtenstein is estimated at 4.27 % of GDP in 2006. More than half of all manufacturing companies invested in R&D during the period from 2004 to 2006. While 57 % of all R&D expenditure was invested in Liechtenstein, 43 % of funds were channelled to facilities abroad. The main reasons for performing R&D abroad are gains from international knowledge transfer, proximity to innovative networks and support to manufacturing and marketing in the target market.

In total, business R&D expenditure amounted up to 337 million francs in 2006. Small and medium-sized enterprises financed about 12 % (CHF 40.3 million) and large companies about 88% (CHF 292.2 million) of all R&D investments. Large corporations in Liechtenstein tend to conduct their R&D mainly in house either at headquarters in Liechtenstein or company owned R&D facilities abroad. In case of partnerships they favour third party R&D contracts to other private companies over R&D partnerships with universities and private research institutions. One reason for their preference might be that large corporations do not have to negotiate patent rights in case of outsourcing R&D to other firms. Liechtenstein currently has no public funding schemes for R&D. However, Liechtenstein contributes financially to R&D funding schemes in Austria and Switzerland and participates in the Framework Programmes of the EU. In 2007, Liechtenstein contributed CHF 250 000 each to the Austria Science Fund FWF and the Swiss National Science Foundation SNF. While SME have not yet benefited from these programs, large corporations have received public funding especially from Switzerland and FP programs. An evaluation of project data shows that large corporations from Liechtenstein participated in 21 research projects which were funded by the Swiss Innovation Promotion Agency (KTI) over the period from 2004 to 2006, and at least 5 projects were carried out partly funded by FP6.

In contrast to the high R&D expenditure of private business, public R&D expenditure remains significantly low with a share of 0.05 % of GDP (2003). With respect to the recommendation of the Lisbon Strategy to channel about 1 % of GDP into public funding of R&D, Liechtenstein clearly lags behind the European average public R&D expenditure. Overall public expenditure on education and science is low. Compared to the OECD average public expenditure on education of 4.9 % of GDP in 2002, Liechtenstein only invested 2.7 % of GDP in her educational system declining to 2.0 % in 2003. While OECD countries spent an average of 1.7 % of GDP on tertiary education, Liechtenstein allocated only 0.2 % of GDP to Universities and other tertiary institutions.

However, Government spending on tertiary education is expected to rise significantly with the start of PhD programs at the University of Liechtenstein in 2009. Success in education can also be reported from the International Survey on Collegiate Entrepreneurship 2006 (cf. Fueglistaller et. al.). According to an international comparison in this study, Liechtenstein ranks first in number of entrepreneurship master students establishing their own business after graduation, followed by Singapore, Austria and Finland. While the ratio of Liechtenstein citizens' tertiary education is internationally rather low, nearly a quarter (23 %) of persons working in Liechtenstein holds an academic degree surpassing the average ratio of academic working population in EU countries.

Besides private R&D investments, the national innovation performance of Liechtenstein is pushed by intensive innovation activity across all sizes of firms and industries in the secondary sector. Nearly two-thirds of all companies with less than 10 employees have engaged in some sort of innovation activity. Innovation activity increases further with the size of the company with each of the 8 large

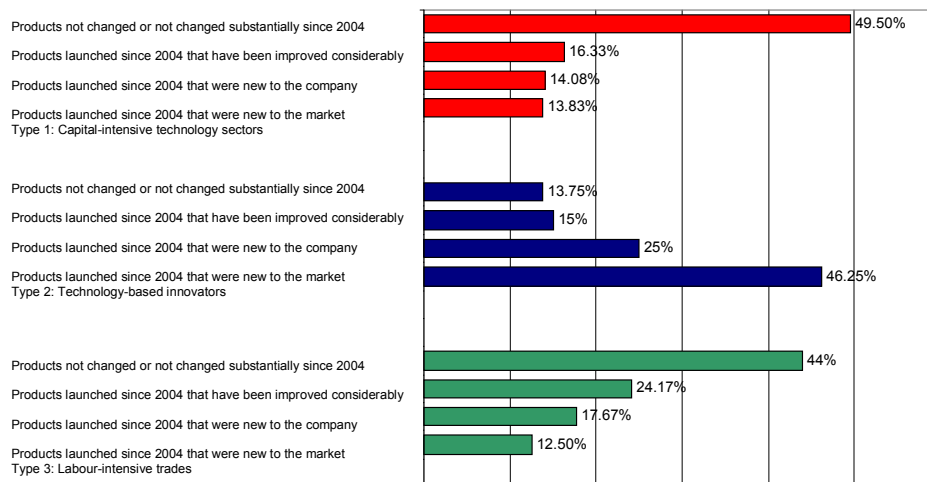
industrial companies with more than 250 employees being active in technological product and process innovation. Breaking data down to industries, innovation activity is the highest in electronics, precision engineering and optical instruments followed by mechanical engineering, automobile engineering and medical technology. In comparison to the EU, all manufacturing sectors with the sole exception of construction are performing above average innovation activity in the EU.

The main incentive for all companies to innovate is to satisfy customer needs. Rising competitive pressure and entering into new markets with high growth potentials are further important incentives to innovate. The fact that innovation activities of competitors are not judged as a major innovation incentive suggests that most innovating companies in Liechtenstein are clearly positioning themselves as innovation leaders in their global product and market niches. When asked about the relevance of their innovation activity, most companies stated that innovation is most important for improving and diversifying the product range, entering into new markets and to increase added value. Innovation also supports their efforts to render production more flexible to satisfy individual customer needs. These findings strongly support the thesis, that most manufacturing companies in Liechtenstein implement a strategy of innovation leadership serving customer world wide with highly specialised and customised technological products.

High business R&D expenditure and innovation activity are being reflected in comparatively high output data on innovation. Employment in medium-high and high-tech industries (chemical; plastics; metal processing; mechanical engineering; electronics, precision engineering and optics; automotive) amounted to roughly 26 % of the total workforce in 2004. Employment in these industries has been growing steadily over the past 10 years. Employment in high-tech services including ICT reached about 8 % (2004). Nearly all exports of Liechtenstein can be attributed to products from the medium-high to high-tech manufacturing industries. Holding 59.1 patents per one million inhabitants, Liechtenstein is very patent-intensive in high technology, for example in comparison to the United States of America (47.6) and Japan (53.5). Finland (125.6) and Sweden (62.8) are the sole European countries still ahead of Liechtenstein.

Based on an analysis of sales of new-to-market products (percent of total turnover) over the period from 2004 to 2006, manufacturing companies in Liechtenstein can be grouped into three different type of innovators (see next Exhibit; note that deviations in percentages from a full 100 % are due to non-item responses).

## Exhibit 2: Types of Innovators in Liechtenstein



Type 1 includes companies in capital-intensive technology sectors with high innovation activity and international sales. The success of innovations is mostly reflected in their ongoing improvement of

products, followed closely (with a share of sales of about 14% each) by innovative products, which were new to the market or new to the company. Given the longer duration of technical life cycles half of their sales are generated from products that did not change or changed only slightly since 2004. Apart from SMEs in the high-tech industries, all large technological companies in Liechtenstein were allocated to this type of innovation.

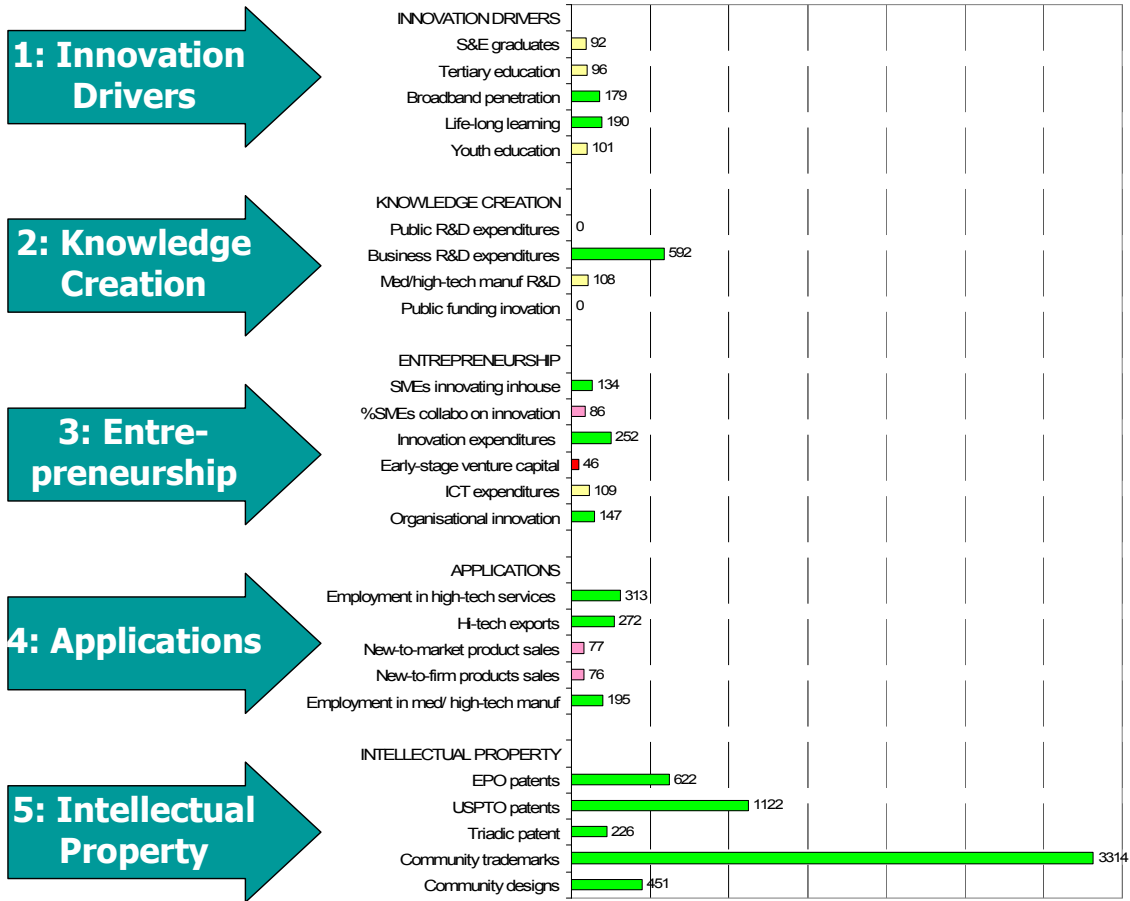
Type 2 companies are young companies in technology-based sectors such as engineering firms, companies dealing with technical, physical and chemical testing as well as technical enterprises specialising in metal-processing and environmental engineering. Their common characteristic is the high share of sales (46.2 %) of products that were new to the market and new to the company (25 %). After market entry these companies try to grow primarily by increasing their range of products. Product improvement is not yet critical to them.

Type 3 companies are characterised by a high percentage of products that have barely changed or have not changed at all. Product improvement is very important to business performance, which is also reflected in high sales of new products. This group includes innovative companies in construction and in more traditional oriented manufacturing business, e.g. printing serving the local and regional market.

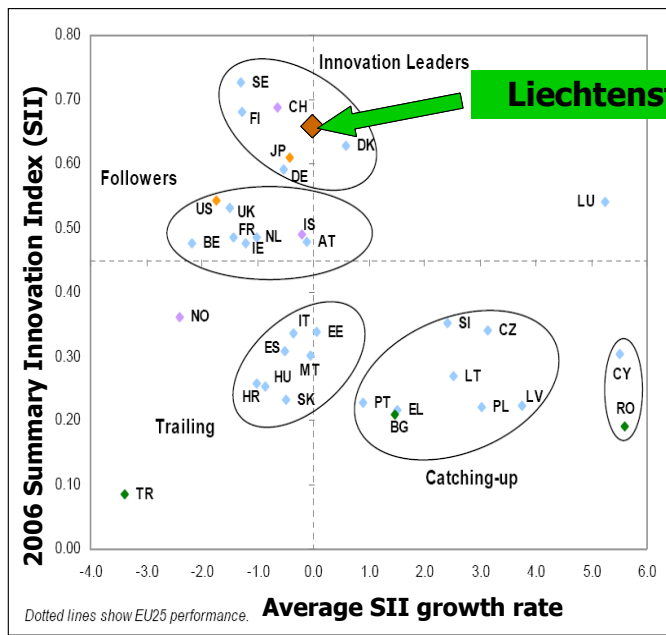
Although innovation indicators of Liechtenstein draw a very positive picture, barriers to innovation are growing in significance and might pose a threat to the future innovation performance. While large companies have little difficulty procuring capital for financing technological innovation, about half of the small and medium-sized enterprises (45 %) find it difficult to secure necessary funds for innovation. Shortages in technical staff and qualified engineers are also posing more and more of a problem to maintain intensive innovation activity. Eventually the lack of public R&D funding in combination with few institutions promoting the transfer of knowledge, technology and best practices at the national level could put pressure on the future innovation performance of Liechtenstein.

Liechtenstein, although a member of the EEA, is not required to supply complete data to Eurostat due to special circumstances related to its small size and population. As a result there are currently no official values for EIS indicators. Based on own research preliminary calculations for 2006 which are presented below in the following exhibits. Please note that Liechtenstein has started to gather standard innovation data and is planning to participate in the EIS as of 2010.

### **Exhibit 3: European Innovation Scoreboard – Preliminary data for Liechtenstein (2006)**



Source: Christian Marx, Institute for Entrepreneurship, University of Liechtenstein



Source: EU Innovation Scoreboard 2006, p. 4, own research

## 1.3 Identified Challenges

The most prominent challenge for Liechtenstein is to assess the need for an explicit innovation policy, its goals and instruments. In the past the general liberal economic policy was instrumental to the economic success. Restrained tax legislation, solid financial policy of public budgets, continuous integration in the EEA and a low level of bureaucracy with fast administrative channels ensured a positive business climate and nurtured entrepreneurial initiatives.

However, findings from the first national innovation survey, from studies by the National Institute for Economic Research and from expert opinions call for further political action amid increasing international competition for innovative firms and talent, financial market failure with respect to corporate finance and a lack of public expenditure on education, science and technology. Implementation of an explicit innovation policy — even if consisting primarily of indirect and horizontal measures — would represent a major turn in national economic policy and would have to be accompanied by building competence, resources and responsibilities in the administration.

Based on the analysis presented above main challenges for a future innovation policy in Liechtenstein can be grouped into three main areas: creating an overall positive climate for innovation, correcting identified barriers to innovation and increasing public expenditure on education, science and innovation. These areas will be discussed in detail in the following paragraphs.

Innovation serves as an important means to corporations to defend their global market position and to expand their growing business in Eastern Europe, Northeast and Southeast Asia and China. In face of increased competition and cost pressure, corporations in Liechtenstein will continue to put high emphasis on innovation and R&D. While in the past the liberal economic policy in combination with comparatively low taxation were instrumental in supporting their innovation activities, recent developments are counteracting these measures. In consideration of taxes, high tech corporations are currently offered very attractive financial packages by other federal Governments in Europe for building new production sites or moving service and R&D capacity. In contrast to being generously welcomed to these other regions, corporations are often confronted with local considerations or even protest against further expansion of their sites as land is very scarce in Liechtenstein. Environmental concerns are another reason for objecting further local expansion.

As financial services have been progressively marketing their services internationally, Liechtenstein has grown an international reputation of banking centre and tax haven. This image has increasingly reflected also on the national population resulting in little knowledge about corporate innovation activities, career opportunities in the manufacturing sector and more generally the importance of industry to national wealth and economic growth. Finally, industrial companies suffered collateral damages from the past financial scandals both in image and business practice. In the most drastic cases, international clients restrict their commercial transactions to accounts outside of Liechtenstein. One of the challenges for policy makers is to create public awareness for the importance of industrial production and more generally for innovative activities in Liechtenstein. In addition, innovation policy should target international audiences to market Liechtenstein as an attractive location for founding new business.

Correction of hampering factors to innovation poses another main challenge for innovation policies. Barriers to innovation have been identified by the first national innovation survey in 2007, studies by the National Institute for Economic Research (KOFEL) and a series of expert interviews with representatives from research, industry, general and financial services. First, an increasing shortage of qualified labour supply in engineering disciplines and managerial leadership puts pressure on corporate innovation activity. While large corporations can overcome shortages in qualified staff by offering higher wages and managerial development plans, SMEs find it difficult to fill in open positions. Second, financial markets are failing to procure potential founders as well as young and growing companies with necessary funds. Market failure occurs because of the small size of the country that hinders the establishment of venture funds. Furthermore, financial institutions in Liechtenstein strongly specialise in private wealth management with little incentive nor competence to offer solutions for

corporate finance. In consequence, there is almost no innovation in the financial market in the area of corporate finance and cost for credits and loans are prohibitively high. Constraints in financing innovation are intensified by a lack of financial management skills in SMEs, especially in the technological area, the absence of any public schemes to support corporate finance and traditional values by family owned business rejecting risk capital or mezzanine funding schemes. Third, the low intensity of knowledge and technology transfer in combination with the absence of any dedicated national institution, instrument or agency to promote networking prevent positive spill-over effects and limit the use of the national science and technology knowledge base.

Finally, comparatively low public expenditure on education, science and innovation in combination with soft factors such as a lack in urbanity and social openness could have a long term negative impact on the overall national innovation performance. In education, low public expenditure can be explained by the small size of the country and a strategy of free riding that worked during the past few decades.

One inherent risk to this strategy that might become more critical in the future is the high dependency on strategic decisions of neighbouring countries. Currently, Austria and Switzerland are in a process of evaluating their federal organisation of education and research facilities. The neighbouring Swiss canton of St. Gallen is especially assessing strategic options concerning the Interstate University of Applied Sciences of Technology Buchs NTB, which is one of the most important educational facilities in supplying the Liechtenstein labour market with engineers. Possible strengthening of the facilities in St. Gallen or the wider agglomeration of Zurich would put further pressure on the labour market in Liechtenstein and drain talent from the country.

Another risk is the lack of public R&D expenditure. As more industrial corporations need to have their R&D capacity close to production and marketing in target regions, they might shift R&D abroad. A sensitivity analysis of the national R&D quota shows that any further shifts would have significant effects on the national innovation performance. If three large companies shifted another 15 % of their R&D to already existing research locations abroad, the national R&D quota would be pushed down to about 3.7 %. If one of the most intensive R&D corporations would transfer all R&D abroad, the national R&D quota would drop immediately to 2.7 %.

The lack of public R&D funding can be largely explained by the traditionally liberal economic policy of Liechtenstein refraining from any form of state intervention. Because of the positive correlations portrayed of regional economic growth and R&D in high technology, innovation policy should target at a constant increase at public R&D expenditure. One of the most critical challenges in this respect is the formulation of a long term strategy to promote science and experimental R&D in Liechtenstein. Furthermore, innovation policy should contribute to the formation of human capital in entrepreneurship, corporate financial management and engineering to avoid an exodus of talent due to a lack of educational institutions in the country or region, and to attract excellent scientific personnel to the existing organisations.

#### Exhibit 4: Main innovation policy challenges

Description of challenge	Relevant indicators and trends
1. Improving access of SME to capital for financing innovation	Indicators to track improvements are number and volume of loans granted to innovative SME, number of enrolment in financial management or hiring of financial managers by SME and early-stage venture capital (% of GDP)
2. Intensifying local knowledge and technology transfer for a better use of the national science base	Indicators to track improvements are number of transfer projects conducted by existing institutions and the progress in establishing a national institution and further programs for such activities; indicators that are linked to activities in this area could be SME using non-technological change (% of all SME) and indicators covering intellectual property
3. Increasing public expenditure on education, science and innovation including R&D	Main indicator to track improvements are overall public expenditure on education, R&D and other forms of innovation (% of GDP), EIS innovation drivers and share of enterprise receiving public funding for

	innovation
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Choice of challenges was based on prioritisation according to estimated impact on long term dynamics of the national innovation system in Liechtenstein and potential contribution to reach public R&D spending of 1 % of GDP as recommended by the Lisbon Reform.

## 2. Innovation Governance and Policies: Key Trends in Structures and Performance

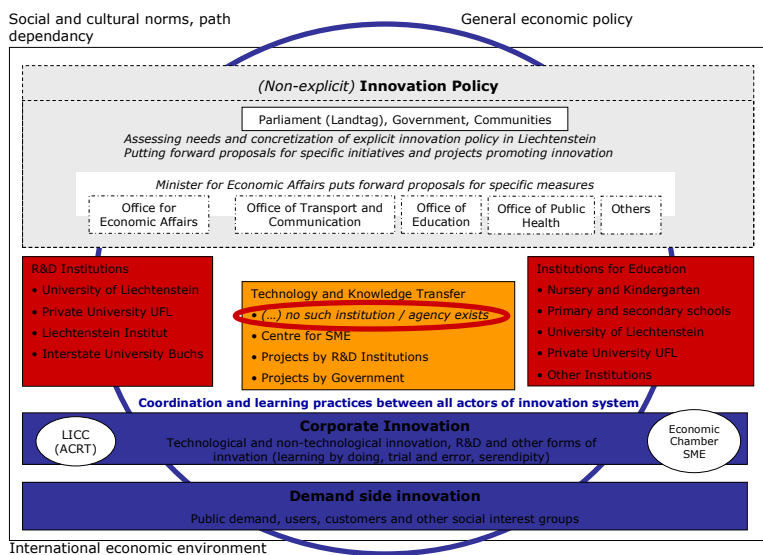
### 2.1 The National Innovation Governance System: an Appraisal

The main function of the Parliament (Landtag) is legislation. In addition to the consent of Parliament, the validity of a law requires the sanction of the Reigning Prince and the countersignature of the Prime Minister. The authority of Parliament also includes the right to nominate the Government, which is appointed by mutual agreement of the Reigning Prince and Parliament. The Parliament also exercises fiscal authority and supervises national administration including justice. The Government of the Principality of Liechtenstein is collegial. It consists of the Prime Minister and four Ministers. They are appointed by the Reigning Prince on recommendation of Parliament. All important issues are subject to the consultation and decision of the collegial Government. The Government portfolios are distributed among the Ministers.

General economic policy in Liechtenstein is managed by the Minister of Economic Affairs. The Minister drafts proposals on a consensus base between all involved supporting Offices. Any proposal of the Minister of Economic Affairs is considered by the Government and subsequently presented to the Parliament after a public hearing. After the final decision by the Parliament, the approved measures are implemented by the Government and managed by supporting offices. In considering economic measures promoting innovation, the Minister of Economic Affairs consults also with representatives from the industry.

On the one hand, the Advisory Council for Research and Technology (ACRT) that was founded in 1989 as an innovation circle of the Liechtenstein Chamber of Commerce and Industry (LCCI). The responsibility of the ACRT is to provide important research and technology information to the LCCI and the Government. Its objective is to improve the basis for decision-making relating to technology policy. The ACRT promotes contacts and exchanges of experience in research and technology between scientists and businesses. General questions concerning education and the recruitment of qualified specialists are also an important topic for the Advisory Council for Research and Technology. On the other hand, needs and concerns of the SME are represented by the Economic Chamber for SME. Experts from research institutions are a further point of contact for analysis and consultation. The following exhibit summarises the governance structure and illustrates the national innovation system of Liechtenstein.

## Exhibit 5: National Innovation System Liechtenstein



### 2.1.1 Main changes in the national governance system

There have been no changes in the national governance system since the last report of 2006.

### 2.1.2 Main changes in the regional governance system

Due to the small size of the country there is neither a regional governance system nor is Liechtenstein integrated into any wider political and economic region as defined by the European Union or other regional initiatives or programs. Although the Rhine Valley is often portrayed as a region uniting the federal country of Vorarlberg (Austria), Liechtenstein and the cantons of Graubünden and St. Gallen (Switzerland), there are no supranational institutions representing or common policy programs operated by this geographical region.

## 2.2 Focus and Trends of National and Regional Innovation Policies

### 2.2.1 The innovation policy mix

As pointed out earlier, Liechtenstein has no explicit innovation policy and lacks any direct instruments. However, the general economic policy is nurturing innovation activity by low levels of regulation, bureaucracy and taxation. With the further specialisation of the University of Liechtenstein in the areas of Entrepreneurship, Banking&Finance and Architecture, the Government is promoting the formation of entrepreneurial, managerial and creative skills.

The ratification of the Kyoto Protocol on Climate Change in 2004 will also have some impact on innovation activity. Liechtenstein has committed to achieving a reduction of greenhouse gas emissions by 8 % (2012) relative to the baseline year of 1990. In striving to meet this goal, the Government has introduced energy controlling for state buildings and mobility management for the National Administration. In addition, financial incentives and new quality standards were put in place for promoting private investment in solar collectors, in alternative sources for heating such as wood pellets and in natural gas as a fuel. By structuring the motor vehicle tax according to ecological criteria, a first measure was taken to raise awareness and promote technological development in the fields of energy and transportation. With respect to trading emission credits, the Government has committed to purchasing credits only if the selling state has committed to investing the revenue in sustainable national environmental projects.

Besides these more general economic policy measures, the Government has funded important projects and initiatives to enhance business and innovation activity in SME. In total public expenditure for such policy measures totalled nearly CHF 1.5 million in 2007. Some of these initiatives are highlighted below.

- Promotion and expansion of the Competence Centre for SME (KMU-Zentrum) affiliated with the University of Liechtenstein. Responsibilities of the centre include advising young entrepreneurs, coaching self-employed persons, and economic and trend research. The centre also acts as consultant to the legislative body and constitutes an important interface between SME and science.
- Funding and organisation of the National Business Plan Competition. Since 2004, this competition has been carried out on an annual basis in cooperation with academic and financial partners in Liechtenstein, Austria and Switzerland. In total about 180 business plans were submitted resulting in 54 business establishments and an estimated 250 new employment opportunities in Liechtenstein and her border region since 2004.
- Funding and implementation of special projects aiming at increasing creative potential and increasing entrepreneurial skills of young people (see also section 2.2.4).

## 2.2.2 New or significantly changed innovation policy measures

The most striking change in general economic policy is that the Government has started a series of studies and expert consultations to assess needs and strategic options for an explicit national innovation policy. Measures with respect to this ambition can be summarised as follows:

- Establishment of a national contact point for FP7 program support and cooperation with the Swiss national contact point EURResearch to promote participation in FP7;
- Funding and implementation of the first National Innovation Survey in 2007;
- Funding and implementation of various studies on structural change, education system, health system, needs of SME and strategic political options for promoting science and innovation in Liechtenstein;
- Funding and implementation of international comparison of national innovation policies in small states and in countries characterised as innovation leaders;
- Implementation of the project „perspektive 11eins“ (perspective 11one) with the goal to coordinate economic policy of the state with economic initiatives of the 11 communities of Liechtenstein;
- Considering participation in the Community Innovation Survey (CIS) 2009.

Based on findings from these studies, the Government has entered into drafting proposals that will be presented to Parliament in late 2008. Topics of discussions will be the formulation and implementation of an explicit innovation policy targeting at correcting market failure and identified innovation barriers. Possible instruments under debate are an increase in financial and innovation oriented services to SME and financial incentives to banks for granting loans and mezzanine capital to innovative firms. Promotion of participation in the guarantee programs of the European Investment Fund is also being considered. In order to intensify knowledge and technology transfer, the Government is evaluating the establishment of a national innovation centre in close cooperation with the Interstate University of Applied Sciences in Buchs (NTB), the University of Liechtenstein and national innovation intensive industrial partners. Finally, the Government is elaborating a long term strategy for promoting innovation and science. However, no decisions have been made and no timeframe for such decision making process has been published.

### Exhibit 6: New Innovation Policy Support Measures

IPM N°	Title	Innovation policy framework category	Organisation responsible
LIE_01	Establishment of national contact point/cooperation with EURResearch	R&D	Office of Economic Affairs
LIE_02	Creation of national innovation data base		Office of Economic Affairs, National Institute for Economic Research, Institute for Entrepreneurship of the University of

			Liechtenstein
LIE_03	Assessment of strategic options and needs in innovation policy		Parliament, Office of Economic Affairs

### 2.2.3 Trends in innovation policy at regional level

Not applicable (see section 2.1.2)

### 2.2.4 Focus sub-theme: policies in support of creativity and innovation

Governments and regional authorities in several countries see creativity as an important driver for increased competitiveness and growth. The need for policies in support of creativity is also perceived as crucial in this regard. In many countries, there are programmes set up specifically to promote creativity and innovation. Such programmes may be carried out by existing actors (for example a Government agency), or new actors may be set up to run them. This year's theme will provide an overview and analysis of the existing mix of policies in support of creativity and innovation and programmes in Liechtenstein.

In Liechtenstein efforts to unleash creative sources are undertaken in the following areas. First, the Government is funding initiatives to foster creativity and entrepreneurship among children and youth. In particular these measures comprise the Children's University Liechtenstein that offers children between the age of 8 and 12 years the opportunity to be inspired by the world of science. Lectures are designed especially to interact with children and nurture their curiosity to explore both everyday and extraordinary questions in relation to science, for example why and how electricity works. Together with the Equal Opportunity Commission of the University of Liechtenstein, parallel events are hosted for adults who bring their girls and boys to Children's University lectures. Adults are given the opportunity to learn more on the topics of education and social issues.

The university also offers childcare services for accompanying children between the ages of 3 and 7 during the events. Another initiative is the program 'Youth Entrepreneurship' that aims at empowering teachers and other staff at all educational institutions to train entrepreneurial skills and ambitions with their own students aged between 15 and 20 years in Liechtenstein, Austria and Switzerland. Currently the project provides teaching materials and professional training supported by web-based information and instructions for experience based and action oriented learning ([www.youth-entrepreneurship.li](http://www.youth-entrepreneurship.li)) The website also serves as an information platform for events, best-practice projects and literature. The project was launched in January 2008 and will be further developed on an ongoing basis. Cost is shared between the state and the Institute for Entrepreneurship of the University of Liechtenstein.

Second, the Government is co-sponsoring a research project at the University of Liechtenstein to investigate new indicators for capturing user innovation and to derive recommendations for policy from new empirical insights into user and distributed innovation. An increasing number of empirical studies at the firm level show that cooperation with users in the process of innovation seems to produce commercially highly attractive products (cf. von Hippel 1986 and 2005). However, despite the portrayed benefits from user and open innovation (cf. Chesbrough 2003) only a limited number of corporations have implemented methods to systematically integrate users in their innovation process. Also there is a lack of aggregated data to assess the impact of user innovation on industries and the national innovation performance. One of the promises of intensified user — producer interaction is an improvement in innovation efficiency as creativity and demand of users are being propelled. The ultimate goal of this research project that is scheduled from 2007 to 2010 is to learn how user — producer interaction could be measured at an aggregated level for reasons of policy formulation.

## 2.3 Innovation Policy and Competitiveness: Main Conclusions

### 2.3.1 How well does policy respond to innovation challenges?

Indicators for knowledge creation, innovation and entrepreneurship as well as application and intellectual property suggest a very strong national innovation performance of Liechtenstein. According to data from the first national innovation survey, Liechtenstein can be ranked among the top innovation performers of Europe. The lack of an explicit innovation policy in Liechtenstein has been counteracted by the general positive economic setting and a successful strategy of free riding on predominantly Swiss, Austrian and German public expenditure on education and science. In the past, general economic policy measures have thus been responding effectively to innovation challenges. However, the policy measures in place might not be sufficient to work against negative trends and factors hampering innovative activity laid out in section 1.3. Without further policy measures these trends might jeopardise the positive dynamics of the existing national innovation system (see following exhibit).

**Exhibit 7:** Summary table: innovation challenges, policy responses and impact

Challenge	Relevance of policy response	Evidence of impact
Improving access of SME to capital for financing innovation	1	3
Intensifying local knowledge and technology transfer	1	3
Increasing public expenditure on education, science and innovation	2	3

Policy response ranking scored from 1 to 5: (1) No specific measures addressing the challenge (possibly a debate but no evidence of any real policy development); (2) Policy development under way to respond to challenge (policy debate or design launched, e.g. announced in National Lisbon Reform Plan, etc.); (3) Specific measures existing for some time but insufficient to respond fully to challenge; (4) Existing measure plus one or more newly launched measures (during last 18 months); (5) A comprehensive set of measures which potentially responds fully to the challenge.

Evidence of impact scored from 1 to 5: 1. Trend for indicators has worsened since measure(s) introduced; 2. No observable change in trend since measure(s) introduced; 3. Too early to appraise (measures introduced in last 24 months); 4. Trend for indicators has improved since measure(s) introduced; 5. Evaluation or study indicates measure(s) has clearly contributed to improving performance of country.

### 2.3.2 Lessons learned from policy evaluation and good practice

Policy measures aimed at promoting business and innovation activity are subject to the controlling system of the national budget. State officials responsible for managing approved measures have to give an account on the project budget, progress and results. As policy measures do not form part of a broader innovation policy agenda, these project based evaluations primarily serve for financial controlling of the national budget. Learning is achieved by carrying out the project and designing next steps procedures or follow-up projects.

A possible best practice is the implementation of the National Business Plan Competition because of continuous evaluation, longevity and economic impact. According to the latest evaluation carried out by the Centre for SME the competition has led to the creation of more than 50 new businesses mostly in medium to high technology industries with nearly 250 new jobs. The competition has also raised positive feedback from bank officials. According to their statements, the competition has increased both awareness and ability to present a professional business plan as a prerequisite for requesting a loan or other means of corporate finance.

### 2.3.3 Possible orientations for future policy actions

Calls for an explicit innovation policy in Liechtenstein are mainly grounded on increasing international competition between countries and regions for innovative talent and firms, increasing barriers to innovation in Liechtenstein and risks inherent to the strategy of free riding, especially in the area of education and science. The formulation of an explicit innovation policy in Liechtenstein should build

upon the past success in combination with experiences and good practices observed in other small and innovation intensive countries like Ireland, Luxembourg and Denmark. Taking into account the high heterogeneity of the industrial base and the small size of the country, Liechtenstein also does not seem to be apt for a high degree of specialisation in promoting science and innovation. High degrees of specialisation versus the implementation of horizontal programs and functionally oriented instruments could easily lead to distortion of competition. High degrees of specialisation would also incur high cost in implementing, operating and evaluating innovation policy measures. The policy making process should foresee consultation of external experts, cooperation with international partners in science and creativity, and should be based to a large extent on evidence based good practice and the results of evaluations and reviews.

Liechtenstein has the potential to establish an interesting case study for small states and regions to establish new solutions for governance, institutional settings and policy learning practices based on the experiences from other nations since the early 1980s. Analysis of the future path of Liechtenstein could provide fresh insight into the emerging third generation of innovation policy and how governments are striving to make innovation policy more coherent.

Because of national elections in March 2009 there might be a hold of major political decisions and long term financial commitments until the formation of the new Government.

### **3. Thematic Focus: Support for Innovative Start-ups, including Gazelles**

Innovative start-ups are seen as important vehicles for economic growth. Without business conditions that facilitate the creation of business start-ups, the contribution of investment in science and technology to innovation and growth will remain limited. New technology-based firms are significant employers of scientific and engineering personnel and key actors in the innovation process. These conditions may include well-functioning venture capital markets, regulatory reform to enable greater entry and exit and a business climate stimulating risk taking in the creation of new innovative firms.

In this section we are therefore investigating the role of policies to support innovative start ups in the national innovation system.

#### **3.1 General Framework Condition for Innovative Start-ups**

Low levels of regulation and taxation create a general positive business climate for business and make the establishment of new firms comparatively easy and inexpensive.

In contrast to these favourable conditions innovative start-ups are confronted with specific hurdles in comparison to other European countries. Access to capital poses a great problem to start-ups and rapidly growing firms, which in Liechtenstein is aggravated by the strong specialisation of financial institutions in Liechtenstein on private wealth management. There are also no public programs or private-public partnerships to provide seed money or risk capital during the early stage of the life cycle. In comparison to neighbouring states of Austria and Switzerland, Liechtenstein also does not offer any institution, agency or platform for organising networking events between investors, providers of technology, founders and other interested parties. There is also no centre or institution that offers shared general services to innovative start-ups or provisioning technical infrastructure or equipment for common use at preferential rates.

#### **3.2 Specific Policies and Programmes for Innovative Start-ups**

There are no specific policies or programmes aimed at innovative start-ups with the exception of the National Business Plan Competition (see section 2.2.1) and personal coaching offered by experts of the Centre for SME.

#### **3.3 Integration with other Competitiveness Policies**

N/A.

## Annex: Sources of further information

### Annex 1: Websites of key innovation organisations

<http://www.hilti.com/>  
<http://www.ivoclar.com/>  
<http://www.oerlikon.com/>  
<http://www.thyssenkrupp-presta.com/>  
<http://www.hilcona.com>  
<http://www.ospelt.com>  
<http://www.hoval.com>  
<http://www.neutrik.com>  
<http://www.kaiser.li/>  
<http://www.inficon.com>  
<http://www.umicore.com>  
<http://www.nti-audio.com/>  
<http://www.pantec.com/>  
<http://www.risch.ch/>

(and many other SME in high-tech and knowledge intensive industries)

<http://www.hochschule.li/>  
<http://www.ntb.ch/>

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