Experiments in research policy

Iceland, with its free-market approach to funding basic research in the natural sciences, may be an interesting testing ground for EU research policies

Iceland is a unique place. The island is a chunk of volcanic rock in the middle of the Northern Atlantic Ocean, and very little of the land is suitable for farming. But the island lies amidst some of the richest fishing grounds in the world that have provided Icelanders with a reliable food source since the first settlement of Scandinavian Vikings in the 9th and 10th centuries. And they have learned to turn the volcanic nature of their country to their advantage: a multitude of hot springs provides geothermal energy for heating and many hydroelectric power stations produce an abundance of electricity used for aluminium smelting.

Icelanders are unique too. Most of today's population of 270 000 are descendants of the early settlers and obsessed with their history. Extensive family records allow the pedigree of most Icelanders to be traced back to the early settlers from whom they stem. In 1996, these records formed the basis of a now growing biotech industry when deCODE was established to use them together with genetic information to identify genes that cause disease. Today, Iceland has 10 biotech companies, two pharmaceutical and another two medical technology companies, some of them world leaders in their specific field.

Iceland is a unique experiment in how to create a knowledge-based economy from a small infrastructure

This recent development of a high-tech industry is common to many small countries. But Iceland is a unique experiment in how to create a knowledge-based economy from a small infrastructure. While countries such as Finland, Ireland or Estonia have used public funds to

invest heavily in basic research and education, the Icelandic government has taken a different approach to make the best use of its resources. The government stresses co-operation of academia with industry, concentrates much of its funds on applied research and contributes a comparatively small share of <50% to the overall money spent on research and development. 'The important thing is not if our own little base is big enough to sustain a biotechnology industry in Iceland, rather the question is whether or not the free market of ideas within the world of science and research remains open,' Björn Bjarnason, the Icelandic Minister of Education, Science and Culture, explained. 'This openness of the free market of ideas [...] is the cornerstone of knowledge-based economies throughout the world.'

This free-market approach makes Iceland pertinent for EC policies that try to find an appropriate balance between basic and applied research. The current trend to strengthen result-orientated research has caused a debate between scientists who see basic research as endangered and politicians who want to reap the economic and social benefits to be gained from new knowledge. The Icelandic approach is therefore interesting for EC policy makers, as it is a purer version of their current research policy. But this strategy has already created a strain on the Icelandic research infrastructure, most notably the University of Iceland. It is no surprise that Icelandic scientists strongly criticise the government, as they feel that basic research in the natural sciences is under-supported. 'The infrastructure is not there and it is not funded well enough,' Einar Árnason, Professor of Genetics at the University of Iceland's Department of Biology, said. 'Without it you will not be able to support this

biotech industry.' And his is not a lone voice. 'I would say that basic research is not well supported here,' Gudmundur

The Icelandic strategy has already created a strain on the research infrastructure and is criticised by its scientists

Eggertsson, Professor of Genetics and founder of the department, said. 'It is really bad. [...] I have stopped explaining to people how bad it is because it is so hopeless.' And the scientists blame the government for this failure. 'It is not the problem of money here in Iceland. Iceland is one of the wealthiest countries in the world,' Árnason said. 'The problem is with the government. The government does not understand science very well.' But that is not the way the government sees its role. 'The Icelandic Government has for a number of years implemented policies that have turned our economy from a path towards deep recession and troubles to an economy in growth,' Minister Bjarnason maintained. 'The role of the Government has been limited to creating favourable conditions and climate for these companies by implementing general provisions, and exceptionally to create specific conditions when necessary,' he explained, citing tax policies and close co-operation between public institutes and the private sector as examples.

Indeed, Iceland has undergone dramatic changes over the last decade towards a knowledge-based high-tech economy. Historically, the country's largest source of income came from the export of fish and fish products and later from the processing of aluminium, with the EU and the USA being Iceland's main trade partners. The biotech industry in Iceland

was virtually single-handedly established by Kári Stefánsson, who, in August 1996, founded deCODE. The company now employs more than 600 people, is still

usually in European countries or the USA. Since the majority usually returned, Iceland has had a steady influx of scientists trained at some of the best universities in

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expanding and has boosted the biotech sector in the country by providing jobs for Icelandic biologists, supporting other biotech start-ups and drawing venture capital to the island.

At the same time, Iceland has made a remarkable recovery from the recession in the 1980s. Economic growth has been stable at 4–5% over the last half of the 1990s—higher than the average growth rate in the EU. And this is reflected in the overall funding for science, as public and private expenditures for research have risen to an estimated 2.5% of GDP in 2000—16.45 billion Icelandic kronur (€180 million). The relative share of fish and fish products in the total Icelandic export income is shrinking, and high-tech exports are on the increase as well as the application of scientific methods for the management of natural resources. '[This] contributes to the stability, which is necessary for companies to invest in their own future, i.e. in research and development,' Bjarnason commented.

The improved economic situation in the 1990s and deCODE's success have greatly contributed to creating the biotech industry. But this success is consuming all of the country's scientists. With its population of only 270 000, finding trained personnel is a larger problem for Iceland than, say, for Finland or Ireland with 5.17 and 3.8 million citizens, respectively. The whole of the University of Iceland has only 7000 students, and fewer than 100 embark on a biology course each year—in 2001, the Department of Biology had a record number of 70 new students. And since the private sector is able to offer more highly paid positions, the number of trained scientists in academia is shrinking since many biological and medical science students are now lured away from the university.

Furthermore, the department did not have a PhD programme until a few years ago, which actually worked to its advantage. To continue their studies, Icelandic biologists were forced to carry out their PhD and postdoctoral training abroad,

the world. But now that many graduate students choose to accept a position in industry, the country's scientific base is gradually diminishing as the number of people willing to work abroad decreases, Eggertsson fears.

This concern is also reflected from the official side. 'There is a lack of skilled people with scientific backgrounds to take on all the qualified positions available at those companies,' Bjarnason

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acknowledged. He therefore wants to see the academic sector train more people with the help of the growing private sector. 'I have urged our universities to make special efforts to attract young people to scientific studies,' he described this strategy. 'Presently the University of Iceland [...] is focusing more than ever on research-based education, including PhD studies. [...] I have underlined the importance of a close co-operation of our universities and public research institutes with the private sector.'

Jakob Kristjánsson, founder and CEO of Prokaria, a company specialising in discovering extremophile organisms, also believes that Iceland's small scientific infrastructure is potentially a matter of concern for industry. 'At some point I

deCODE and other biotech industries contribute to this. 'You may note that deCODE has already recruited about 600 employees of which about 160 are expatriates,' Vilhjálmur Lúdvíksson, Director of the Icelandic Research Council, pointed out. Furthermore, he regards the small size of the government and the informal Icelandic society as an additional attraction for foreign scientists. 'There usually are ways to deal with the specific problems associated with immigration,' Lúdvíksson explained. 'Our system tends to be less bureaucratic and more flexible in the way it deals with these issues.'

But most of the foreign researchers will still go to the biotech industry rather than the university. Although the government thinks that the industry's success will also benefit basic research, Eggertsson prefers the university to remain independent. 'You see that most of the basic research that counts is not done by companies,' he said. 'I would like to see a separation of basic research and company research. I don't like having the university people with one foot in the university and one in the company.' This leaves the ball in the government's court to provide more money for basic research.

And that is not part of their strategy. Even existing funding for basic research in the natural sciences, which would attract foreign scientists, could be better utilised, according to the university's professors. 'The research environment in Iceland is relatively difficult,' Árnason said. 'There is very little money; the foundations are very small.' This is made even more difficult by a bureaucratic application system for grants that must be renewed every year, he added. Furthermore, much of the money spent on research is used to strengthen the country's economic base, most notably research on fishery and agriculture (15% in 1999), health (25%) and

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think we have to import people,' he said. And Kristjánsson remains confident that Iceland's growing biotech industry will attract foreign scientists. 'People are very interested in coming to Iceland and staying a couple of years,' he said, noting that the increasing mobility among young scientists today makes it less of an obstacle to work abroad.

industry (26%). And the university's professors are not alone in thinking that this is an ill-advised strategy. 'I think it is a danger that the government doesn't fund the university doing basic research,' Jórunn Eyfjörð, Head of the Icelandic Cancer Society's Molecular Biology Division, said. She thinks that what is missing is foresight on the government's side.

But Lúdvíksson explained that the expansion of the old Science Fund and the establishment of a new fund in the mid-1980s have already contributed to Iceland's increasing spending on research and development (R&D). Indeed, R&D

Existing funding for basic research could be better utilised according to the university's professors

expenditures increased to an estimated 2.5% in 2000, and so too did the overall amount of money spent on basic research. But at the same time, the government's share decreased. In 1985, the government contributed 44% compared with 11% from the private sector; in 1999, the representative numbers were 32% and 44%. Furthermore, the relative share of the overall R&D expenditures for basic research shrank as well, from 27% in 1985 to 18% in 1999. 'These changes of course call for a reflection of the role of the Government in funding R&D,' Bjarnason, commented. 'We are aiming at focusing the public engagement in fundamental research and research training of young scientists and leaving the development more to the companies and venture capital,' he added. And he is sure that Iceland will be able to meet these challenges. 'I am confident that we will manage to sustain a fairly broad scientific base in Iceland, and [...] that Icelandic scientists will also be able to contribute to the pool of knowledge,' Bjarnason explained.

Indeed, if judged by their publications, Iceland's researchers are performing well in the fields of medicine, the geosciences and the humanities, Lúdvíksson stressed. Furthermore, he pointed to the success of

Iceland's researchers in applying for EU grants—45% of applications were successful under the 4th Framework Programme and 35% under the 5th Framework Programme since the country started participating in the EC's programmes. But Iceland's scientists find it difficult to fulfil the various requirements for EU grants. 'The problem with the EU is that you have to find different countries [to co-operate with] and that it has to have this social component,' Árnason said. He therefore thinks that the money contributed to the EU could be better spent on basic research in Iceland.

To attract foreign scientists, one also needs facilities, Árnason pointed out. And the university's facilities are not very attractive. The Department of Biology is situated in a rented building in a commercial area in Western Reykjavik that has been a temporary solution since its creation in the late 1960s. Laboratory and office space is scarce, and some professors have their offices in small cramped rooms that barely hold their accumulated literature. Much of the department's equipment is old and sometimes even outdated compared with many laboratories in the USA and other European countries. Although the university is building new facilities at its main campus to house the natural sciences, progress is slow, as much of the funding is dependent on revenues from a university-run public lottery. And as the funds are mainly used for construction, little remains for buying new equipment.

But Bjarnason thinks that the lottery money is actually an advantage. 'It is unfair to pretend that the University Lottery has not been of great benefit for the university,' he said replying to this criticism. It rather reflects the government's standpoint that more intervention into and oversight of the university is not

acceptable. 'The lottery has contributed greatly to underpin the independence of the University of Iceland, including its autonomy concerning setting priorities when it comes to building activities,' Bjarnason maintained. This independence also leaves the university free to seek co-operation with private investors to fund and construct new buildings at the university campus. 'These new buildings will be used jointly by the companies concerned and university institutions [...] and the ownership will gradually be trans-

'If you are doing things on a small scale, you have to do better than the average'

ferred to the university as the investment pays off,' Bjarnason described the scheme.

For a small country the challenges of establishing a knowledge-based society are indeed great. Fewer people in Iceland study science and, with a smaller GDP, the amount of funding for research and development is relatively low even if its share of GDP is higher than in other countries. 'If you are doing things on a small scale, you have to do better than the average,' Eyfjörd said in describing the challenge. It is thus an interesting experiment to see whether the Icelandic government, with its emphasis on applied research and free-market policies to research, will succeed. On the other hand, the high quality of the scientists and the specific social conditions of the Icelandic people might turn out to be special assets. 'Maybe we can survive by being different,' Eyfjörd said.

Holger Breithaupt

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