# CHAPTER

# Innovation and Wealth Creation

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## INTRODUCTION

Over the years there has been enough evidence of a correlation between scientific achievements and the well-being of nations and regions. Places with strong economies produce remarkable scientific achievements. The other way around, scientific progress often gave rise to industrial and military strength which created and maintained strong economies. It is, therefore, tempting to equate thus: Science = Wealth. This is a good reason for scientists in every region to demand and expect more resources with a vague promise that eventually the stakeholders will be paid back directly or indirectly. For example, there is a current debate about the Lisbon goals in the E.U. and the lack of progress in implementing them.

In our view, Science is definitely interesting, but not necessarily lucrative. It is true that strong economies have outstanding Science. It would have been surprising otherwise. People who can afford it develop intellectual curiosity which eventually is channelled to the Arts, Music and, why not, Science. It is also true that some, though not all, scientific results can produce unique opportunities for enrichment. The problem is to predict which ones. The temptation is to pump enough money into Science and hope that statistically and eventually there will be a huge payback. That approach fits well the interests of scientists, but unfortunately not finance directors and finance ministers.

To improve the success rate of the investment in Science one can concentrate efforts in specific areas. Over the years the "hot areas" are redefined, with a current emphasis on Info/Bio/Nano. There is always a large effort to pinpoint the most promising areas in scientific programmes which eventually guide the distribution of resources. That approach is in itself too static to be successful. First, during the execution of research programmes, prospects can

change dramatically. Second, scientists are very clever and they relabel rather than reinvent their efforts. Third, the definition of what is "hot" is very subjective, and is influenced by the people who are themselves beneficiaries. In short, the Research Programme definition process is time-consuming and has limited success. It is better than random choice, but far from efficient.

To really be efficient we need to link scientific effort with economic activity. That Scientific Innovation = Wealth Creation is not controversial. Everybody believes that when science is applied to real world problems, then there are economic benefits. The goal is uniformly accepted. Scientists love to see their results work in practice. Alternatively, industrial activity draws decisive advantages from specific scientific results. It leaves us with the problem of organization and implementation. Mount Everest is known and visible. The difficulty is to find the way to the top. We will call the way of achieving wealth creation by scientific innovation simply Innovation. This problem is not new. History has many successful examples of enlightened leaders who through scientific achievements became rich and powerful.

The issue of Innovation has become very actual lately mainly for three reasons. First, Science has become much more expensive. It is normal that stakeholders want value for money. Second, timing is critical. There is ferocious competition for economic advantage which translates into time pressure to produce and exploit results. Third, globalization allows transfers of capital, know-how and people. It becomes important to reap the benefits locally and not give them away to potential competitors.

In the rest of the paper we will sketch different ways to Innovation and explore their relative advantages. In the whole discussion we should not forget: The goal is to create wealth, not only to advance Science.

## THE RESEARCH UNIVERSITY MODEL

The most traditional and well accepted model for Innovation is through people. When students in universities are well educated in the most modern, advanced methods and techniques, they in turn bring the necessary Innovation to the economy. This gave rise to the linking of research and education and the role of the university professor as a truly independent thinker in the modern research university. The goal of such a university is always to produce well educated people. Research, and especially its application to the economy, are important funding opportunities, but are often considered secondary.

This Innovation model has three problems. First it does not scale easily. In many countries there is an effort to produce more well trained people by increasing the number of students and/or increasing the number of universities. This approach has many shortcomings. Elite universities cannot grow indefinitely, nor be established overnight. Second, it takes too long for

progress in Science to be introduced in educational programmes and then for the trained people to find their way in the economy. Third, educated people are becoming very mobile. They will go to work where they can optimise their own personal and professional life. This, in turn, creates long-term opportunities for a region if they come back. Short and medium term, the costs are real and the benefits virtual.

We do believe in the important role of elite universities. Educating the best people is necessary for Innovation. We believe, nevertheless, that it is not sufficient. We sometimes see the phenomenon that regions can chronically lack in Innovation, although they still retain a high level of university education. Educating the best students does not imply Innovation.

## THE RESEARCH CENTRE MODEL

To focus and accelerate Innovation in specific areas, countries and companies have created research centres. In this way, experienced and talented scientists can get together and share knowledge and infrastructure in specific, well defined areas. The research centre model works analogous to cooking:

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| 1) Get excellent people | (the best ingredients); |
| 2) Give them what they need | (prepare); |
| 3) Provide local/global competition | (heat); |
| 4) Monitor and focus | (cook); |
| 5) Disseminate widely | (serve). |

It is clear that such a model produces the best scientific research and usually the best results. It is not clear, however, that these results have any direct relation to Innovation. First, there is often a mismatch between produced results and exploitation potential, especially locally. Second, research centres are often concentrated thematically. It is difficult to combine different scientific areas to bring to bear on real world problems. Third, technology transfer is notoriously difficult. Excellent scientists want to talk to other excellent scientists and not to unwashed company developers.

We do not argue against research centres. We believe that excellent research centres are a necessary condition for Innovation. They are not, however, sufficient. Doing first-class research does not imply Innovation.

## THE TURBO MODEL

Most countries already have a university and a research centre infrastructure. To achieve Innovation there is the temptation to use it as a platform to pump in a tremendous amount of money. This model works in the following steps.

1) Focus on specific areas.
2) Hire the best research management talent.
3) Network with the best worldwide.
4) Invest in extravagant infrastructure.
5) Get the best young people worldwide.
6) Overspend for a sustainable period.

This results in extraordinary achievements within a short time. In addition, a brand name is obtained, which is necessary to attract further excellent people. The costs, however, are also extraordinary.

The problem with such an approach is its inherent instability. When the interest of the stakeholders wanes, whether companies or countries, things turn around. A short period of under-investment or disinterest results in undermining the whole effort. The best people are also the most mobile. The real difficulty is nevertheless technology transfer. Excellent researchers, well funded in universities and research centres, become very arrogant. They are pushing for Nobel prizes and they consider any other activity very marginal. Innovation requires long hours of field work and there is nobody willing or able to undertake it.

The turbo model works like a hotrod car. It accelerates fast in a straight line, but cannot take curves and it does not win races.

## THE FORMULA 1 MODEL

To achieve Innovation a more global, all encompassing, approach is needed. Most of the preceding models are preconditions. We need a strong elitist university system. We need excellent visible research centres. We need to turbocharge the university and research infrastructure to achieve brand name and global reach. In addition, we need a whole series of other very important steps:

1) We need to finance cooperative projects between industry and research. In this way we strengthen the existing national champions.
2) We need to create clusters between universities, research centres and companies large and small.
3) We need to actively manage IPRs and put the accent on exploitation.
4) We need to finance new ventures and start-ups with seed capital.
5) We need to promote innovative markets with national programmes.
6) We need to give tax breaks for venture capital to attract risk-taking investors.
7) We need to help exit strategies in terms of IPOs and trade sales for investors.
8) We need flexible bankrupt laws to protect small entrepreneurs.
9) We need to attract international investors.

10) We need media coverage that we are seriously embarking in a new direction to obtain local support and global interest.

We claim that without an all-round strategy we cannot win. This is the reason that we call it the Formula-1 Model. It is not about having the best motor, or best tyres, or best aerodynamics. It is about having the whole car performing. If one link in the innovation chain is weak, the whole thing does not work.

There are examples of countries and regions that have achieved this model. The areas of intervention are known. The difficulty is to match them to local conditions. One cannot imitate Silicon Valley. One has to create its own version. There are already many developed countries committed to intensifying their efforts for Innovation, e.g., Sweden, Finland, Germany, Singapore or France. They are using mainly two instruments: agencies and institutions. Here we present two examples, Vinnova as agency and Fraunhofer as institution.

## Example 1: The Swedish Agency Vinnova (www.vinnova.se)

Scandinavian innovative action was determined by the question of how to change the whole innovation system efficiently. While modifications in innovation policy, e.g. in Finland, occurred rather incrementally, the innovation structures of the other Nordic countries, especially Sweden, underwent far-reaching changes. However, all activities were affected by the rationale of systemic innovation.

The most obvious effect of this change in Sweden was the establishment of the Swedish Agency for Innovation Systems (VINNOVA) in 2001, which currently has around 150 employees and a total budget of 1 GSEK (€100 million). The goal was to promote sustainable economic growth by developing effective innovation systems in Sweden and by funding problem-oriented research towards the needs of society and industry, primarily at the universities. It is one of the most important agencies of the Swedish Government for financing research.

The system-based approach is the guiding principle for all initiatives. Hence, they address failures in the innovation system, strengthen innovative capacity of Swedish industry and help transform knowledge into technology. The various programmes address national, regional or sectoral innovation system issues.

## Example 2: The Fraunhofer Model in Germany (www.fraunhofer.de)

Most German R & D which is financed by the public sector is conducted by public research institutions, about half of which are universities. Knowledge transfer between Science and Industry is promoted by a highly organized divi-

sion of labour between research institutes, mainly oriented towards basic research and others with an applied research focus. Fraunhofer is the largest organization focused on applied research. It employs roughly 13,000 people in 58 institutes across Germany, and has a R & D-Budget of more than €1 billion. Fraunhofer is active in different fields of technology, e.g. Life Sciences, Information and Communication Technology, Microelectronics, Materials and Components. This broad technological expertise makes Fraunhofer's research particularly strong in cross-section fields. Fraunhofer is run according to a decentralized management concept, in which the otherwise independent institutes share the same basic aims and a common organizational structure.

Fraunhofer receives base funding from the public sector (approx. 40%) and contract research earnings (approx. 60%). As a consequence, Fraunhofer operates in a dynamic equilibrium between application-oriented research and innovative development projects. Fraunhofer develops products and processes right up to commercial maturity. Individual solutions are sought in direct contact with its more than 3,000 customers.

Fraunhofer's designated role is to intermediate between business enterprises and science based institutions and facilitate knowledge and technology transfer to industry. The volume of base funding is linked to success in obtaining research contracts from the private and public sector, allowing the institutes to engage in basic research and in technology transfer to private sector enterprises. Because of this infrastructure and corresponding funding schemes, comparatively few enterprises in Germany report a lack of technological knowledge as a factor limiting their innovation activities. SMEs are important customers of Fraunhofer and are simultaneously actors of technology dissemination.

The intensified commitment to innovation of the developed countries is accompanied by many national innovation initiatives which recently have been established with different configurations and goals. For instance, the German innovation initiative intends to increase the awareness within the population and therefore tries to realize different innovative pioneering projects. Even in the U.S. well known experts wrote the report "Innovate America" showing paths to increase innovativeness.

Developing countries also have no good reason to complain and stay out of the Innovation game. There are steps which prepare the ground and eventually enable every dynamic country to participate. As a first step, it is necessary to develop the economy and infrastructure. We need at least the following actions:

1) Bring in manufacturing and service industry with tax laws, low costs.
2) Generate enough economic activity to feed the Innovation chain.
3) Buy some time to upgrade universities and research centres.
4) Become known to the global players.

Later on we need to bootstrap the expertise and join the global innovation activity. This can be achieved by exploiting existing potential. For instance, we need the following actions:

1) Repatriate talent and give benefits for global players to establish R & D locally.
2) Leverage your manufacturing facilities.
3) Get the necessary local/global recognition to attract/keep top talent.
4) Link to the global R & D effort.
5) Get ready for a general mobilisation with Innovation as a goal.

Countries like China and India show very clearly that this path is feasible.

## CONCLUSION

In this paper we made the following points: The benefits of Innovation are well known and accepted (*Everest*). However, to get there you need a careful plan and many years of sustainable efforts (*expedition*). It should be promoted and accepted widely as national goal and kept outside parochial political interests (*you play to win and not to explain failures*). For every region and country the plan has to fit local strengths and weaknesses (*no uniform strategy for everybody*). Getting half way through has no benefits (*reaching halfway up Everest brings nothing*). The whole plan should be visible, known and accepted to the people shouldering the burdens (*role of politics, media*).

We should mention in closing that many countries have already realized the importance of Innovation and are taking appropriate action. This situation puts in turn enormous pressure on the rest. Globalization has created competition and a level playing field for all regions. In a flat world every person or region has chances, but has also the great responsibility to exploit them.