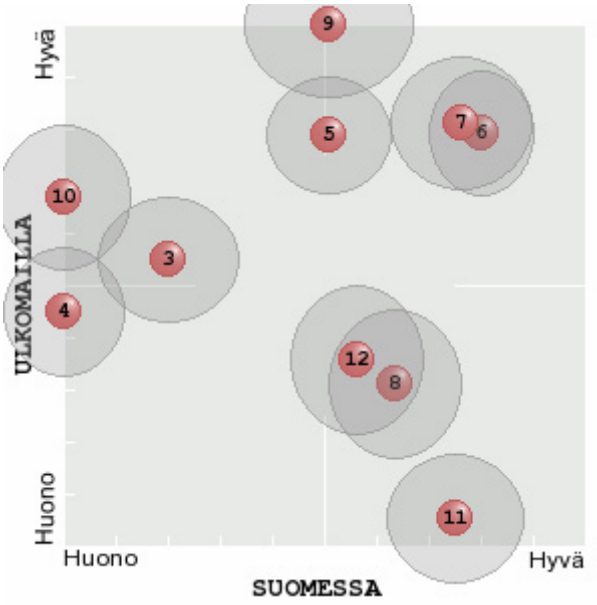

Innovation environment today and tomorrow

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VTT

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ZEF Solutions Ltd

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Innovation environment today and tomorrow

Abstract

VTT has inquired executives' views on the current state and future prospects of Finnish R&D environment. The aim was to get detailed information on, how Finland will confront the globalisation challenges today and in coming years. The division of R&D between domestic and foreign location turned into one of the most significant issues. The CEOs of largest Finnish companies (50) and innovative internationalising SMEs (160) constituted the population of respondents. Total response rate climbed into 49 percent. The study was conducted in co-operation with ZEF Solutions Ltd 29.12.2005–10.1.2006.

According to analysis at the moment 56 percent of Finnish companies R&D investments are made in home country as the amount in six years time will be only 46 percent.

Keywords
innovation environment, current state, future prospects, globalisation, research and development, investments, social factors, personnel, technology factors, economical factors, political factors

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Innovaatioympäristö tänään ja huomenna

Tiivistelmä

VTT on selvittänyt yritysjohtajien näkemyksiä Suomen T&K-ympäristön nykyisestä tilasta ja tulevaisuudesta. Tarkoituksena on saada tarkempaa tietoa siitä, miten Suomi selviää globalisaation haasteista tänään ja tulevaisuudessa. Merkittäväksi nousi ennen kaikkea suomalaisten yritysten tutkimus- ja kehitystyön (T&K) investointien jakaantuminen Suomen ja ulkomaiden välillä. Selvityksen vastaajiksi valittiin toimitusjohtajia liikevaihdoltaan suurimmista suomalaisista yrityksistä (50) ja kansainvälistyvistä innovatiivisista pk-yrityksistä (160). Vastausprosentti oli 49. Selvitys tehtiin yhteistyössä Zef Solutions Oy:n kanssa 29.12.2005–10.1.2006.

Selvityksen mukaan suomalaisten yritysten T&K-investoinneista 56 prosenttia päätyy nykyään kotimaahan, mutta kuuden vuoden päästä osuus on enää vain 46 prosenttia.

Avainsanat
innovation environment, current state, future prospects, globalisation, research and development, investments, social factors, personnel, technology factors, economical factors, political factors

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Preface

VTT Technical Research Centre of Finland has conducted a study on perceptions of the present status and future prospects of the Finnish R&D environment held by Finnish business leaders. The aim was to gain a clearer picture of how Finland will confront the challenges of globalisation today and in the future. The division of R&D investments made by Finnish companies between Finland and foreign countries became a crucial issue. CEOs from Finland's 50 largest (in terms of turnover) companies and 160 innovative internationalising SMEs were surveyed. The response rate was 49%.

Surveys conducted in recent years on the division of R&D investments between Finland and foreign countries show that Finnish companies direct 60% of their R&D investments to Finland (Confederation of Finnish Industries EK, 2004). According to a VTT survey, 56% of the R&D investments made by Finnish companies currently end up in Finland, but within six years that figure is expected to drop to 46%. In 2005 Finnish companies put a total of EUR 3,770 million into R&D investments.

Estimates between corporate segments concerning future developments seem to be even more certain, especially with regard to large corporations. During the next six years, their domestic R&D investments will drop from 63% to 43% – a decrease of roughly 20 percentage points. The situation for SMEs, on the other hand, would seem to stay at roughly the same level, dropping from 53% to 47%.

Both international and Finnish surveys show that R&D investments and economic growth are linked to one another. Culminatively, survey results indicate that the predicted decrease in R&D investments can have a negative impact on economic growth. However, one must keep in mind that survey results are relative. Even if R&D percentages were to decrease in Finland, it does not necessarily mean a reduction in the absolute input made in R&D investments.

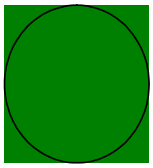
In lieu of a conventional survey approach, this survey applied the new ZEF method, in which CEOs gave an assessment of their company's situation today and in six years based on the points addressed in this publication. The survey was conducted in co-operation with ZEF Solutions Ltd during the period 29 December 2005–10 January 2006.

Contents

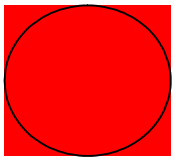
List of symbols

= average of TODAY responses

= average of IN SIX YEARS responses



= average variation of TODAY responses



= average variation of IN SIX YEARS responses

1. Introduction

VTT Technical Research Centre of Finland has conducted a study on perceptions of the present status and future prospects of the Finnish innovation environment held by Finnish business leaders. The aim was to gain a clearer picture of how Finland will confront the challenges of globalisation today and in the future. The survey was conducted using an online questionnaire, for which the CEOs of Finland's 50 largest (in terms of turnover) companies and 160 innovative internationalising SMEs were selected as respondents. The 50 largest companies were selected from the Talouselämä Top 500 list of companies for 2004. Innovative SMEs were selected from the Finnish Innovation Database – Sfinno®. A majority of the SMEs fall under operating areas within the technology industry.

The innovation environment comprehends institutions which, together and individually, contribute to the development and dissemination of new information and new technologies and which comprise a structural and legal framework, on which the government executes policies promoting innovation. The innovation environment consists of structures, actors, reciprocalities and a legally created operating environment. In addition to these, other key elements include an innovation culture, processes that inspire individuals and organisations to create the new, global information channels as well as shared innovation knowledge and interpretative frames of reference. (Hautamäki & Kuusi, 2005.)

The VTT survey was conducted in co-operation with ZEF Solutions Ltd during the period 29 December 2005–10 January 2006. An invitation to participate in the survey was sent out by email on 29 December 2005. Participants were given two weeks to respond to the survey. The first reminder was sent out on 3 January 2006 and the second on 9 January 2006. The response rate was high – 49% – in spite of the survey timing and shortness of the response period.

The questions were divided into two sections: The situation today and the situation in six years. Each section contained thirteen items, one of which was reserved for free-form comments. An effort was made to formulate the items in question using the PEST frame of reference, which describes operating environments.[1] Respondents were asked to evaluate the importance of said items both in Finland and abroad as seen from their own company's perspective. All twelve evaluated items are presented in this publication. All items examined in the survey were gauged using the ZEF analysis.

[1] PEST = Political, Economic, Social and Technological.

The ZEF analysis is a multidimensional, electronic evaluation system developed by ZEF Solutions Ltd. A typical application is the strategic process, in which, for example, SWOT and evaluations are used to examine the present situation from the perspective of various interest groups and, in the second phase, the company vision, mission, goals and measures are assess to map out the future situation. In the evaluation of the present situation the vertical axis represents the situation “abroad” and the horizontal axis the situation “in Finland”. The system calculates a report, in which the average plot of respondent plot points is calculated and a variation ellipse is drawn around it. The report table, which looks like the evaluation table, allows the viewer to see in a single glance which key items are in order and which need improvement. The variation ellipses indicate directly the agreement or disagreement of respondents.

Relative report calculation was used in the ZEF four-field analysis. The relative report is produced by z-scoring as follows: First, the average point for all the respondent’s responses is calculated and then placed in the centre of the response field. Then, the responses are spread evenly over the entire response field, whilst maintaining the original proximal relationships. The relative calculated result is more accurate because it advantages the maximum allowable accuracy for the entire response field.

2. R&D investments and operating area

2.1 Division of R&D investments

The shifting of research and development operations to developing countries, such as China and India, is characteristic of the so-called “third wave” of globalisation. In new business models the various phases of the value chain are outsourced. This is increasingly applicable to research and development as well as other parts further up the value chain. (Hautamäki & Kuusi, 2005.)

According to Statistics Finland, nearly EUR 5.3 billion was spent on research and development in Finland in 2005. Of all research expenditures, the percentage of corporate research expenditures dropped slightly to 70%, but still totalled EUR 3.8 billion. Last year, research and development expenditures accounted for 3.5% of the GDP. A total of 76,700 people were employed in R&D capacities in 2004. (Statistics Finland, 2005.)

According to Statistics Finland, the company survey shows that R&D investments are still considered important and their increase is promoted by, for example, the need for new products and services as well as technological development. Places where research and product development are practised are most heavily affected by the availability of researchers, availability of R&D knowledge and predictability of legislation regulating R&D activities. Labour costs are, in terms of investments, of the least interest. Companies prefer to maintain their R&D operations in their country of domicile. (Statistics Finland, 2005.)

According to data gathered from Confederation of Finnish Industries EK (2004) member companies, just under one-quarter of R&D personnel and less than 40% of R&D investments are in foreign countries. ETLA surveys have also come up with similar figures (Ylä-Anttila, 2004). According to OECD (2001) data, just over 13% of company R&D expenditures are used in foreign units (the difference with EK data indicates the essential differences in data based on different sources). According to OECD (2001) data, the presence of foreign R&D of companies located in Finland is fairly low by international standards. What is noteworthy here, however, is that the foreign R&D portion of Finnish companies experienced rapid growth in the 2000s. (Ylä-Anttila, 2004.) Indeed, this only applies to the metal and electronics industries, which accounts for over 90% of all company R&D operations abroad. Foreign growth indicates not only the need to be close to markets, but also the availability of skilled resources and other factors related to the quality of the innovation environment, not to mention the internationalisation of companies. Large corporations in particular have

enjoyed R&D growth abroad, resulting from R&D units gained through corporate acquisitions.

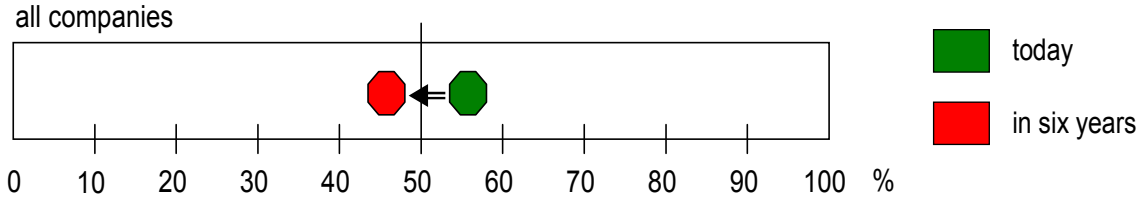


Figure 2.1. R&D investments in Finland today and in six years (all companies).

We asked CEOs to estimate the division of their respective company's R&D investments between Finland and foreign countries. According to the survey, 56% of R&D investments are earmarked for Finland (see Figure 2.1), when examining the average of all companies queried. The figure is thus very close to those arrived at in previous surveys, excluding the OECD survey. The situation is, however, changing very rapidly, based on CEO estimates. In six years there will be a 10% reduction in the amount of R&D investments earmarked for Finland, bring the total to 46%. Consequently, R&D investments will continue to be directed abroad in the future. Thus the trend which R&D investments have followed in recent years will continue. Roughly calculated, this means that if the absolute amount of R&D investments were to remain constant in six years, Finnish companies would then be investing EUR 380 million more in R&D than they do at present. Considering that, according to EU statistics, growth in corporate R&D investments has generally slowed (in Finland also Nokia), the above-mentioned figure could very well be a reality in six years.

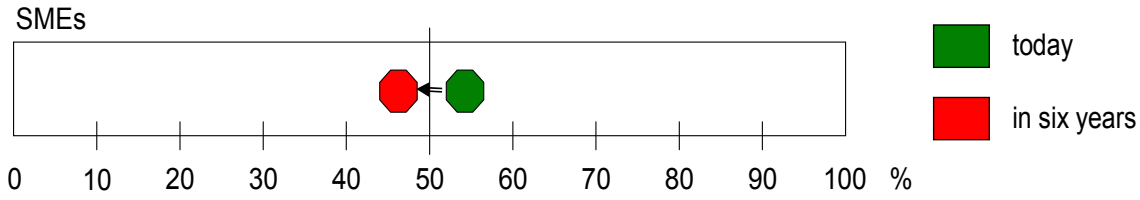


Figure 2.2. R&D investments in Finland today and in six years (SMEs).

When looking at the division of SME R&D investments today and in six years (see Figure 2.2), one can see that the investments earmarked for Finland would decrease from 53% to 47%. This represents a decrease of some six percentage points. This result indicates that SMEs are already investing heavily in R&D abroad. According to free-form comments made, one of the biggest reasons for directing R&D investments outside of Finland was the cost of R&D services there. SMEs quite simply did not have the financial resources to obtain the necessary services in Finland. Indeed, investments have

been increasingly targeted at Eastern European countries, which are considered to have highly skilled human resources and good working environments.

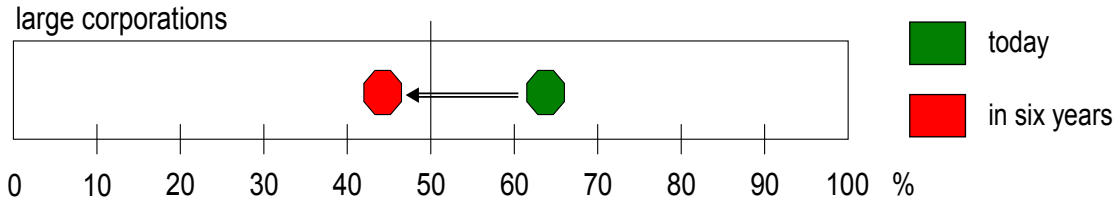


Figure 2.3. R&D investments in Finland today and in six years (large corporations).

The changes in R&D investments seem to be the most dramatic in large corporations (see Figure 2.3). According to the survey, a decrease of 20 percentage points is expected, resulting in a change from 63% to 43%. This trend will have a significant impact on Finnish society as a whole for several reasons: First, when R&D personnel are increasingly hired abroad, tax revenues in Finland are reduced. Second, large corporations usually employ smaller companies, from which they purchase R&D services for their own needs. If the change is in line with the survey results, these small R&D service providers will suffer a major blow to their operations. What might further exacerbate the situation is the fact that, despite the level of high technology, the sale of these services to foreign companies may prove to be extremely difficult. At present, the sale of Finnish R&D services to foreign companies is marginal at best, and no serious efforts to rectify the situation have been made. If large corporations were to purchase their R&D services from foreign service providers, the (third) result might be a decline in R&D investments in Finland. Below is an examination of the relationship between R&D investments and economic growth.

The impact that corporate R&D investments have on economic growth (i.e. growth in productivity) has been estimated using econometric analyses. Studies show that the impact has been a positive one. (Rouvinen, 1999.) According to one study, a, for example, one percent increase in corporate R&D expenditures would increase overall productivity growth by 0.13% (OECD, 2001).[2] Furthermore, the social benefits generated by corporate R&D investments has been shown by studies to be even more significant than private benefits: For example, a 1% rise in public R&D expenditures would increase overall productivity by 0.17% (cf. above). However, it must be kept in mind that the causal link between R&D investments and economic and productivity growth is temporally long, complex and scientifically difficult to prove. Studies done on R&D investments and growth show a positive correlation at the industry and

[2] See also Niininen, 1999.

macroeconomic level, but if reference is made to economic growth in general, certain countries which have invested a great deal less in R&D, such as Denmark, seem to have achieved a high degree of success.

The impacts that R&D projects have on corporate profitability and value formation are complex and difficult to predict. The motive of conventional research is to enhance a company's turnover by developing new or existing products. If mechanical, method or process improvements are made, the R&D work will have a reductive effect on operative costs. It can therefore be said that successful R&D investments will have a beneficial influence on a company's gross margin. There is, however, a dearth of accurate research data on the extent of this influence. (Kärri, 2001.)

2.2 Primary operating areas

Finnish companies operate on foreign markets in direct exports as well as extensively through subsidiaries operating locally and in third countries. The importance of individual countries to a company can be examined from the standpoint of investments in production, sales or personnel. Companies are interested in the demand potential offered by the market and strive to optimise the utilisation of that potential by investing in production. (Confederation of Finnish Industries EK, 2004.)

According to a Confederation of Finnish Industries EK (2004) survey, a majority of foreign employees still work in Western Europe and North America, but the fastest growth in personnel can be found on developing markets. In addition to new EU member states, the number of industrial employees has grown rapidly, for example, in China. In examining investments made abroad, the percentage of new EU member states was very low compared to personnel working in these countries as well as their percentage of Finnish exports. This was partly due to the labour-intensive nature of production, but above all large-scale corporate acquisitions made in Western Europe and the United States, which significantly increased the overall volume of foreign investments during the period 1998–2002.

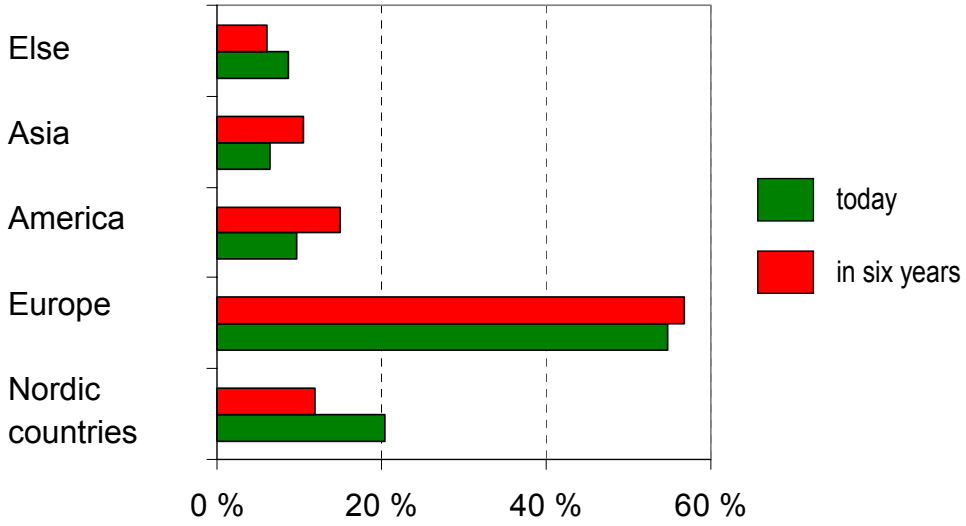


Figure 2.4. The primary foreign operating area of Finnish companies today and in six years.

In order to obtain information on the development of the companies' primary operating areas today and in six years, we asked CEOs to choose the most applicable alternative from our list. Based on the responses we received (see Figure 2.4), it seems that the primary operating area today and in the near future is Europe (including the Nordic countries). Europe's share, however, will be shrinking over the next six years (when including the Nordic countries). Today, Europe is the primary operating area for 75% of companies and in six years for 68%. According to a Confederation of Finnish Industries EK (2004) survey, the share of new EU member states, particularly Estonia and Latvia, is expected to experience considerable growth in the near future. Based on the data we obtained, American and Asian shares will also increase. The American share is expected to rise from 10% to 15% and Asia from 6% to 10%. In light of these results it would seem that the primary operating area of these companies is gradually moving away from their countries of domicile. Europe will still retain its status as a key operating area.

3. Social factors

3.1 Availability of skilled personnel

Skilled labour is a national asset. When it moves from Finland to foreign shores, Finland's own economy loses the utility it provides. As global competition gets tougher, the pressures exerted on the Finnish educational system are constantly increasing. According to the latest PISA surveys, the Finnish educational system has thus far done exceptionally well in international comparisons, even to such an extent that other countries are modelling their own educational systems after the Finnish system. As international competitiveness increases, numerous different actors have begun to make recommendations to improve the educational system. One solution model has been specialisation. Finland can only be home to a few top international universities. Discussions have also touched on improving the attractiveness of vocational education by systematically updating the equipment and teaching environments of educational institutes, in order to ensure the availability of skilled personnel in the years to come.

Economic growth will be based on the utilisation of increasingly focused expertise. According to Hautamäki and Kuusi (2005), Finland's strongest area of expertise at present is research and development, but even there investments are on the decline in industry. The areas requiring the greatest development are commercialisation and marketing, which characteristically lack in enterprise and have undeveloped service sectors. (Hautamäki & Kuusi, 2005.)

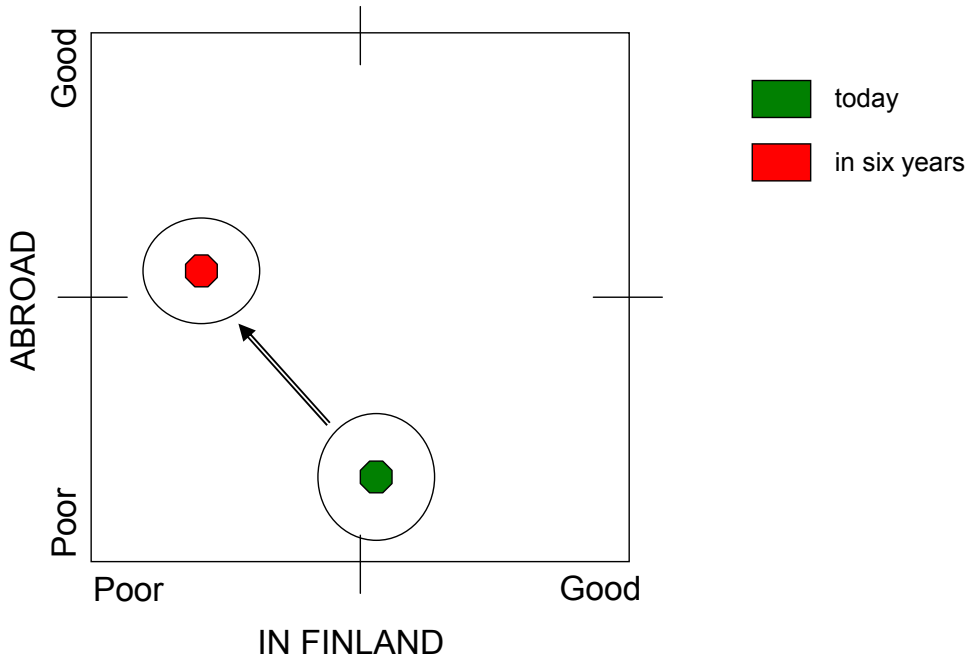


Figure 3.1. Availability of skilled personnel today and in six years.

When CEOs were asked about the availability of skilled personnel today and in six years (see Figure 3.1), the future growth trend seems to be bad where Finland is concerned. Faith in the availability of skilled personnel in Finland is, in the view of several respondents, failing, whereas the situation abroad would be the opposite. Even right now, the availability of skilled personnel in Finland is, according to many studies, problematic. According to a survey conducted by Finnvera Plc with the Federation of Finnish Enterprises (2002), the availability of professional labour was a very common problem facing SMEs a year ago. In the future the availability of skilled personnel in Finland will be much more difficult. This is made evident in, for example, a survey conducted by Talouselämä (Vihma, 2006), in which the directors of personnel development from 40 of Finland's largest companies were asked to give their opinion on the adequacy of labour as well as the expertise needs for management and expert personnel. Just over half of the large corporations believe they will get a sufficient number of qualified supervisors and experts over the next five years. How well Finland is able to maintain and attract a sufficient amount of skilled personnel will be a key issue in the near future.

3.2 Professional skill of subcontractors

With the advent of specialisation, companies have increasingly focused on the management and further development of their own technologies. The result of this is, for example, the increased importance of subcontractors in production during the past few decades. Recent international studies have found that in Finland the role subcontractors play in a company's innovation functions is considerably more important than in other European countries. (Dachs et al., 2004.) With the coming of the 21st century, the status of subcontractors has been put to the test. Even though the level of professional skill in Finland is high, large corporations have increasingly shifted their subcontracting functions abroad in search of cheaper labour costs. One of the most recent examples of this is the Vaisala Group, which announced in January 2006 that it would be transferring its production operations to subcontractors in Malaysia. The professional skill of subcontractors has generally been strong in Finland. According to a survey conducted by Finnvera Plc and the Federation of Finnish Enterprises (2002), a shortage of subcontractors was listed as the biggest obstacle to company growth by some 10% of the over 3,000 respondents.

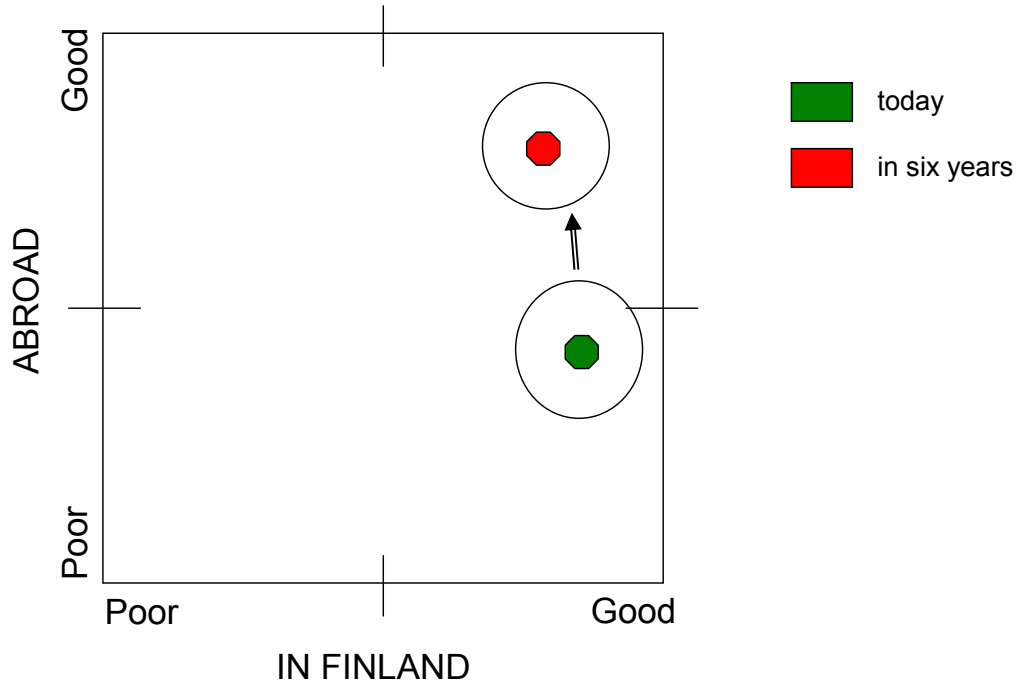


Figure 3.2. Professional skill of subcontractors today and in six years.

When CEOs were asked to rate the professional skill of subcontractors in Finland and abroad today and tomorrow (see Figure 3.2), it would seem that the situation in Finland is good. The professional skill of subcontractors is currently considered very good in Finland, and there is no sign of a serious decline in future estimates. According to the responses given, the greatest change will be a rapid improvement in professional skills abroad over the next six years. For example, China and India are making massive improvements to their educational and research systems. This will surely put Finnish subcontractors on an even more competitive footing, when professional skill alone is no longer the same type of competitive advantage as it has been until now.

3.3 Entrepreneurial culture

Promoting enterprise involves creating an atmosphere in which companies can succeed and which encourages individuals to use their creativity and new ideas as effectively as possible, thus creating new jobs. A strong entrepreneurial culture produces new and competitive companies and rejuvenates existing companies and organisations. As a result of this, the development of entrepreneurial education and training was a key area of focus in a government enterprise project initiated in Finland at the beginning of 2000. Factors such as work ethic, enthusiasm, incentive and motivation as well as negative aspects such as envy are integral parts of the entrepreneurial culture.

Even at the EU level, attention is given to improving the entrepreneurial culture. Efforts have been made to encourage SMEs and service sector companies in particular to, for example, create new jobs. Furthermore, efforts have been made to use new technologies and innovation to create and develop new companies as well as promote environmentally-friendly production and consumer approaches. There has also been a dramatic increase in research and development funding. In addition to this, attention has been given to: facilitating the founding of companies and engaging in business operations; reducing the general costs of hiring new employees; developing risk capital markets; and altering taxation policies to move job creation in a favourable direction. (European Commission, 2005.)

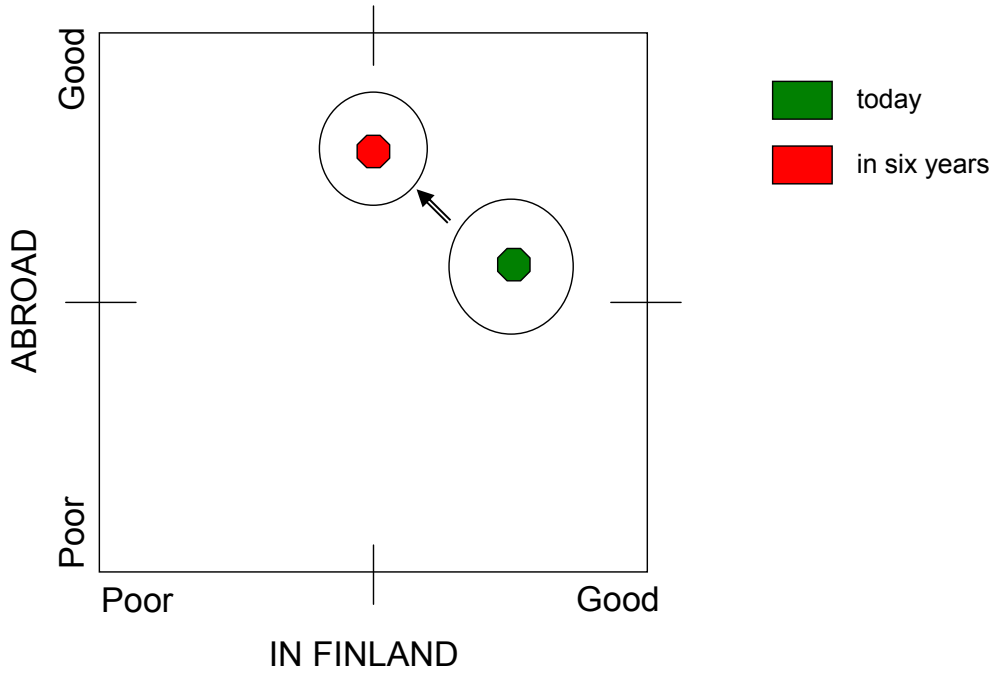


Figure 3.3. Entrepreneurial culture today and in six years.

According to the survey, entrepreneurial culture is considered to be extremely good in Finland (see Figure 3.3). This has been affected by measures promoting enterprise which have been realised by the government in recent years. Attention has also recently been given to attitudes. Efforts have been made to create a positive perception of enterprise, particularly in the eyes of students. The current high marks for entrepreneurial culture will not, however, be quite as high in six years. The survey showed that the change is the worst possible, i.e. Finland is headed in a negative direction, whilst abroad the entrepreneurial culture is seen as developing in a considerably more positive direction.

In the free-form comment section, CEOs gave advice on how entrepreneurial culture could be developed in Finland. The comments focused on, for example, the promotion

of academic enterprise, so that Finland's "innovation minds" could be employed in positions of optimal benefit to society and also create jobs for others. It was found that since the 1990s this situation has improved, but there is still much work to be done. Greater government support for enterprise and the reduction of bureaucracy to facilitate a favourable environment for enterprise were also desired. Comments were made stating that encouraging enterprise and innovation activity limits a low risk-taking ability, and respondents wondered at official inspection functions, in which inspection bodies maintain almost complete control over the entire market, depending on the industry. It was also mentioned that it is difficult for small businesses to grow in Finland, when markets are dominated by a few large corporations holding a disproportionately large market share.

4. Technology factors

4.1 Technical resources

In addition to social factors, technology factors also play a key role in a functional innovation environment. In Finland there has been great confidence in the fact that, when it comes to technology, it is fully competitive with other countries. The level of technology in Finland underwent a dramatic period of "catch-up" following the Second World War, when it developed from an almost non-existent state to one of the highest in the world. (Saarinen, 2005.) The equipment base of companies has improved significantly over the past few decades. Following a brief downturn in the early 2000s, the fixed investments of Finnish industrial companies experienced growth in 2004. This growth in investment has also spurred growth in the investment rate. The investment rate, or investment percentage of industrial value-added, is estimated to be 13–14% for 2005–2006. According to a Confederation of Finnish Industries EK survey (2006), in 2006 the primary objective of industrial investments will be to replace existing production capacity. Despite this good news, SMEs felt that one of the biggest obstacles to company growth was a shortage of facilities, machinery, equipment and raw materials (Finnvera Plc & Federation of Finnish Enterprises, 2002).

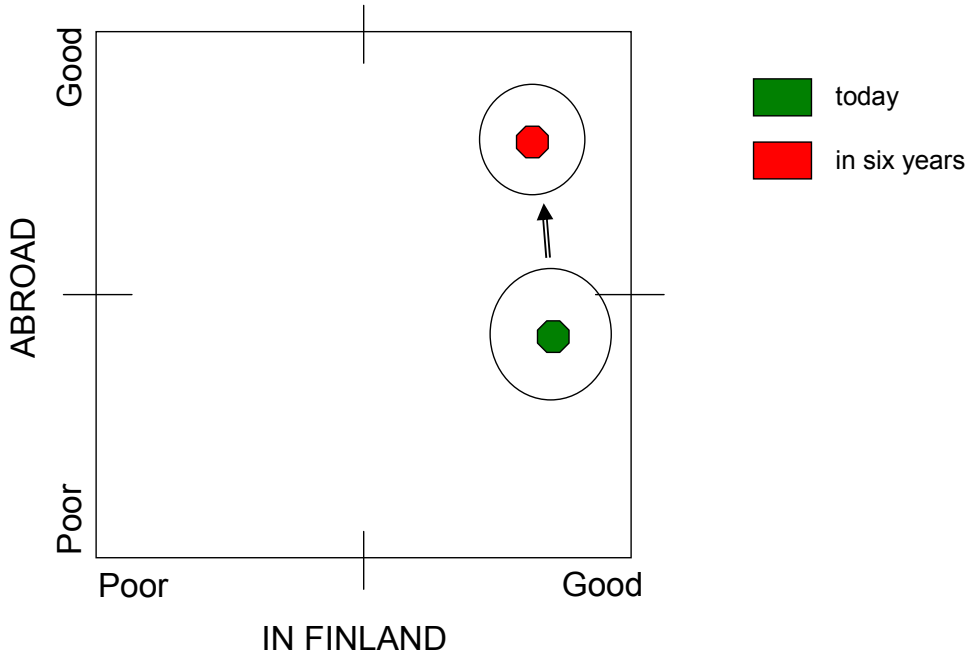


Figure 4.1. Technical resources today and in six years.

According to the survey, CEOs rate the technical resources in Finland as being very good (see Figure 4.1). The result should not come as a surprise to anyone, considering the current level of technology and infrastructure in Finland. What is interesting about the result, however, is that future estimates on technical resources lean somewhat

toward a decline, whilst the situation abroad is showing considerably more positive growth. In free-form comments SMEs expressed concern that they would not necessarily have the financial resources to invest in the acquisition of new equipment and machinery. One solution suggested was to enhance the opportunities for co-operation with research institutes and institutes of higher education, considering that these usually possess state-of-the-art technologies.

4.2 Predictability of technological development

The current rate of change in the opening and expansion of world trade as well as the continuous development of technology pose major challenges for all companies. During such rapid worldwide growth, it is even more important to identify future weaknesses as early as possible. Vast amounts of data and estimates concerning these are produced throughout the world and in Finland. Companies accustomed to dealing with shorter term issues have a difficult time sifting through such an enormous volume of data to find information crucial to their own needs. (Hautamäki & Kuusi, 2005.)

Technology forecasting comprehends information on what new technologies are on the horizon, the maturity and developmental dynamics of technologies, which boundary conditions and correlations affect development, and when technologies can be moved from the laboratory into production. The charting of key actors in technological development, various competitive situations and, for example, the impact of standards on technological development are also crucial. Technology forecasting also involves technological applications and new innovations in various industries. Technology forecasting helps generate ideas for developmental paths in the future. (VTT, 2005.)

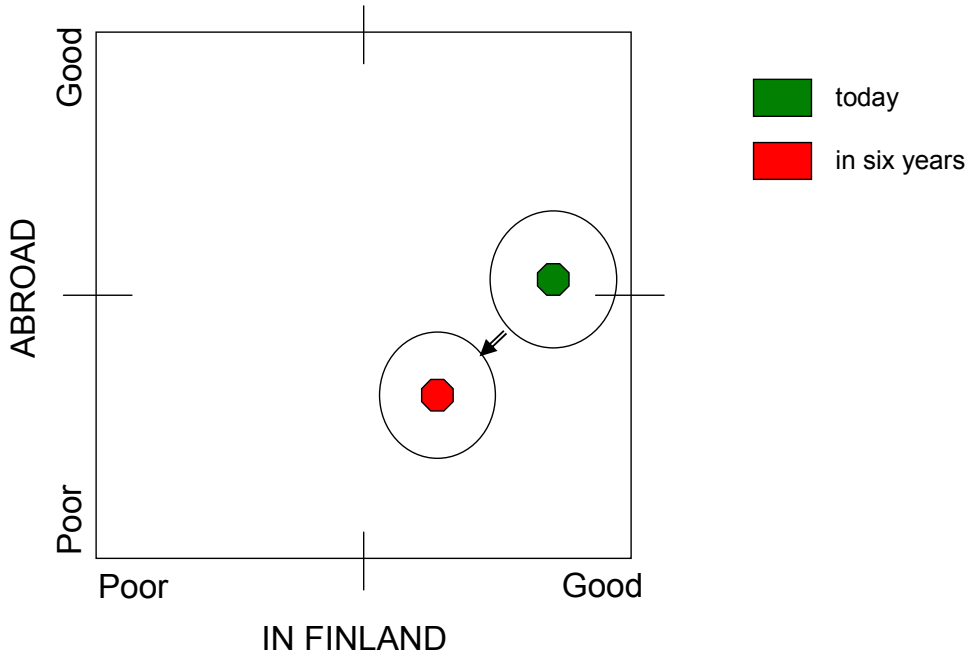


Figure 4.2. Predictability of technological development today and in six years.

The predictability of technological development is generally easier in technical fields which are close to the company's own core technology. It must also be assumed that companies know their domestic market and local infrastructure better than they do foreign matters. We asked our CEO respondents to evaluate the predictability of technological development in Finland and abroad today and in six years. Our assumptions are readily apparent in the responses (see Figure 4.2). The predictability of development in Finland is currently very good, whilst abroad predictability is somewhat more difficult. In the future the situation will progress toward the origin. This too is largely a predictable result, as forecasting in the future will be a major challenge with technology undergoing such rapid development.

5. Economic factors

5.1 Availability of risk financing and private equity investments

Seen from a commercial utilisation perspective, Finland's rapidly growing and high-level research and development sector requires the support of business and internationalisation expertise, co-operative and distribution channels to domestic and foreign markets, and an adequate, functional private equity investment market. In recent years private equity investment has become one of the most important sources of financing for innovation utilisation and internationalisation. The impacts on investment objects are manifold: In addition to the company's shareholder equity, the possibilities for supplementary financing, international co-operative and distribution channels and business expertise as a whole will be enhanced. (Science and Technology Policy Council of Finland, 2002.)

A majority of public private equity investments are directed at seed and start-up phase financing, with growth and internationalisation being more the domain of private and international private equity investors. Tekes, the Finnish Funding Agency for Technology and Innovation, provides financing for research and development, Finnvera provides risk financing using loan and surety instruments, and Finnish Industry Investment Ltd is the state-owned private equity investor. In addition to these, the difficult to compile direct investments made by private persons form a considerable percentage of the private equity investments aimed at budding technology companies. (Science and Technology Policy Council of Finland, 2002.) In 2002 the ratio of private equity investments to the GDP was, after Sweden, highest in Finland, followed by the United States and other EU countries.

Public research and development financing is used to create and develop expertise for future needs. It ensures that expertise and technology services will be available. It also encourages companies to engage in long-term R&D. Public financing also significantly promotes R&D co-operation between research institutes and companies as well as within them. (Tekes, 2002.) Despite the positive aspects listed above, risk financing and a lack of business expertise in starting companies are a recognised problem in Finland (Kauppalehti, 16 January 2006; Finnvera & Federation of Finnish Enterprises, 2002).

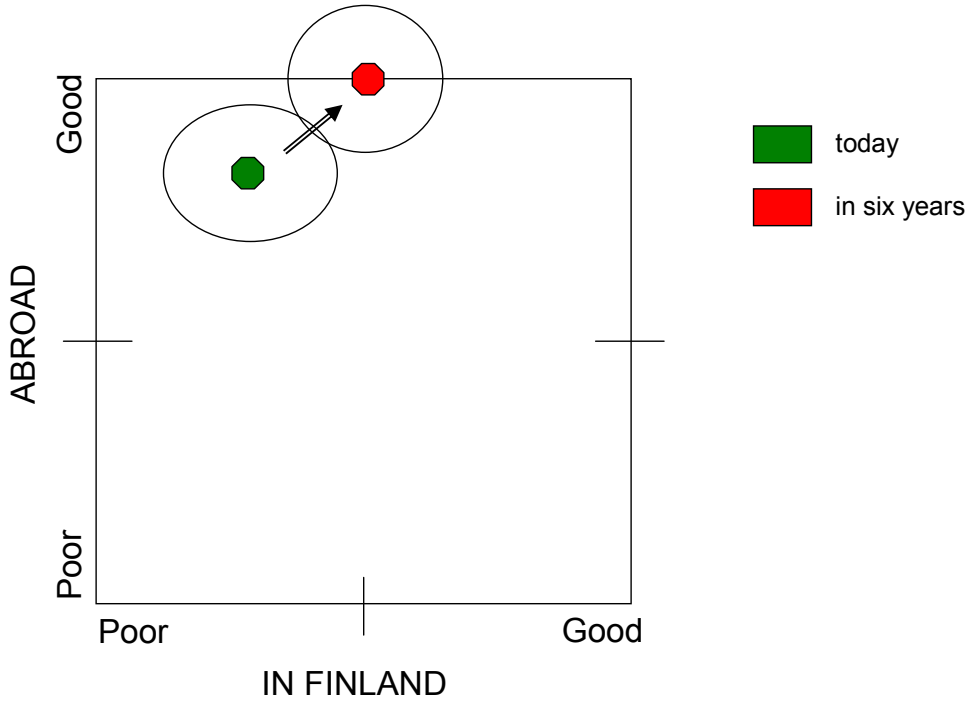


Figure 5.1. Availability of risk financing and private equity investments today and in six years.

In this innovation environment survey we asked CEOs about the availability of risk financing and private equity investments in Finland and abroad. The responses indicate the difficulty that companies must endure when seeking risk financing or private equity investments in Finland. In light of the results obtained (see Figure 5.1) it would seem that there is currently a higher availability of financing abroad than in Finland. This does not, however, mean that companies would have to seek financing abroad. The result can be more interpreted as Finnish companies being aware of the functionality of financial instruments in other countries, with these experiences used to mirror the functionality of similar instruments in Finland. The positive aspect of the results obtained was that the CEOs felt that developments in the future would be better than they are at present. It can also be estimated that developments will also be even more positive abroad, receiving excellent marks in six years.

5.2 Personnel costs

Finland has been part of the Eurozone since the beginning of 1999. Changing the external value of domestic currency is no longer possible, which has compromised the ability of national policy to affect the price competitiveness' of companies. Instead, it is still possible to affect company cost development, particularly in regard to labour costs. With the advent of globalisation, labour costs will face serious challenges, as the labour

costs in new EU member states and especially China and India are only a fraction of those in Finland. The price of other costs, such as raw materials and energy, are largely determined by global market prices.

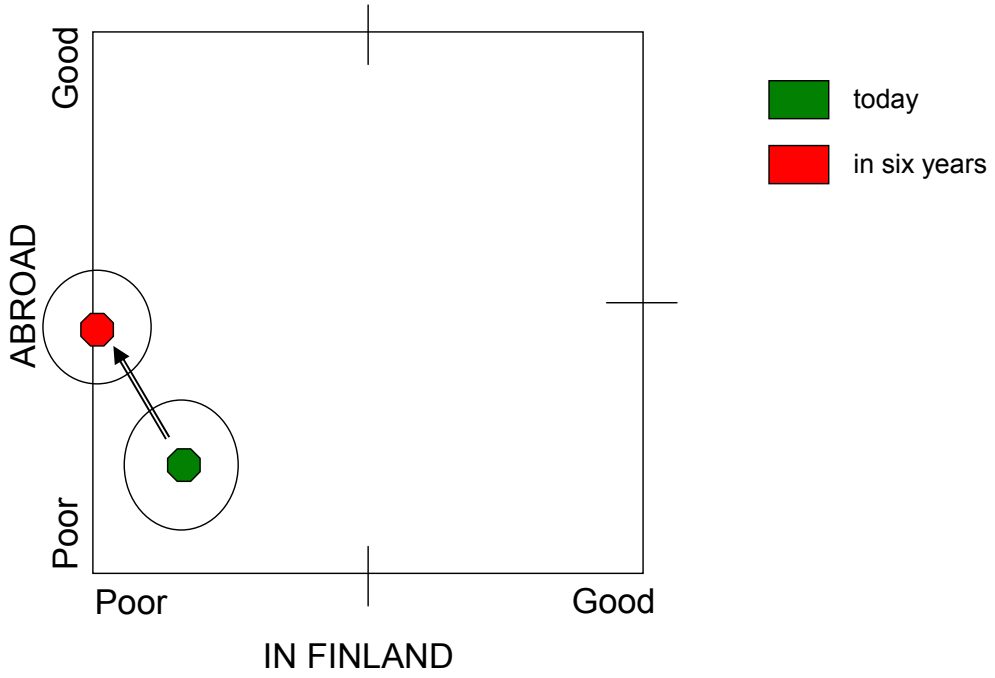


Figure 5.2. Personnel costs today and in six years.

The CEOs felt that the current personnel cost situation in Finland was not very good (see Figure 5.2). It was also surprising to find that foreign cost levels also received low marks, placing almost on a par with Finnish results. What is interesting about the results, however, is that the future trends are headed in different directions. In Finland it is expected that company personnel costs will rise further, whilst many believe that the trend abroad will be more moderate. In free-form comments it was generally stated that, despite the high level of costs, Finland is a good country for doing business in comparison with other European countries. However, the comparisons excluded new Eastern European EU member states, which, with their potential and innovation, will hopefully become the economic engine for Europe.

6. Political factors

6.1 Predictability of operating environment

Our operating environment is changed and moulded simultaneously by two forces: On one hand, continuous global unification and, on the other, the expansion and deepening of the European Union. The increasing regulation of the EU has been proven to have an increasingly powerful influence on the competitiveness of the corporate operating environment. Integration of the global economy promotes overall economic growth, but it also results in ever tightening competition between countries. In the 1990s Finland achieved a great deal of success and quickly joined the ranks of globalising countries, but now the challenge is even greater. (Tekes, 2005.) In future the key actors in the global economy will be innovative and attractive metropolitan areas, in which experts, research institutes, technology firms, private equity investors, business service providers, etc. congregate. In Finland this means that the active development, high international profile, interaction and marketing of the Greater Helsinki Area are vital to the development of the country as a whole, both directly and indirectly. (Hautamäki & Kuusi, 2005.)

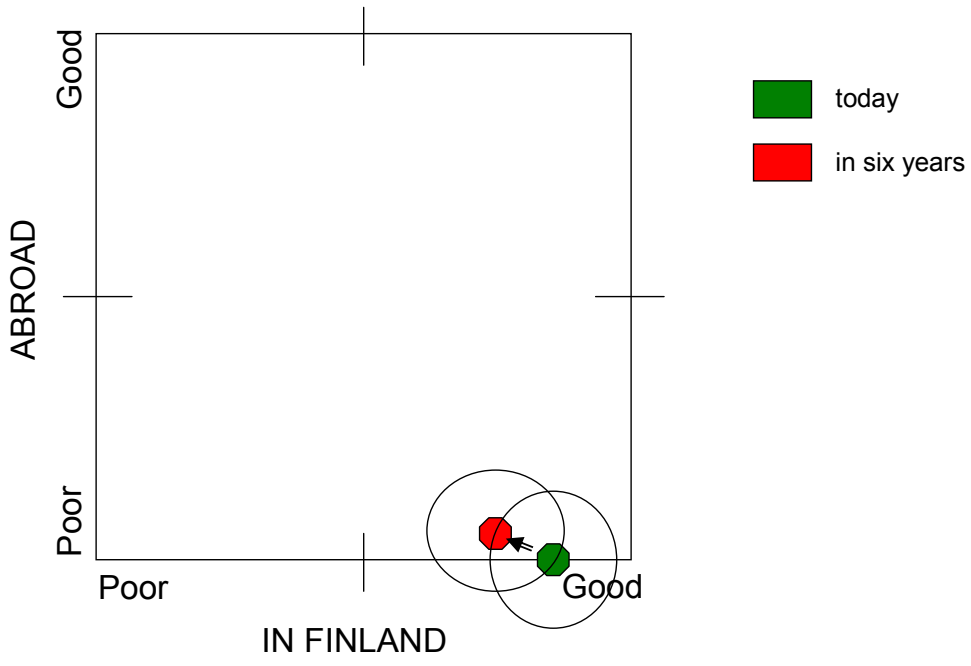


Figure 6.1. Predictability of operating environment today and in six years.

In regards to the predictability of operating environment, the CEOs gave similar marks as they did for the predictability of technological development. The predictability of the operating environment in Finland is considered extremely good, whilst abroad the situation is completely the opposite (see Figure 6.1). The predictability of operating

environment in six years was also given a good forecast, although it was not expected to be as good as the situation today. This development is completely normal, in that the future always holds unknown quantities. The situation abroad in six years is expected to remain unpredictable, although slightly better than it is today. This is affected by the flow of information and its proper utilisation, which will show a marked improvement in the near future.

6.2 Taxation policy

Social solutions concerning enterprise and taxation have direct impact on the competitiveness of companies. It is vital to Finland and the well-being of Finns that companies ensure Finland will remain a prime location for both Finnish companies and foreign investors. (SET, 2003.) At present, it seems that taxation is becoming a complex competitive factor also in Europe, where Ireland's profitable model has been adopted with great zeal by new EU member states and candidate countries (Hautamäki & Kuusi, 2005). Some OECD countries offer tax exemptions for R&D operations. In Finland the percentage of these types of incentives is quite low.

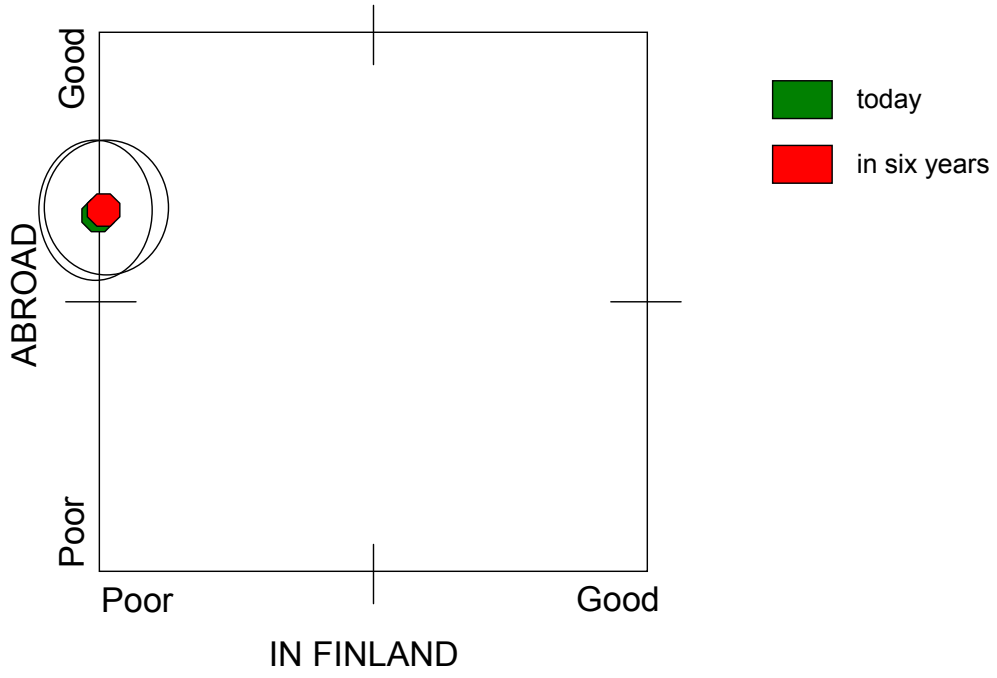


Figure 6.2. Taxation policy today and in six years.

Finland's taxation policy received poor marks from the CEOs (see Figure 6.2). In addition to the poor marks, this issue produced the most heated commentary in the free-form section. It was found that, among other things, making tax competitiveness a reality in Finland is an absolute necessity for companies to succeed. It was emphasised

that Finland must be able to ensure the permanence of Finnish development resources and availability of foreign development resources through taxation and other means. It was hoped that taxation could be made more profitable where entrepreneurs are concerned. Some of the solutions proposed were to switch to, for example, a three-year tax period, provided that no capital is taken from the company for shareholders during that time. Solutions for the taxation of patent revenues and, particularly, their multiple taxation were also sought. It should be possible for entrepreneurs to get non-taxable returns on investments made in their own companies. Taxation could also be much more effectively used to support bringing new innovations to market. The risks associated with innovations are currently borne by the entrepreneur, but the tax authority is the first to take revenues.

6.3 Technology and innovation policy

In Finland innovation policy drove the need to increase technological innovations beginning in the 1990s. It was one of the main objectives for pulling Finland out of the recession, and it did so exceedingly well. Innovations are, however, also accelerators of social and cultural development, and this particular business sector has received greater appreciation in the 2000s. Technological innovations are necessary for social development, but these are accompanied by the need to produce successful social innovations in all social sectors. (Science and Technology Policy Council of Finland, 2002.)

In January 2006 the importance of innovation policy to Finland's recent development was a hot topic of debate in newspapers. Without taking a position on how big a role innovation policy played in Finland's success story, it has been interesting to see that the issue has inspired such widespread public debate. Until now, the debate has been restricted to very small circles, failing to reach the broader public.

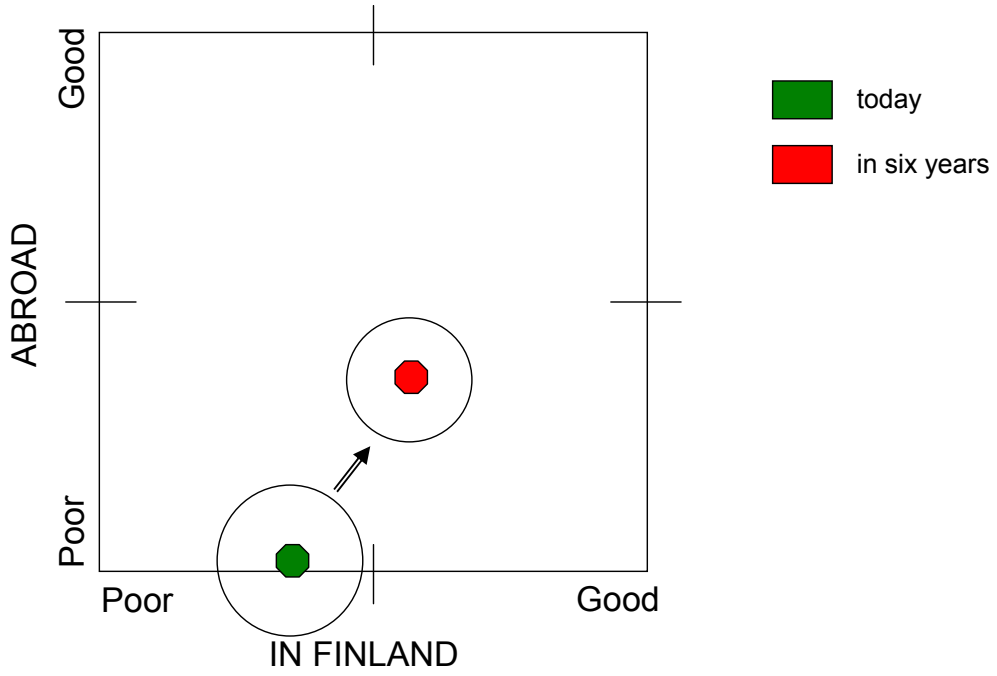


Figure 6.3. Technology and innovation policy today and in six years.

Technology and innovation policy did not receive unconditional support from our survey respondents (see Figure 6.3). The policy in question received below average marks in Finland. Correspondingly, it was considered extremely poor abroad. What is interesting here is that technology and innovation policy are expected to improve in the near future, both in Finland and abroad. This, combined with the availability of risk financing and private equity investments, is the only thing in this survey with positive prospects for the future. In this respect political decision-makers, if there are any such decision-makers in political circles, could play a crucial role in the future.[3] Everything would be ready to go, and the policy would not hinge on innovations or the positive perceptions of the future held by entrepreneurs.

[3] This refers to a lively debate on the Finnish innovation system and policy that took place in the Helsingin Sanomat newspaper in January of 2006.

7. Summary

VTT Technical Research Centre of Finland has conducted a study on perceptions of the present status and future prospects of the Finnish R&D environment held by Finnish business leaders. The aim was to gain a clearer picture of how Finland will confront the challenges of globalisation today and in the future. CEOs from Finland's 50 largest (in terms of turnover) corporations and 160 innovative internationalising SMEs were surveyed. The response rate was 49%.

The division of R&D investments made by Finnish companies between Finland and foreign countries became a crucial issue. According to a VTT survey, 56% of the R&D investments made by Finnish companies currently end up in Finland, but within six years that figure is expected to drop to 46%.

Estimates between corporate segments concerning future developments seem to be even more certain, especially with regard to large corporations. During the next six years, their domestic R&D investments will drop from 63% to 43% – a decrease of roughly 20 percentage points. The situation for SMEs, on the other hand, would seem to stay at roughly the same level, dropping from 53% to 47%.

In the survey Finnish CEOs were also asked to evaluate the importance of social, technology, economic and political factors to the innovation environment, today and in six years. Social factors comprehended an assessment of the availability of skilled personnel, the professional skill of subcontractors and entrepreneurial culture. In regard to technology factors respondents were asked to give their opinion on technical resources and the predictability of technological development. Economic factors comprehended the availability of risk financing and private equity investments as well as personnel costs. The last section dealt with political factors, on which the CEOs were asked to give their viewpoints concerning the predictability of operating environment, taxation policy and technology and innovation policy. The above-mentioned sections also separately addressed the situation in Finland and abroad.

The second most important finding of the survey was the rather negative perception held by CEOs concerning the domestic development of the items queried, while development abroad was primarily given a more positive outlook. Indeed, the survey raises the question: What kind of impact do the above-mentioned factors have on the transfer of R&D investments from Finland to foreign countries? Or are the issues addressed in the survey independent of one another?

References

Dachs, B., Ebersberger, B. & Pyka, A. 2004. *Why do Firms Co-operate for Innovation? A comparison of Austrian and Finnish CIS 3 results.* Volkswirtschaftliche Diskussionsreihe, Beitrag Nr. 255, Januar 2004. Augsburg: Institut für Volkswirtschaftslehre.

Confederation of Finnish Industries EK. 2004. *Teollisuuden ulkomaantoiminta: Kilpailukykyä EU:n laajentumisesta – Osaamisstrategian tarve korostuu.* (In Finnish.) Helsinki: Confederation of Finnish Industries EK. www.ek.fi/julkaisut.

Confederation of Finnish Industries EK. 2005. *Suhdannebarometri – Elokuu 2005*. (In Finnish.) Helsinki: Confederation of Finnish Industries.

Confederation of Finnish Industries EK. 2006. *Investointitiedustelu – Tammikuu 2006*. Helsinki: Confederation of Finnish Industries.

European Commission. 2005. *Yhteiset toimet kasvun ja työllisyyden hyväksi – Yhteisön Lissabon-ohjelma.* Komission tiedonanto neuvostolle ja Euroopan parlamentille, KOM (2005) 24, 2.2.2005. (In Finnish.)

Finnvera Plc & The Federation of Finnish Enterprises. 2002. *PK-yrityksen rahoituskysely, toukokuu 2002.* (In Finnish.) Helsinki.

Hautamäki, A. & Kuusi, J. 2005. *Suomi innovaatiotoiminnan kärkimaaksi: Kilpailukykyinen innovaatioympäristö -kehittämisohjelman loppuraportti.* (In Finnish.) Helsinki: Sitra.

Kärri, T. 2001. *Perusteollisuus muuttuvassa toimintaympäristössä 2000–2030: Teknologiset kehitysmahdollisuudet.* (In Finnish.) Lappeenranta: Lappeenranta University of Technology.

Niininen, P. 1999. *High Technology Investment, Growth and Productivity, Empirical Studies of Finnish Data.* Helsinki: Helsinki School of Economics and Business Administration, A-158.

OECD. 2001. [Quellec, D. & van Pottelsberghe de la Potterie, B. 2001.] *R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries*. STI Working Paper Series, 2001/3. Paris: OECD.

Rouvinen, P. 1999. *Issues in R&D Productivity: Causality, Lags and "Dry Holes"*. Discussion Papers No. 694. Helsinki: The Research Institute of the Finnish Economy, ETLA.

Saarinen, J. 2005. *Innovations and Industrial Performance in Finland 1945–1998*. Lund Studies in Economic History 34. Stockholm: Almqvist & Wiksell International.

Science and Technology Policy Council of Finland. 2002. *Osaaminen, innovaatiot ja kansainvälistyminen.* (In Finnish.) Helsinki: Science and Technology Policy Council of Finland.

SET. 2003. *Suomen suuri mahdollisuus.* (In Finnish.) Helsinki: Sähkö-, elektroniikka- ja tietoteollisuus SET ry.

Statistics Finland. 2005. *Tutkimus- ja kehitystoiminta.* (In Finnish.) Helsinki: Statistics Finland. www.stat.fi.

Technology Industries of Finland. 2004. *Tilanne ja näkymät 1/2004*. (In Finnish.) Helsinki: Technology Industries of Finland.

Tekes. 2002. *Ylihuomisen kilpailukyky ratkaistaan tänään – Teknologiarahoituksen tulokset ja vaikutukset.* (In Finnish.) Helsinki: Tekes.

Tekes. 2005. *Innovaatioista hyvinvointia – Painopisteet tulevaisuuden rakentamiseksi. Tekesin strategian sisältölinjaukset 2005.* (In Finnish.) Helsinki: Tekes.

Vihma, P. 2006. *Oikea asenne valikoi huippuosaajat*. (In Finnish.) Talouselämä 2/2006.

VTT. 2005. *Toimintasuunnitelma 2006*. (In Finnish.) Espoo: VTT.

Ylä-Anttila, P. 2004. *Suomi globaalissa kilpailussa -esitelmä.* (In Finnish.) The Research Institute of the Finnish Economy (ETLA) and Etlatieto Ltd 30.1.2004.

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