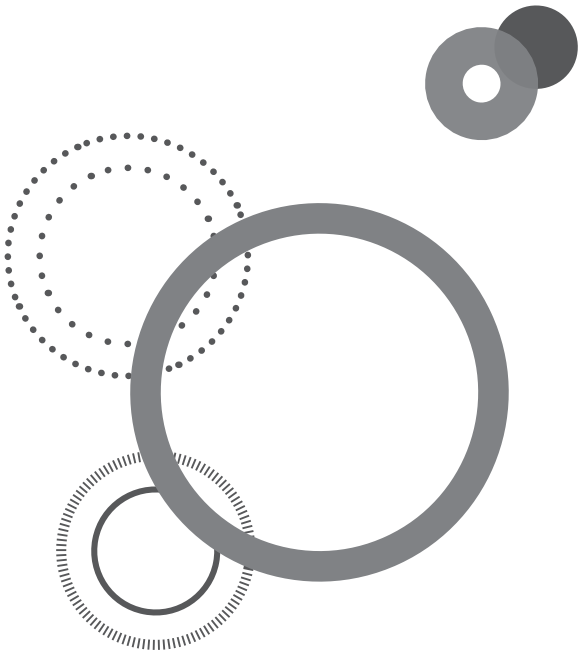
Position paper

September 2008

Analysis of the Netherlands' private R&D position



innovatieplatform

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Content

This position paper provides a starting point for the meeting of experts organised by the Innovation Platform on the 3rd of October on behalf of platform members Alexander Rinnooy Kan and Gerard Kleisterlee. This meeting of experts will bring together scientists and 'decision makers' from the business world in order to produce a joint analysis of the private R&D shortfall in the Netherlands. This group will specifically be asked what drives companies to invest in R&D 'somewhere' and where opportunities lie for the Netherlands to increase private R&D intensity considerably.

This paper was written under the responsibility of the Innovation Platform. Help was received from several organisations. We like to particularly thank the Ministry of Economic Affairs for their time and input, both with materials of previous studies as well as fruitful discussions.

Conclusion

The Netherlands is lagging far behind its own targets in the area of private research investments. Comparisons with the OECD and the EU15 show that the Dutch sector composition is playing an important role, but that the Dutch emphasis on services does not explain everything. The Netherlands is not sufficiently attractive for foreign companies to carry out research. Mediocre location appeal may also mean that Dutch companies will relocate their key research centres. If the Netherlands wants to increase private research expenditure (an investment with potentially a very high return), we must look in the first instance at the appeal of the Netherlands to technology-intensive companies. Research by these companies can be attracted by having enough knowledge workers, world class knowledge institutions and a dynamism which encourages innovation. This requires government investment, but also efforts by private parties. By providing extra investment in knowledge in a structural and effective way, technology-intensive companies can be bound to the Netherlands. This would also change the Netherlands' sector composition in due course. It is not likely that the Netherlands will match the amounts invested in research in the US or Japan. But a significant increase on the current amounts can certainly be achieved.

1. Introduction

Investment in private research in the Netherlands is lagging behind our peers and well behind our targets. The position paper seeks explanations for this shortfall. It also tries to find directions for improvement. Furthermore, the current targets are considered in a global context.

In March 2008 Statistics Netherlands (CBS) published figures on R&D expenditure in the Netherlands in 2006 (Statistics Netherlands, 2008). R&D expenditure by the private sector as a proportion of GDP fell from 1.02% in 2005 to 0.96% in 2006. R&D expenditure by the public sector (= universities and (semi-)public research institutions) as a proportion of GDP fell from 0.72% in 2005 to 0.71% in 2006. This brought total R&D expenditure to 1.67% of GDP in 2006. That figure is a long way off the European Barcelona target of 3% of GDP set for 2010 (European Council, 2002). The Innovation Platform's Knowledge Investment Agenda (KIA) (2006) sets out goals for R&D expenditure which are based on the Barcelona target. For private R&D expenditure the goal is an increase towards 2% of GDP in 2016. For public R&D expenditure the goal is an increase towards 1% of GDP in 2016.

Compared to other countries, the Netherlands has an above-average position in terms of R&D expenditure in the public sector as a percentage of GDP and a below-average position in terms of R&D expenditure in the private sector as a percentage of GDP. However, the Netherlands' lead over other countries in terms of R&D expenditure in the public sector has narrowed considerably over the years, and is now – based on the latest figures for 2006 – 0.05-0.06% of GDP above the EU15 and OECD average (OECD, 2008a). On R&D expenditure in the private sector the Netherlands' shortfall in 2006 was 0.26% of GDP compared to the EU15 average and 0.65% of GDP compared to the OECD average. Figure 1 shows an international comparison of private R&D intensity over an extended period.

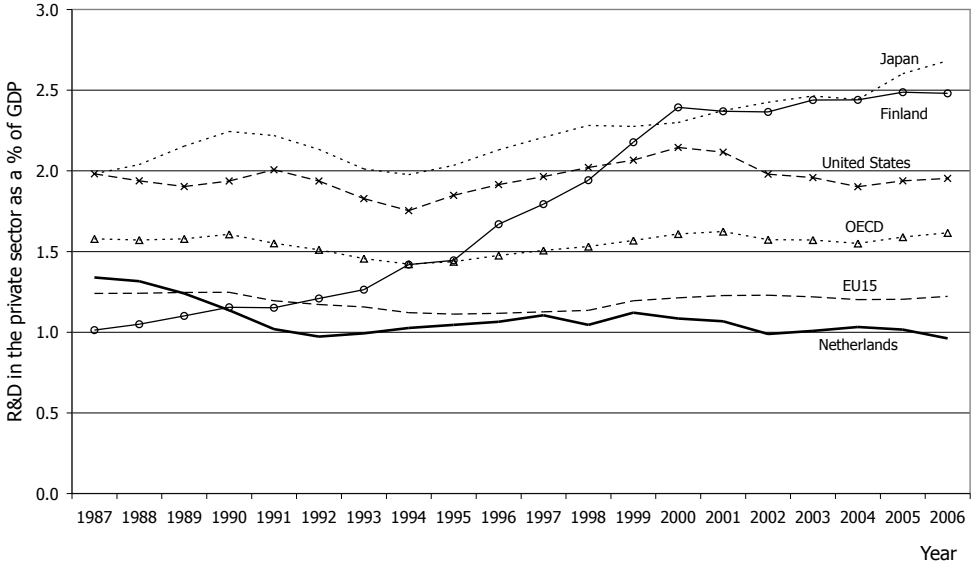

Figure 1: International comparison of private R&D intensity (% of GDP); 1987-2006

Source: OECD (2008a).

This position paper offers explanations for the Netherlands' private R&D shortfall and identifies how the private R&D intensity could be substantially increased towards 2% of GDP in 2016[1]. The Netherlands will thereby be compared with the OECD average and with the EU15 average. The average private R&D intensity in the EU15 will also be compared with that in the US and Japan. A distinction will thereby be drawn each time between a sector composition effect and an intrinsic effect. These two terms will be discussed further in Section 2.

The analysis indicates where there are opportunities to increase private R&D intensity, both for the Netherlands and for the EU15 as a whole. We will also look at how comparable the Netherlands and the EU15 are with the US and Japan. In addition to this, we will consider the question of whether Europe should be considered as one entity. Does a target of 3% for Europe mean that the Netherlands as an individual country within Europe also needs to achieve that 3%? In the final part of the paper we discuss points of departure for action. These will be heavily based on the importance of different explanatory factors for private R&D intensity according to existing empirical research.

This position paper provides a starting point for the meeting of experts organised by the Innovation Platform on the 3rd of October. This meeting of experts will bring together scientists and 'decision makers' from the business world in order to reach a shared analysis on the Netherlands' private R&D shortfall and options for follow-up actions. The main questions that are addressed in this position paper are:

- How large is the private R&D shortfall of the Netherlands with regard to private R&D investments compared to its peers and how can it be explained?
- What is a realistic level of ambition for the Netherlands set against the position of the Netherlands within Europe?
- What are promising action lines to increase private R&D intensity in the Netherlands considerably?

The contents of the position paper are based on a survey of existing scientific studies into R&D investments, particularly research carried out by the Ministry of Economic Affairs. Sources are listed in the Appendix.

1) The link between R&D and innovation is not a direct one, and the growth of the economy and innovation in the Netherlands in recent years are not solely attributable to R&D investments. Nonetheless, R&D is very important to an economy. Research investments are also needed in order to be able to utilise knowledge from other countries, areas or sectors (absorptive capacity). Combined with a good innovation system, the return on R&D is high. Empirical research indicates that a rise in private R&D intensity by 0.1% of GDP will lead in the longer term to around 1% additional labour productivity in the business sector (Coe and Helpman. 1995; Guellec and Van Pottelsberghe, 2001; Donselaar, Erken and Klomp, 2004). In short, the Netherlands will have to increase R&D investments if it wants to strengthen the knowledge economy.

2. The Netherlands' private R&D shortfall compared to the OECD average

The Netherlands' shortfall compared to the OECD average is partly explained by the sectors in which Dutch companies operate: the Netherlands has little high-tech activity compared to other countries. The shortfall is also explained by the fact that foreign companies' research investments are low when set against the openness of the Dutch economy. The size of the Dutch market does not appear to play an important role.

A number of studies have examined the differences between countries in terms of private R&D. It is thereby customary to pay attention to the impact of the sector composition on private R&D intensity in a country as well. Van Pottelsberghe (2008) recently emphasised the role of the sector composition in a discussion of progress within the EU towards achieving the Barcelona target for R&D intensity. He concludes on the basis of underlying research by Mathieu and Van Pottelsberghe (2008) that 'technological specialisation explains the variation in R&D intensity much better than any other country specificities'.[2] The impact of the sector composition on the Netherlands' private R&D position compared to other countries has previously been calculated in research by Hollanders and Verspagen (1998, 1999) Ruiter (2003) and Erken and Ruiter (2005).[3]

According to research by Erken and Ruiter (2005), the effect of the Netherlands' sector composition is responsible for around 60% of the Netherlands' shortfall compared to the OECD average in 2001.[4] The Netherlands has comparatively little manufacturing within the

2) Mathieu and Van Pottelsberghe (2008) carried out a regression analysis with panel data for around 20 industrial sectors in 10 countries, whereby country dummies were used to investigate how R&D-intensive the various countries are compared to one another, adjusted for the impact of the sector composition.

3) In these studies R&D differences between countries on an aggregated level have been split into an intrinsic effect and a sector composition effect using a formula. Data at sector level for the amount of R&D expenditure in proportion to value added and the sectors' shares in total value added of the economy have been used in order to calculate to what extent an R&D difference between countries can be attributed to differences in the level of the R&D intensities at sector level and – as a complement to this – to what extent to differences between the individual sectors' shares in the total economy.

4) The paper by Erken and Ruiter (2005) is written in Dutch. An abridged version in English is also available: Erken and Donselaar (2006).

total economy's value added and also a smaller share of high-tech sectors within manufacturing. This has a negative impact on private R&D intensity at macro level, because manufacturing sectors are – on average – more R&D-intensive than other sectors and because within manufacturing it is particularly the high-tech sectors which spend a comparatively large amount on R&D in proportion to value added. This leaves around 40% of the Netherlands' shortfall, and this is called the 'intrinsic effect'. The findings of the research by Erken and Ruiter (2005) are confirmed in more recent calculations by the Ministry of Economic Affairs based on data available in 2006. Figure 2 uses those more recent calculations to show how the Netherlands' shortfall compared to the OECD average can be explained through an intrinsic effect and a sector composition effect.

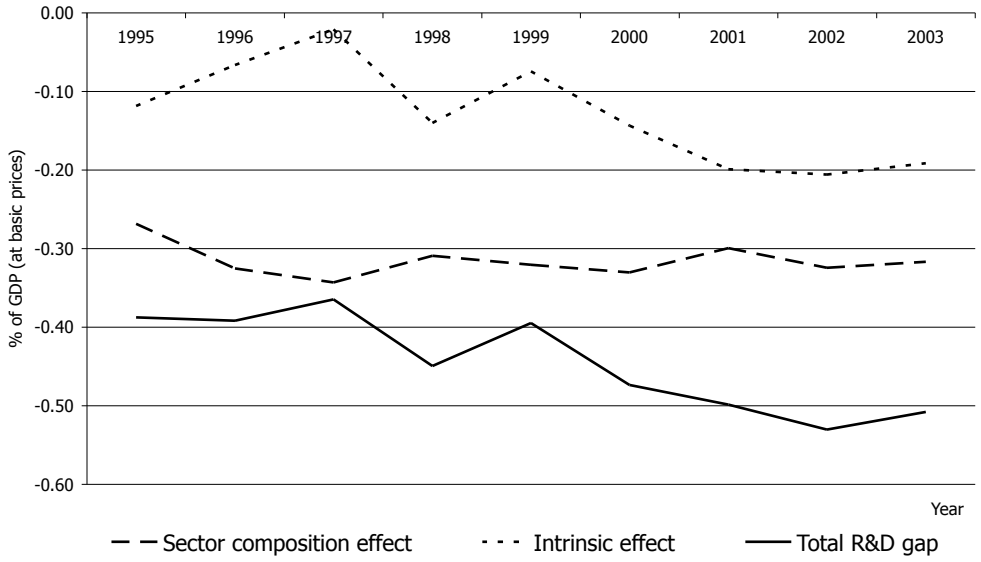

Figure 2: Breakdown of the Netherlands' private R&D shortfall compared to the OECD average (% of GDP at basic prices); the Netherlands compared with the entire OECD, excluding Luxembourg

Source: Ministry of Economic Affairs (database developed in 2006, consisting of data from the OECD and GGDC in particular).

Figure 2 compares the Netherlands with the entire OECD (excluding Luxembourg). Sufficient data is available from 1995 for that complete group of OECD countries. If the group of OECD countries is limited to the countries that were already a member of the OECD prior to 1994, a comparison can be made from 1987 onwards.[5] The result of this is shown in Figure 3. For the years since 1995 there is a comparable picture to Figure 2. It is notable that the sector composition effect over the entire period has been fairly stable at around 0.3% of GDP. On the other hand, the intrinsic effect shows a much greater fluctuation. The intrinsic effect thereby has a strong influence on the movements which can be seen in the overall (private) R&D difference between the Netherlands and the OECD countries.

5) The full OECD consists of 30 countries. The following six countries have joined since 1994: Mexico, Czech Republic, Hungary, Poland, Korea and Slovakia.

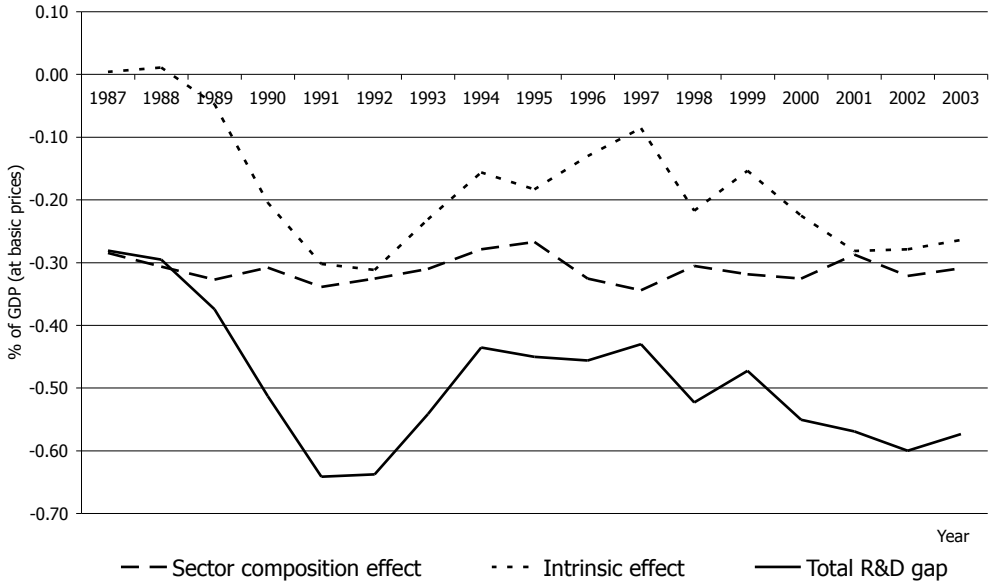

Figure 3: Breakdown of the Netherlands' private R&D shortfall compared to the OECD average (% of GDP at basic prices); the Netherlands compared with the OECD countries which were already a member of the OECD prior to 1994, excluding Luxembourg

Source: Ministry of Economic Affairs (database developed in 2006, consisting of data from the OECD and GGDC in particular).

Zooming in on sector composition

The sector composition is a snapshot of earlier choices relating to technology and research, a reflection of technological competitiveness: "A positive sector composition effect is [...] the result of successful competition on technology markets" (Erken and Van Es, 2007). The sector composition does not have to be viewed as a fait accompli. It is partly exogenous and thus a given (due to, for example, the Netherlands' climate and location), but partly certainly also endogenous and open to influence (see Section 5). The research by Erken and Ruiter (2005) indicates that a focus on R&D will result in the attraction and development of more technology-oriented companies and this causes a gradual positive change in the sector composition. Something of the kind has taken place in Finland, where an increase of 1.3% of GDP in the sector composition effect (compared to the EU15 average) has been achieved within 10 years, and to a lesser extent in Canada, with an increase of 0.4% of GDP (Erken and Ruiter, 2005). The Finnish example is shown in Figure 4. The most important driver behind the Finnish model was targeted government investment in innovation (Erawatch, 2008). Following the collapse of the Soviet Union, a large part of Finland's market disappeared and hard choices had to be made in order to keep the economy on its feet. The choice to focus on high-tech industry turned out to be the right one.

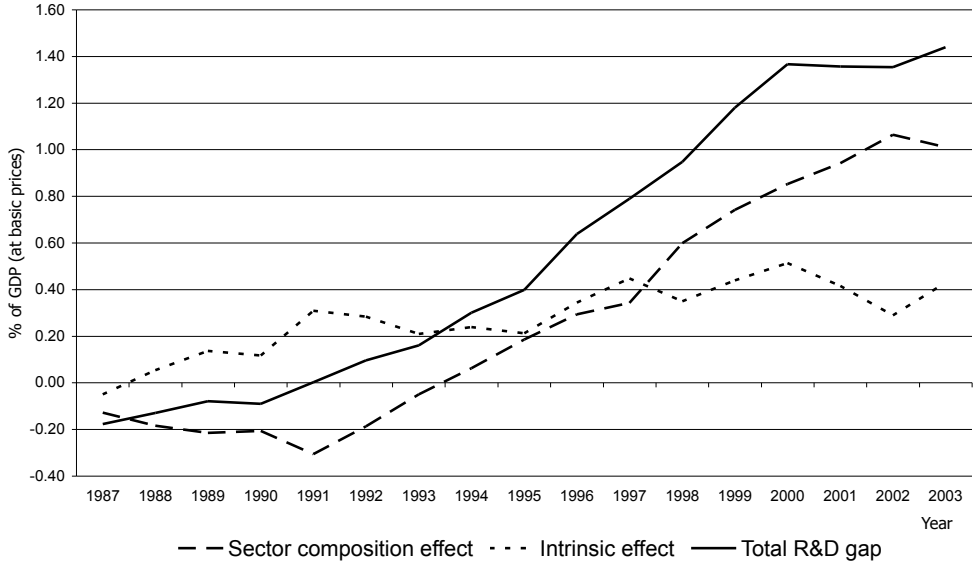

Figure 4: Breakdown of Finland's private R&D shortfall/lead compared to the EU15 average, excluding Luxembourg (% of GDP at basic prices)

Source: Ministry of Economic Affairs (database developed in 2006, consisting of data from the OECD and GGDC in particular).

Zooming in on the intrinsic effect

The intrinsic effect explains the rest of the Netherlands' shortfall. This specifies the amount of money (relative to GDP) that enterprises in the Netherlands fail to spend on R&D once one has adjusted for the impact of the sector composition. Erken and Ruiter (2005) have drawn up a breakdown of the private R&D shortfall compared with the OECD average, in which the remaining intrinsic effect is explained on the basis of the findings of empirical research. The various factors which contribute to the intrinsic part and their effects are shown in Table 1.

In the Netherlands foreign companies account for a substantial proportion of the private R&D investments.[6] This was roughly a quarter in 2001 according to the study by Erken and Ruiter (2005). When, however, this contribution is adjusted for the openness of the economy[7], this factor actually results in a reduction of 0.25% of GDP in the Netherlands' R&D score compared to the OECD average. These are investments that one might expect on the basis of our peers, but which are not taking place. In view of the open nature of the Dutch economy around half of private R&D expenditure in the Netherlands should be made by foreign companies, according to the calculations by Erken and Ruiter (2005). The strong openness of the Dutch economy goes hand in hand with a comparatively high level of R&D by Dutch companies abroad, for which there is insufficient compensation in the opposite direction from foreign R&D investors in the Netherlands.

6) The proportion of foreign companies is based on OECD data on R&D expenditure of foreign affiliates: "Data on the activity of foreign affiliates are based on the concept of controlling interest and the statistical test for data collection is that of majority interest (over 50% of shares that carry voting rights on a company's board of management)." (OECD, 2008a: p. 69)

7) Measured as total imports and total exports relative to GDP, adjusted for the import component within total exports.

Table 1: Breakdown of Dutch private R&D shortfall compared to the OECD average, 2001

Determinants	Contribution;
	% of GDP
Sector composition effect	***–0.33%***
Intrinsic effect	***–0.21%***
Foreign R&D investments	–0.25%
Openness of the economy	+0.10%
Government funding of private R&D	–0.06%
Inward-oriented economic regulation	+0.01%
Intellectual property rights	–0.03%
Public R&D	+0.04%
– Higher education R&D	+0.02%
– Public research institutions	+0.02%
Capital income share	+0.01%
Real interest rate	+0.02%
Fast-growing firms	–0.02%
Residual	–0.03%
Total private R&D shortfall	***–0.54%***

Source: Erken and Ruiter (2005).

It can be deduced from this that foreign companies find the Netherlands of too little interest as a knowledge country to set up R&D facilities. In order to gain a better insight into this, we need to look at micro level at the factors involved for the decision makers when making R&D allocation choices. Location appeal and location factors play a role in this (see Section 6). Creating a positive location appeal is an interesting area for measures since it affects both domestic and foreign parties. Erken, Kleijn and Lantzendörffer (2005) refer to a 'double-edged sword' in this regard. The low share accounted for by foreign R&D investments is emphasised in a memorandum from the Confederation of Netherlands Industry and Employers (VNO-NCW, 2008), which compares the share of foreign R&D in the Netherlands (25%) with figures for Sweden (45%), the UK (45%) and Ireland (72%) and refers to a Netherlands Attractiveness Survey by Ernst & Young which shows that between 2003 and 2006 the Netherlands only managed to attract 7 R&D projects by foreign investors compared with 14 for Sweden, 26 for Belgium, 59 for Germany, 121 for France and 177 for the UK.

A second factor is government financing of private R&D. This comprises tax facilities for R&D (e.g., the WBSO in the Netherlands), direct R&D subsidies and R&D contracts from the government. The comparatively low level of government financing of private R&D contributed to the Netherlands' R&D shortfall by 0.06% of GDP in 2001. The substantial shortfall of the Netherlands in this respect is explained by the relatively small amount of government R&D contracts, partly caused by a huge amount of defence contracts in the US. Finally the Netherlands has a lower score in the area of intellectual property rights and a lower share of fast-growing companies. This contributed 0.02% and 0.03% of GDP respectively to the Netherlands' shortfall compared to the OECD average.

Table 1 shows that the Netherlands' private R&D shortfall compared to the OECD average can actually be attributed entirely to a negative impact by the sector composition in the Netherlands (around 60%) and too little R&D expenditure by foreign companies in the Netherlands (the remainder of around 40%). As indicated in the VNO-NCW memorandum, it can be deduced from this that R&D investments by Dutch (domestic) companies are on an average level compared to their foreign counterparts in the same sectors. They contribute roughly what might be expected of them, given the Netherlands' sector composition. The shortfall therefore does not lie primarily with the Dutch companies.

It is worrying that the large multinationals contribute such a large share of the investments. In 2006 the 'big eight' accounted for 51% of the private R&D expenditure in the Netherlands, according to figures from Technisch Weekblad (2007).[8] This creates vulnerability. It is therefore important to take signals from these enterprises about the Dutch knowledge climate seriously in order to ensure that key centres are not relocated. All the more because a lot of high-tech SME activity exists thanks to or in symbiosis with these multinationals (Agrawal and Cockburn, 2003). It is certainly also sensible to seek to expand the pool of multinational companies[9]. Although these companies will only make a significant contribution to R&D expenditure after some time, some may also join the big eight in due course, which means that the group of large R&D-intensive multinationals can expand to a greater number than the current eight. The 'problem' that a few companies provide a large proportion of the R&D expenditure also occurs in other countries, incidentally. For example, in Finland Nokia is responsible for almost 1/3rd of all Finnish R&D expenditure and in Sweden Ericsson accounts for 2/5^{ths} of all R&D expenditure (Schibany and Streiger, 2005).

The comparison with OECD countries gives an insight into the background to and reasons for the Netherlands' shortfall (compared to the OECD average), but requires some refinement. After all, the Netherlands is thereby being compared to countries including Japan and the United States. It is debatable whether this is realistic, since the economies of these countries are many times larger than that of the Netherlands. As a country within the EU15 the Netherlands is more comparable to a state within the US. It seems likely that R&D investments are influenced by the size of the country. A larger country offers more room for spillovers within the national frontiers, which allows more knowledge developed elsewhere in the country to be utilised by companies to build on in their own R&D efforts. A larger domestic economy also means more possibilities for the sale of new products in the home market. Yet a cross-section correlation between the size of the working population and the R&D intensity of companies in 20 countries shows no significant relationship (Donselaar and Segers, 2006). The same applies if this test is repeated for gross domestic product. The hypothesis can therefore not be confirmed empirically. It may be that the spillover opportunities are influenced more by distance than by national frontiers. The potential market may in turn be offset by the openness of the economy. Openness makes national frontiers less relevant.

8) The 'big eight' are the eight multinationals with the highest R&D expenditure in the Netherlands: Philips, ASML, Akzo Nobel, NXP, Shell, DSM, Océ and Unilever.

9) On the advice of the Innovation Platform, the Ministry of Economic Affairs is actively pursing a policy on the development of SMEs through the Growth Accelerator programme.

Europe has set itself targets with regard to R&D investments, but it is questionable whether these targets can be translated directly to the Netherlands ("3% for Europe is 3% for the Netherlands"). The extent to which the Netherlands has a negative sector composition effect compared to the countries of the EU is thereby important. It is also possible to ask to what extent the 3% target at EU level is achievable, given the characteristics of Europe compared to the US and Japan. An empirical comparison of the Netherlands with the EU15 and of the EU15 with the US and Japan in the sections below provide some additional insights.

3. The Netherlands' private R&D shortfall compared to the EU15 average

The shortfall of 0.2% of GDP in the Netherlands' research investments compared to the EU15 average can be entirely attributed to differences in the sector composition. It could be concluded from this that the Netherlands' target for private research investments may only deviate by 0.2%-points from the European target of 2%.

Compared to the EU15, the Netherlands has a fairly small private R&D shortfall of 0.2% of GDP. Figure 5 shows that this is entirely attributable to a negative sector composition effect. This means that if targets for Europe as a whole are maintained and Europe achieves them, the Netherlands can only hide behind its sector composition to a limited extent. It is therefore not unreasonable to translate the European 3% target to 3% for the Netherlands (possibly 2.8%) and with this 2% private R&D (possibly 1.8%)?

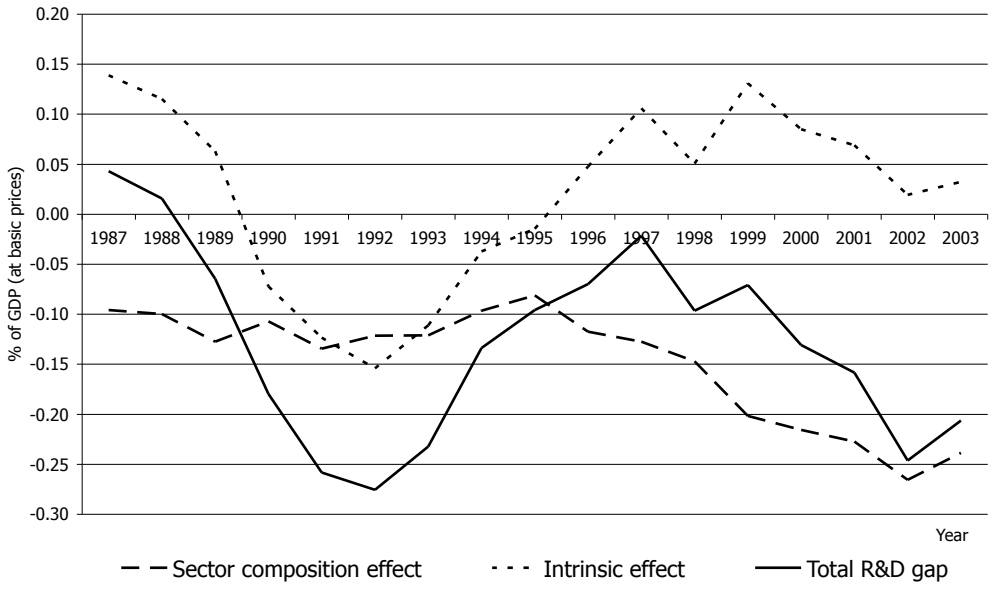

Figure 5: Breakdown of the Netherlands' private R&D shortfall compared to the EU15 average (% of GDP at basic prices)

Source: Ministry of Economic Affairs (database developed in 2006, consisting of data from the OECD and GGDC in particular).

Although the Netherlands has no negative intrinsic effect compared to the EU15 average in the way it does when compared to the OECD average, research by Erken and Ruiter (2005) supplemented by research by Erken and Van Es (2007) shows that the Netherlands also lags behind in the amount of the R&D expenditure by foreign companies when compared to the EU15 countries. However, this is slightly less so when compared to the EU15 average, because the US scores considerably better on this point than the EU15. The research cited offers no breakdown of the private R&D position of the Netherlands compared to the EU15. However, it can be concluded from the underlying figures from that research that the negative effect of the amount of R&D expenditure by foreign companies is compensated importantly by a positive effect of the strong openness of the Dutch economy.[10]

10) With regard to the openness of the economy, a correction has been made here for the size of the economy. Companies in smaller countries sell more to foreign markets, but set against that is a smaller domestic market. Even when corrected for the size of the economy, the Netherlands still turns out to be one of the most open economies in the OECD.

4. Private R&D shortfall of the EU15 compared to the US and Japan

The US and Japan have been used as the benchmark for setting the European targets. Their scores for private research investments do not seem achievable for Europe as a whole. After all, Europe does not have a Community patent (valid for the whole region), scores less positively than the US in terms of regulation and competition and also lacks the US's defence expenditure as a driver for research spending.

A few European countries still score highly with their research investments within the given European context. They thus show that there is also scope for the Netherlands to take steps to increase its private research investments.

An increase in the private R&D intensity of the Netherlands to the OECD or EU average would be insufficient to achieve the 2% ambition, based on the current situation. According to the most recent figures, which refer to 2006, private R&D intensity in the OECD averages 1.6% of GDP (OECD, 2008a). For a large part this is due to the fact that private R&D intensity in the EU15 is currently still only 1.2% of GDP. In the two large countries which together with the EU15 make up a large proportion of the OECD – namely the US and Japan – private R&D intensity is much higher: 1.95% of GDP in the US and 2.7% in Japan. The US and Japan were important benchmark countries in formulating the Barcelona target within the EU in 2002 (European Commission, 2002). That particularly applies to the US, where total R&D intensity according to the latest figures is equal to 2.6% of GDP. In Japan total R&D intensity is even higher at 3.4%, according to the most recent figures.

One question which arises is whether it is realistic for the EU as a whole to strive for a private R&D intensity of 2%, with linked to this question the fact that the Netherlands is close to the EU average (and where only a 0.2%-points difference to the EU average could be justified as compensation for sector composition). Doubts about the Barcelona targets are now widespread.[11] In order to gain more insight into how realistic the targets are, the difference between private R&D intensity in the EU15 and the US is examined below. We will also give further attention to the relatively high private R&D intensity in Japan. The 3% target will be re-examined on the basis of this comparison with the EU peers.

Figures 6 and 7 show that the sector composition only accounts for a small part of the EU15's shortfall in private R&D intensity compared to the US and Japan. The lead of both the

11) For critical comments about the feasibility of the targets see Schibany and Streicher (2005) and Van Pottelsberghe (2008), amongst others.

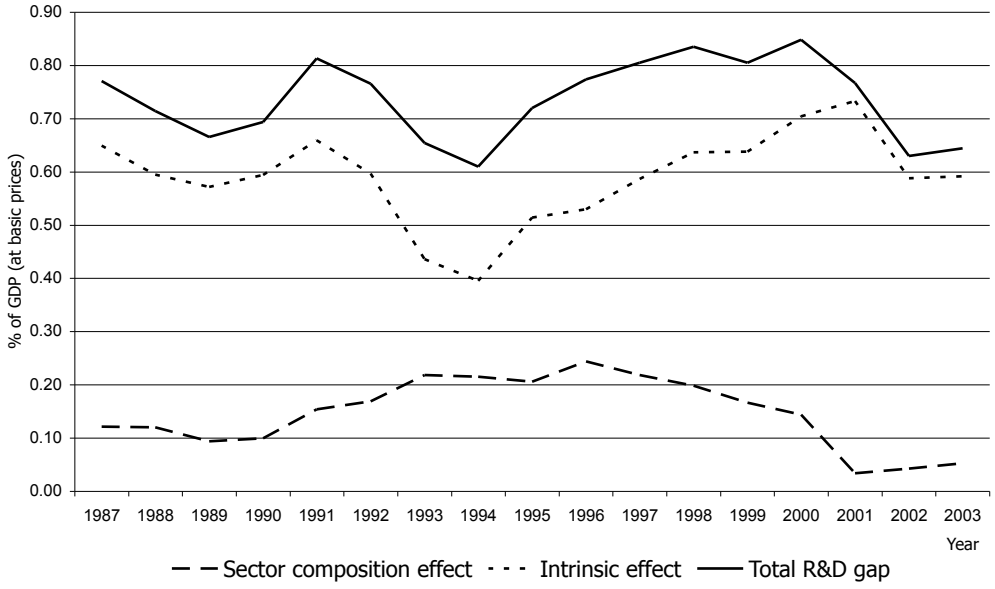

Figure 6: Breakdown of the US's private R&D lead compared to the EU15 average (% of GDP at basic prices)

Source: Ministry of Economic Affairs (database developed in 2006, consisting of data from the OECD and GGDC in particular).

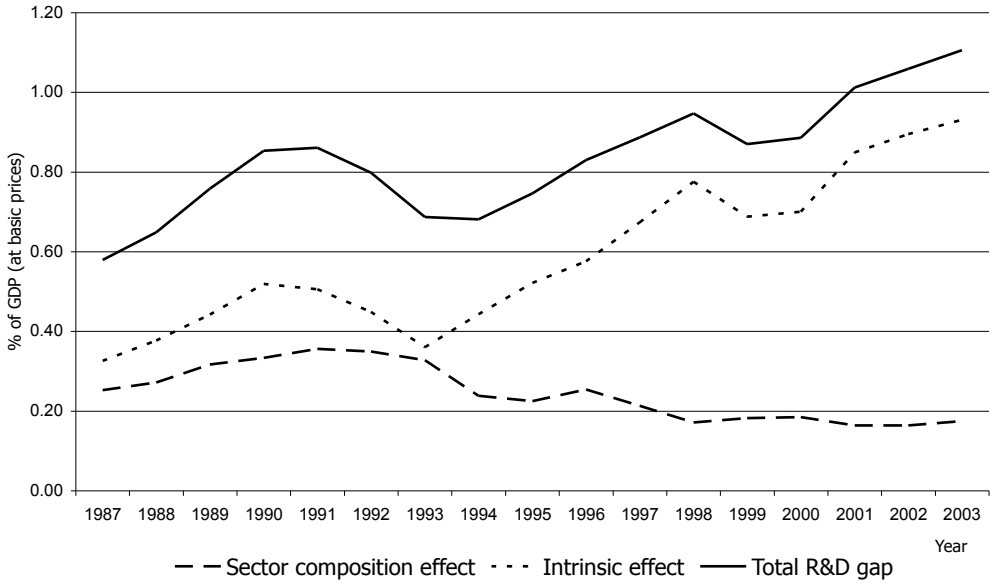

Figure 7: Breakdown of Japan's private R&D lead compared to the EU15 average (% of GDP at basic prices)

Source: Ministry of Economic Affairs (database developed in 2006, consisting of data from the OECD and GGDC in particular).

US and Japan over the EU15 is mainly intrinsic and thus can – theoretically – be influenced. Erken and Van Es (2007) have drawn up a breakdown which gives an insight into the explanatory factors for the EU15's intrinsic R&D shortfall compared to the US. Table 2 shows that breakdown. From this it appears that the intrinsic factors also include institutional components which are difficult to influence (in the short term). Differences in regulation and competition (–0.30%) cannot quickly be turned around. The US scores significantly better than Europe on this factor (inward-oriented economic regulation). Manifestations of

this factor include barriers to competition, price controls, influence over business activities and decisions and public ownership of companies (Erken and Van Es, 2007). Nor does Europe have a Community patent. As a result, the costs of patenting in the US (one patent) are less by a factor of ten than for Europe as a whole (effectively one patent in each country) (Van Pottelsberghe, 2008). Nor will Europe catch up with the US any time soon in terms of government spending on defence. No breakdown is yet available for Japan. Explanations for its high score may lie in one national patent (Van Pottelsberghe, 2008) and a culture immersed in technology and leadership. Additional research would have to be carried out in order to gain more insight into the Japanese lead.

Table 2: Breakdown of the private R&D shortfall of the EU15 compared to the US, 2002

Determinants	**Contribution; % of GDP**
Sector composition effect	***–0.08%***
Intrinsic effect	***–0.54%***
Foreign R&D investments	–0.11%*
Government funding of private R&D	–0.14%*
Fast-growing firms	–0.03%
Openness of the economy	+0.02%
Public R&D	–0.04%
– Higher education R&D	+0.01%
– Public research institutions	–0.05%
Inward-oriented economic regulation	–0.30%**
Intellectual property rights	–0.14%
Capital income share (CIQ)	–0.01%
Real interest rate	+0.04%
Business cycle	+0.01%
Bank credits	+0.07%
Interaction effect	–0.01%
Residual	+0.10%
Total R&D shortfall	***–0.63%***

Commentary: * 2001, ** 2003.

Source: Erken and Van Es (2007).

The above shows that although Japan and the US are Europe's peers, they have a lead which cannot be made up in the short term. To do this, decisions would have to be made at European level on issues including a Europe-wide Community patent. Choices would also have to be made – mainly at national level – concerning (the reduction of) market regulation. Until then it will be virtually impossible for the Netherlands to achieve the 3% figure. But the Netherlands can make significant moves within the European context. After all, there is considerable heterogeneity within the EU15. Despite the lack of shared patent and the hindrance of an imperfect market, some European countries score highly, whereby Finland and Sweden in particular can be cited as positive examples.

Private R&D can be increased by influencing the sector composition or by reducing the intrinsic shortfall by tackling the location appeal. Both aspects are discussed in the next section.

5. Influencing the sector composition

With targeted investment in knowledge, the Dutch government can have an impact on the size of technology-intensive sectors in the Netherlands. Government investment in public research has a major effect on private parties' investments through the altered sector composition. It is thereby important that structural investments take place over a longer period.

The starting points for policy relating to private R&D investments are set out in Figure 8. The sector composition can be influenced in two ways. Extra R&D expenditure (both public and private) improves the sector composition effect over time. One might thereby particularly think of an improvement in the technological competitive position of technology-intensive companies, which leads to larger technology-intensive sectors within the national economy. One might also think of the arrival of foreign technology-intensive companies which establish themselves in a country, creating a cluster of such companies, plus knowledge institutions and SMEs aimed at them. Empirical estimates by Erken and Ruiter (2005) indicate that an increase in a country's intrinsic private R&D position compared to other countries by 0.10% of GDP would, in the long term, lead to an improvement in the sector composition effect of 0.116% of GDP. This means that an improvement in a country's intrinsic private R&D position by 0.10% will translate in due course into an improvement of a country's overall private R&D position by more than double, namely 0.216%. Just like an improvement in the intrinsic private R&D position, an improvement in a country's public R&D position compared to other countries of 0.10% would lead to an improvement in the sector composition effect on private R&D of 0.116%. A second factor is the labour cost per unit of product compared to the foreign competition in the manufacturing sectors. An increase in this by 10% leads to a deterioration of the sector composition effect by 0.02% of GDP in the following year through a deterioration in the price-competitive position of manufacturing companies.

The private intrinsic R&D position and the public R&D position of a country gradually affect the sector composition with a long time-lag. Continuity is very important here. Structural investments need to be made over a long period in order to actually achieve the positive sector composition effects described above. In other words, altering the sector composition is a time-consuming process. Just as the current sector composition is a snapshot of the policy pursued in the past, the future sector composition is a snapshot of the policy pursued today. Extra private or public R&D expenditure will have to continue for a longer period in order to alter the sector composition. As has been stated above, it has been shown in Finland (and to a lesser extent Canada) that this can be done.

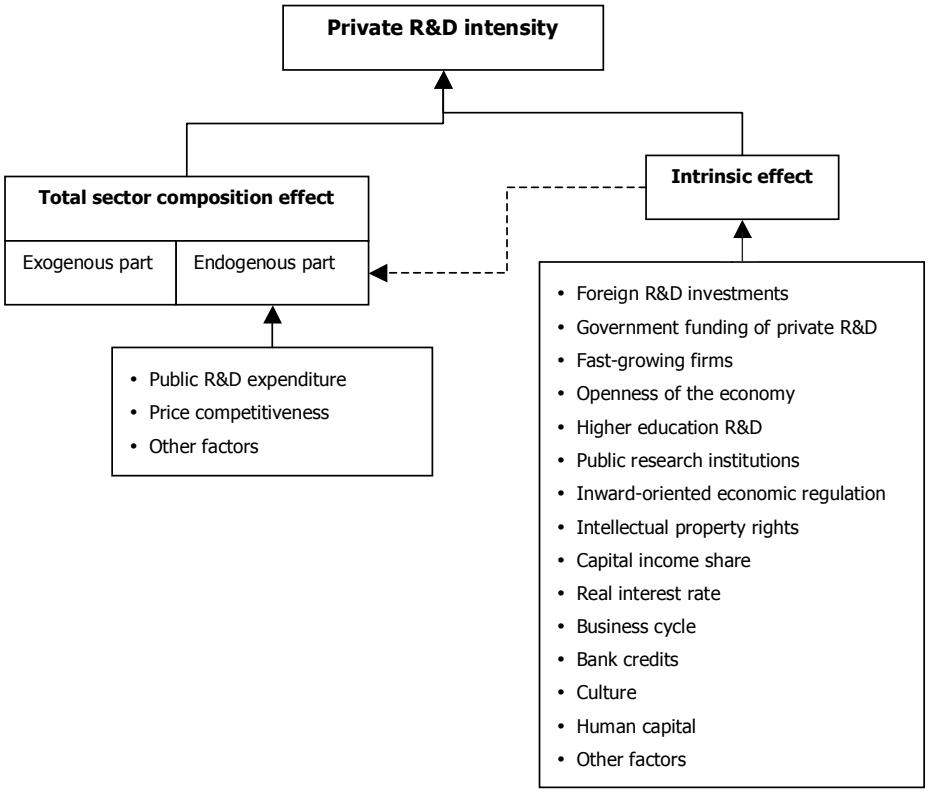

Figure 8: Relationship between private R&D intensity, the intrinsic effect and the sector composition effect
Source: Erken and Van Es (2007), based on Erken and Ruiter (2005).

It is hard to identify which part of the Netherlands' sector composition effect is endogenous and which part is exogenous. It is possible, however, to indicate – for example – how large the Netherlands' sector composition effect will be in the long term if the Netherlands'

private intrinsic position compared to the OECD average is reduced to zero. On the basis of the fairly stable sector composition effect in the period 1987–2003 shown in Figures 2 and 3, it can be assumed that with unchanging circumstances the Netherlands' negative sector composition effect will remain at around 0.3% of GDP compared to the OECD average. Then it can be calculated that the reduction of the Netherlands' intrinsic private R&D shortfall compared to the OECD average (0.2% of GDP in 2003) to zero would reduce the Netherlands' sector composition shortfall compared to the OECD average to around 0.1% of GDP in the long term. The remaining sector composition effect represents how exogenous factors such as location, climate and culture affect private R&D intensity in the Netherlands compared to the OECD average via the sector composition. If the Netherlands wanted to completely reduce the sector composition effect to zero, a further improvement of the Netherlands' intrinsic private R&D position would be required.

An improvement in the private intrinsic effect can partly be achieved through an improvement in the public R&D position. Empirical research indicates that increasing public R&D intensity by 0.10% of GDP has a positive effect on private intrinsic R&D expenditure of around 0.03% of GDP (Donselaar and Segers, 2006). Knowledge developed by universities and public research institutions can be used by companies to increase the results of their own R&D efforts, which leads to a positive effect of public R&D expenditure on private

intrinsic R&D expenditure. This means that an improvement in the public R&D position leads to an improvement in the sector composition effect through two channels. Firstly, there is the direct effect of the public R&D position on the private sector composition position as described above. There is also an indirect effect through an improvement in the private intrinsic R&D position. The effect of an increase in the public R&D position on the private R&D intensity as a whole can therefore be substantial. An increase in the public R&D position by 0.10% of GDP could, in the long term, have a total positive effect of 0.18% of GDP on the private R&D position of a country.[12] This is a large effect which, although based on empirical research, must be interpreted cautiously. Additional research into the effect of public and private R&D expenditure on the sector composition would be needed before a clear conclusion can be drawn here.

12) This is made up as follows: 0.116% (direct effect on the sector composition position) + 0.03% (direct effect on the intrinsic position) + (0.03/0.10) x 0.116% (indirect effect on the sector composition position).

6. Influencing the intrinsic effect

Excellent location appeal is very important in order to attract foreign research investments and maintain the key centres of the Netherlands' own multinationals. This can be translated into location factors where the Netherlands needs to score highly in order to be appealing. If the Netherlands has sufficient knowledge workers, trailblazing knowledge institutions and the willingness to take risks, the Netherlands can move up companies' shopping lists. Structural investment in knowledge and stimulating focus and mass in research also offers opportunities for the Netherlands.

After discussing the possibilities for influencing the sector composition effect, we now discuss in more detail the possibilities for tackling the intrinsic effect. Five lines of action can be identified within the Ministry of Economic Affairs' research (particularly Erken and Ruiter, 2005):

- an excellent location appeal;
- structural investment in knowledge and stimulating focus and mass in research;
- implementing institutional renewal;
- ensuring a favourable financial environment;
- broadening and deepening the base of R&D companies.

The lines listed are aimed at influencing the choice at micro level. After all, however well all the sectors may be supported, we are dependent on businesses. Businesses need to choose to make R&D investments (in the Netherlands) on the basis of rational considerations. We need to look at all the factors at micro level (optimising the implementation of the innovation function). This means different objectives for different groups of companies. The 'big eight' should keep their (historically determined) key R&D centres in the Netherlands as much as possible. Foreign companies must place the Netherlands at the top of their list of choices. And we want all other parties to start investing comparatively more in R&D.

Excellent location appeal

If we look at the internationalisation of R&D (comparatively little R&D expenditure by foreign companies in the Netherlands, adjusted for the openness of the economy), location factors for R&D can be improved. This also has a direct benefit in retaining the activities of the 'big eight'. The allocation of R&D is a commercial decision. There are – broadly speaking – two motives for companies to organise their R&D internationally:

- modifying products, processes and technologies to local market requirements and offering support to foreign production and distribution facilities;
- gaining access to excellent research results and talents, and initiation and strengthening of R&D where the greatest returns are expected (Erken, Kleijn and Lantzendörffer, 2004).

With regard to the first motive, the Netherlands has the disadvantages of the absence of major production facilities or a large local market. In other words, the Netherlands does not have the ideal provisions for following up R&D. The second motive can be translated into a set of location factors. The Netherlands needs to score well on these in order to be appealing. Multinationals are still in the Netherlands because of 'path dependence' (decisions made in the past), but excellent knowledge is becoming more important than nationality. This effect is amplified by recent takeovers of Dutch multinationals by foreign companies and investment funds.

The effect of location factors has been investigated by the Ministry of Economic Affairs, but also by the OECD (2008b) amongst others. These studies generally reveal the same factors. The findings of the Ministry of Economic Affairs' study are shown in Table 3. What makes this list particularly interesting is that they are also important factors in investment decisions of Dutch (domestic) companies. Important factors are **availability of highly-skilled personnel** and **world class knowledge institutions**. VNO-NCW reproduces the list of location factors in full in its R&D memorandum, but thereby also identifies the lack of innovative dynamism in the Netherlands. This is linked to the factor of regulation and legislation, but results in fewer fast growers and lagging productivity. Translated into concrete measures and policy this means a greater willingness to dare to take risks on the part of both government and the private sector. It also means taking failure less seriously. This has recently also been put forward in a recommendation from the Scientific Council for Government Policy (WRR) (2008).

Table 3: Degree of importance of R&D location factors and the Netherlands' score

Location factors	Importance (0 – 100)	Netherlands' score (3 is international average)
Availability of highly-skilled personnel	65	3*
International accessibility	52	3
Quality of knowledge infrastructure/universities	50	4
Value added of foreign firms	45	2
Private R&D capital	45	1.5
Cooperation between firms and knowledge institutions	44	2
Capacity and quality of ICT infrastructure	42	4
Proximity of lead users and/or strategic partners	42	No data available
of R&D stimulation incentives	41	2
Costs of R&D personnel	40	2
Quality of life	39	5
Tax regulations	36	3
Regulation and legislation	36	3
Entrepreneurial climate which fosters innovation	35	3

Commentary: *4 for stock of talent; 2 for inflow

Source: Erken, Kleijn and Lantzendörffer (2005).

Structural investment in knowledge and encouraging focus and mass in research

Investments in public R&D (as set out in the KIA) are lagging behind the targets, whilst 0.10% of extra R&D investments in the public sector (universities and research institutions) increases the private intrinsic R&D position by 0.03%. Public R&D also appears to have a strong impact on the sector composition, as discussed in Section 5. The Dutch government financing of private R&D, expressed as a proportion of GDP, is low compared to the OECD average (0.16% compared to 0.22% in 2001; Erken and Ruiter, 2005). A boost of 0.10% to **financing of private R&D by the Dutch government** would lead to 0.10–0.15% extra private R&D expenditure (Donselaar and Segers, 2006). In this the US scores particularly well with items such as defence expenditure, but France also scores well through major infrastructural expenditure such as on the construction and development of the TGV. In addition, companies particularly indicate that they want **focus and mass** in the knowledge infrastructure and in the stimulation measures for research and development. Here the Key Areas Approach ('Sleutelgebiedenaanpak') is a positive development. The impact of the Key Areas Approach on private R&D investments will be included in the audit of the key areas by the Innovation Platform at the end of 2008. There could often be a better match between the private and public research agenda. Van Pottelsberghe (2008) indicates that the emphasis must be placed on the transfer of knowledge when investing in universities. Here the role of institutes which can act as a bridge between knowledge institutions and business is important.

Remaining action lines: implementing institutional renewal; ensuring a favourable financial environment; broadening and deepening the base of R&D companies

Institutional renewal relates to **intellectual property**. The Netherlands already scores relatively well here, but Van Pottelsberghe (2008) indicates, for example, that the costs of a Europe-wide patent are ten times those of a US patent. A **favourable financial climate** is a requirement for substantial private R&D investments. Increasing the number of fast-growing companies does not have a major effect on the amount of R&D in the Netherlands straightaway, but does ensure a **broadening and deepening of the base** in the longer term. This would make the Netherlands less dependent on the big eight. (This is a European problem, incidentally: "…across the EU, there are strikingly few firms in fast-growing (and R&D intensive) new sectors, with the notable exception of mobile telephony." (Barysch, Tilford and Whyte, 2008))

Appendix

List of Ministry of Economic Affairs studies relating to R&D plus other consulted literature.

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