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STRENGTHENING INNOVATION IN THE NETHERLANDS: MAKING BETTER USE OF KNOWLEDGE CREATION IN INNOVATION ACTIVITIES

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ABSTRACT/RÉSUMÉ

Strengthening innovation in the Netherlands: making better use of knowledge creation in innovation activities

Strengthening the innovation system in the Netherlands is a priority for raising productivity growth, which has been relatively weak in recent years. Knowledge creation in the Netherlands is strong -- scientific publications per capita are the sixth highest in the OECD -- but innovation activity is only around the average for OECD countries according to the EIS Summary Innovation Index. The main weaknesses are in business R&D intensity, the share of the population with tertiary education, and in commercially applying new knowledge. This paper discusses reforms being implemented to overcome these weaknesses and suggests directions for building on such reforms. Co-operation between public research organisations and innovating firms is being strengthened, support for innovation is being rationalised and measures are being taken to increase both the current and prospective supply of scientists and engineers with a view to making the Netherlands a more attractive location for R&D investments. To increase the tertiary attainment rate, the authorities are considering introducing shorter tertiary courses and are experimenting with greater competition among tertiary education suppliers for public funds. To strengthen performance in commercial application of new knowledge, barriers to entrepreneurship are being reduced but more should be done to strengthen incentives for entrepreneurship.

This Working Paper relates to the 2005 OECD Economic Survey of the Netherlands (www.oecd.org/eco/surveys/netherlands).

JEL classification: I2, O39; O31; O33; O34; O38; O52.
Keywords: Innovation; EIS, R&D; factor analysis; scientists and engineers; skilled migration; public research organisations; patents; intellectual property rights; product market competition; entry barriers; regulatory reform; tertiary education; tertiary attainment; Netherlands.

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Renforcer l'innovation aux Pays-Bas : mieux utiliser la création de connaissances dans les activités d'innovation

Il est essentiel de renforcer le système d'innovation aux Pays-Bas pour y relancer la croissance de la productivité, qui est relativement faible depuis quelques années. La création de connaissances est dynamique aux Pays-Bas -- qui se classe au sixième rang des pays de l'OCDE en termes de publications scientifiques par habitant -- mais les activités d'innovation se situent simplement aux alentours de la moyenne de la zone OCDE, d'après l'indice de synthèse de l'innovation (ISI) du tableau de bord européen de l'innovation (TBEI). Les principaux points faibles résident dans l'intensité de recherche-développement (R-D) des entreprises, la proportion de la population diplômée de l'enseignement supérieur, et l'exploitation commerciale des nouvelles connaissances. Ce document examine les réformes mises en œuvre actuellement dans le but de remédier à ces faiblesses, et propose des orientations en vue d'aller plus loin. Pour l'heure, la coopération entre les organismes de recherche publics et les entreprises innovantes est renforcée, le système de soutien à l'innovation est rationalisé, et des mesures sont prises pour accroître l'offre, tant actuelle que future, de scientifiques et d'ingénieurs en vue de faire des Pays-Bas un site plus attractif pour les investissements de R-D. Afin de relever le taux de diplômés de l'enseignement supérieur, les autorités envisagent de mettre en place des formations supérieures plus courtes et ont décidé, à titre expérimental, de faire davantage jouer la concurrence entre les fournisseurs de services d'enseignement supérieur pour l'attribution des fonds publics. Afin d'améliorer les résultats obtenus en matière d'exploitation commerciale des nouvelles connaissances, les pouvoirs publics s'emploient à réduire les obstacles à l'entrepreneuriat, mais il faudrait aller plus loin pour stimuler l'esprit d'entreprise.

Ce document de travail complète l'*Étude économique* consacrée aux Pays-Bas par l'OCDE en 2005 (www.oecd.org/eco/etudes/paysbas).

Classification JEL : I2, O39, O31, O33, O34, O38, O52.
Mots clés : Innovation, TBEI, R-D, analyse factorielle, scientifiques et ingénieurs, migrations de travailleurs qualifiés, organismes de recherche publics, brevets, droits de propriété intellectuelle, concurrence sur les marchés de produits, barrières à l'entrée, réforme de la réglementation, enseignement supérieur, taux de diplômés de l'enseignement supérieur, Pays-Bas.

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STRENGTHENING INNOVATION IN THE NETHERLANDS: MAKING BETTER USE OF KNOWLEDGE CREATION IN INNOVATION ACTIVITIES

By

David Carey, Ekkehard Ernst, Rebecca Oyomopito and Jelte Theisens.[1]

1. Introduction

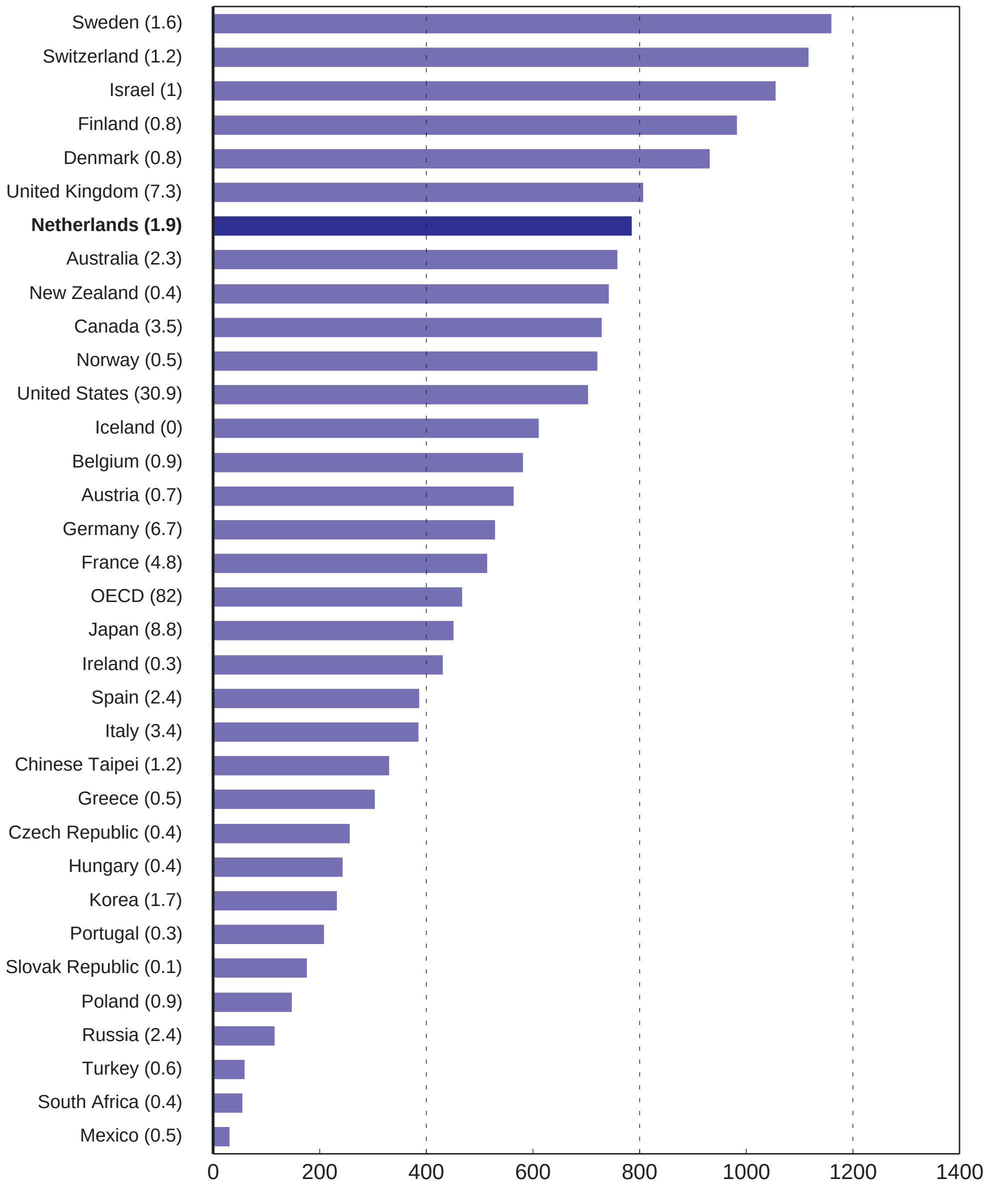
1. The Netherlands has an excellent record in knowledge *creation* but a mediocre record in innovation activity, which is defined as the successful *development* and *application* of new knowledge in new products and/or processes.[2] Key innovation indicators that are relatively weak include the business R&D intensity, the proportion of the population with tertiary education, the use of non-technological changes, and the introduction of new processes and products (at least those that are new to the firm). This chapter begins by discussing the aspects of innovation activity that are relatively weak. It then analyses the causes of these weaknesses, discusses reforms that are being made to attenuate them and suggests directions in which the reforms could be taken further.

2. A Dutch paradox

2. The Netherlands performs well in knowledge creation: scientific publications *per capita* are 6th highest in the OECD (Figure 1) and the citation impact is high at 25% above the worldwide citation average[3]. However, innovation activity, which entails the development and application of new knowledge in new products and/or processes, appears to be only mediocre. According to the European Innovation Scoreboard (EIS) Summary Innovation Index, which brings together 22 indicators considered to reflect innovation activity (Box 1), innovation activity in the Netherlands ranks 12th out of the 20 high-income countries for which the index has been calculated (Figure 2). Although the Netherlands ranks slightly above the EU15 average, it is far below the leaders. Along with Norway, the Netherlands ranks 6 places lower on innovation activity than on the scientific publications score, the largest fall in ranking between these two indicators (Table 1). This performance represents a paradox because rankings for scientific publications and innovation activity are in general highly correlated.

3. This chapter identifies the areas in innovation activity where Dutch performance is weak and makes recommendations to improve performance and thereby reduce the gap between knowledge creation and innovation activity. To focus the discussion, factor analysis[4] (see Annex A1.1 for details) has been used to determine which of the EIS indicators are related to the same underlying phenomena, with the other indicators being set aside. Ten of the EIS indicators are highly related to each other and seem to reflect *knowledge development*.[5] The Dutch score on these indicators is high for European Patent Office (EPO) high-tech patent applications and public R&D expenditure as a share of GDP but below average on the proportion of the population with tertiary education and business expenditures on R&D as a percentage of GDP (see Annex A1.1, Table A1.4). Four additional indicators[6] are related to each other and mostly appear to reflect *knowledge application*. The Netherlands scores relatively poorly on all four of these indicators, pointing to weaknesses in implementing organisational change and in introducing new products and/or processes (see Annex A1.1, Table A1.5).

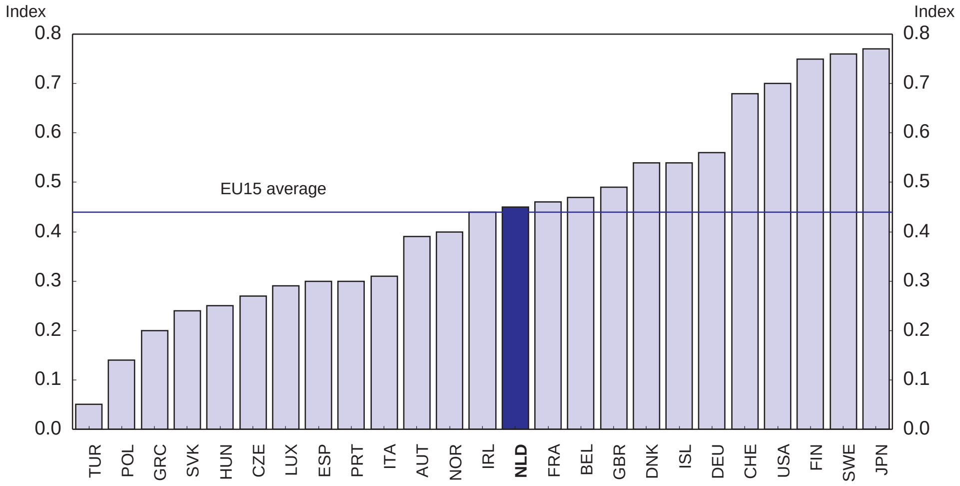
Figure 1. Scientific articles per million population, 2001[1]



1. Data in parenthesis represent the country share in total world scientific articles in 2001.

Source: OECD (2005a), OECD Science, Technology and Industry: Scoreboard 2005.

Figure 2. European Innovation Scoreboard Summary Index in 2004



Source: European Commission, European Innovation Scoreboard 2004 Database.

Table 1. Ranking for scientific publications and EIS Summary Innovation Index[1]

	Scientific publications Per million inhabitants	EIS Summary Innovation Index	Difference in ranking
Austria	12	15	-3
Belgium	9	10	-1
Denmark	4	7	-3
Finland	3	3	0
France	11	11	0
Germany	10	6	4
Greece	18	16	2
Iceland	13	8	5
Ireland	15	13	2
Italy	17	17	0
Japan	14	1	13
Luxembourg	20	20	0
Netherlands	**6**	**12**	**-6**
Norway	8	14	-6
Portugal	19	19	0
Spain	16	18	-2
Sweden	2	2	0
Switzerland	1	5	-4
U.K.	5	9	-4
U.S.	7	4	3
Spearman's rank correlation 0.734, t= 4.58			

1. Table includes only the countries from Figure 5.1 for which EIS data are available

Source: OECD (2005a), OECD Science, Technology and Industry: Scoreboard, European Innovation Scoreboard and our calculations.

Box 1. Indicators and weights for the 2004 EIS Summary Innovation Index (SII)[1]

Indicator	Weight	Indicator	Weight
1.1 S&E	1.0	3.1 SMEs innovating in-house	1.0
1.2 Work pop with 3rd education	1.0	3.2 SMEs innovation co-operation	1.0
1.3Lifelong learning	1.0	3.3 Innovation expenditures	1.0
1.4 Employment med/hi-tech manufacturing	1.0	3.4 SMEs using non-tech change	1.0
1.5 Employment high-tech services	1.0	4.1 High-tech venture capital	1.0
2.1 Public R&D expenditure	1.0	4.2 Early stage venture capital	1.0
2.2 Business R&D expenditure	1.0	4.3.1 New-to-market products	1.0
2.3.1 EPO high-tech patents	0.5	4.3.2 New-to-firm products	1.0
2.3.2 USPTO high-tech patents	0.5	4.4 Internet access (composite indicator)	1.0
2.4.1 EPO patents	0.5	4.5 ICT expenditures	1.0
2.4.2 USPTO patents	0.5	4.6 Value added high-tech manufacturing	1.0
		Total	20.0

1. Detailed descriptions of these indicators in Hollanders and Arundel, 2004 Country rankings can be found in Annex A1.1, Tables A1.4 and A1.5.

3. Improving knowledge development

Increasing business R&D expenditure

Business R&D intensity is relatively low

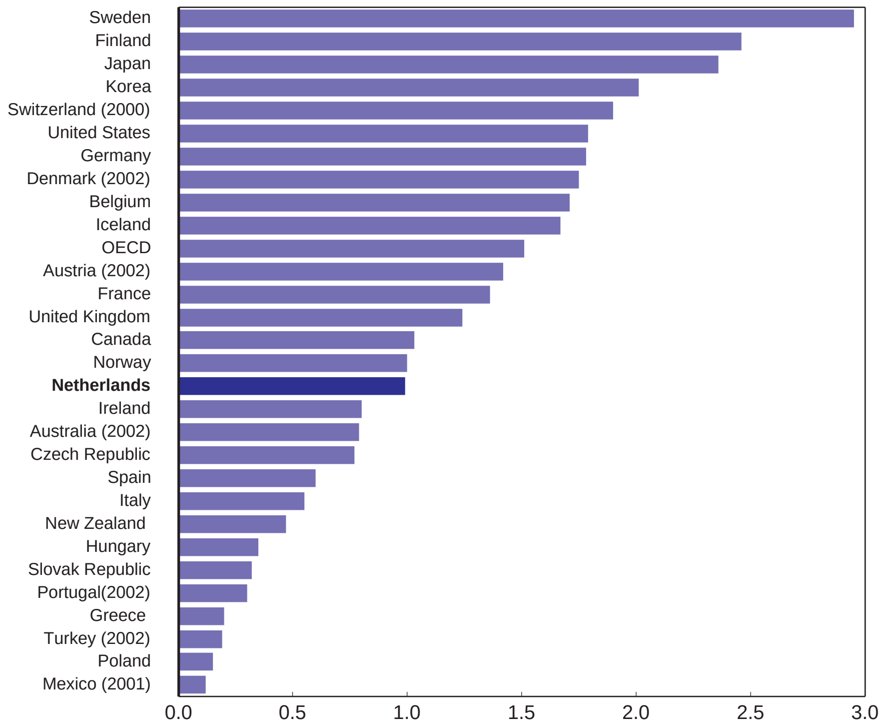
4. Business R&D intensity in the Netherlands is 1.0% of GDP (Figure 3), which is low in comparison with both the EU15 average (1.3% of GDP) and the OECD average (1.5% of GDP) and far behind the leaders. Moreover, while R&D intensity has increased markedly in most OECD countries over the last two decades, especially in a number of other small European countries, R&D spending in the Netherlands has been stable, remaining at its low starting point (Table 2).

Table 2. Long-term developments in business R&D intensity
Percentage of GDP

	1981	2003
Netherlands	0.95	0.99
Belgium	1.00	1.71
Austria	0.61	1.42[1]
Denmark	0.53	1.75[1]
Finland	0.64	2.46
EU15	1.04	1.25
OECD	1.28	1.51

1. 2002.
Source: OECD (2005b), Main Science and Technology Indicators, 2005:1.

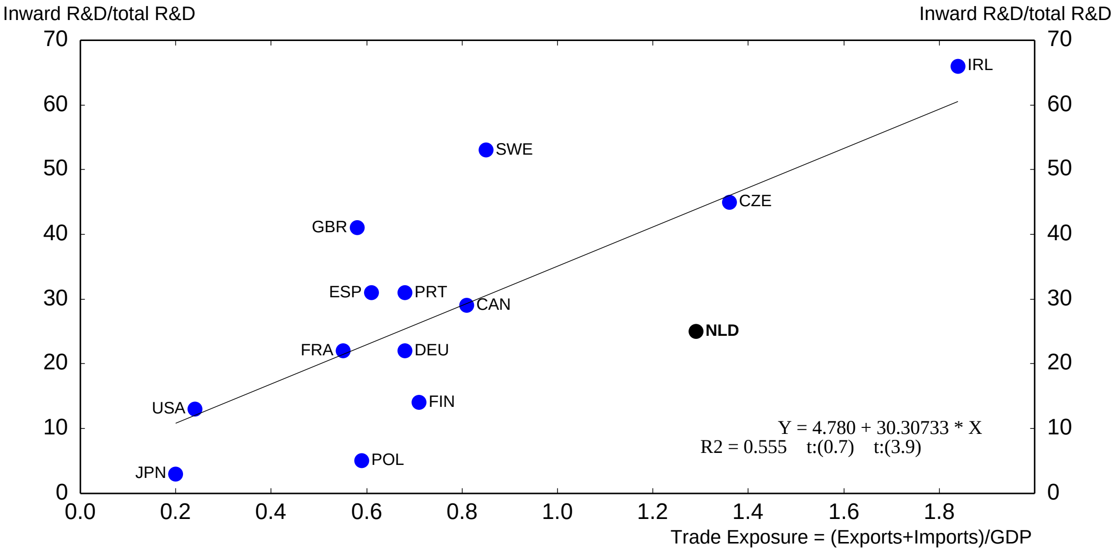
Figure 3. Business enterprise sector expenditure on R&D
Per cent of GDP, 2003 or latest available year



Source: OECD (2005b), Main Science and Technology Indicators, 2005:1.

5. About 60% of the shortfall compared with the OECD average is related to the industry structure (Erken and Ruiter, 2005, Table 12.1): R&D extensive sectors are relatively large in the Netherlands. As far as low business R&D expenditure is attributable to specialisation in sectors that are R&D extensive, there is not much that can be done about it in the near term. However, in the longer-term, success in innovation and related policies could contribute to shifting the Netherlands' competitive advantage towards more R&D intensive sectors. The remaining shortfall can be mainly attributed to lower inward R&D investments by foreign firms (*i.e.*, R&D expenditure of foreign affiliates) in the Netherlands (adjusted for the openness of the economy) in relation to total R&D (Figure 4).[7] In 2001, approximately one-quarter of total private R&D expenditure in the Netherlands came from foreign affiliates. Given the open character of the Dutch economy, however, one would expect the foreign component in total private R&D in the Netherlands to amount to 50% (instead of 25%). This observation is strengthened by looking at FDI in general (see Figure 5). The figure clearly shows that, adjusted for the openness of the economy, the Netherlands performs quite well in attracting FDI in general. The main problem, therefore, is the R&D component within total inward FDI, which is, as already concluded, too low. This suggests that private R&D could be increased by improving the R&D climate – especially for inward R&D.

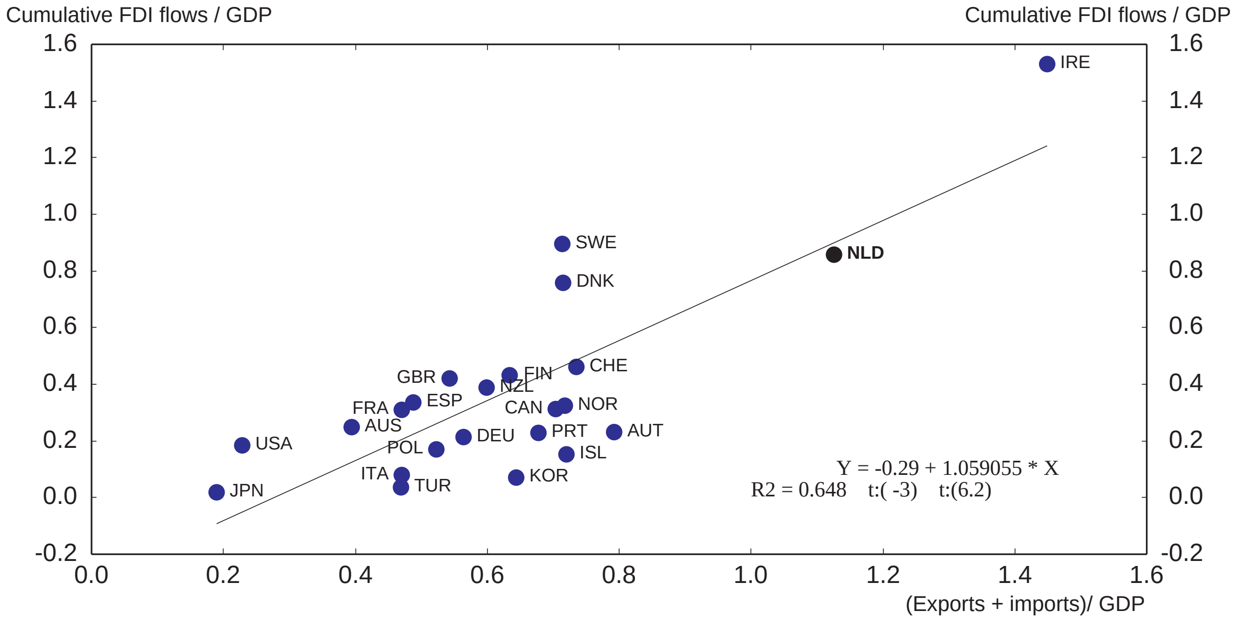
Figure 4. Inward R&D as a share of total R&D in relation to openness of the economy
2001



Source: OECD (2005c), OECD Economic Outlook 78 Database; Erken and Ruiter (2005).

Figure 5. FDI in relation to openness of the economy

1990-2003 average

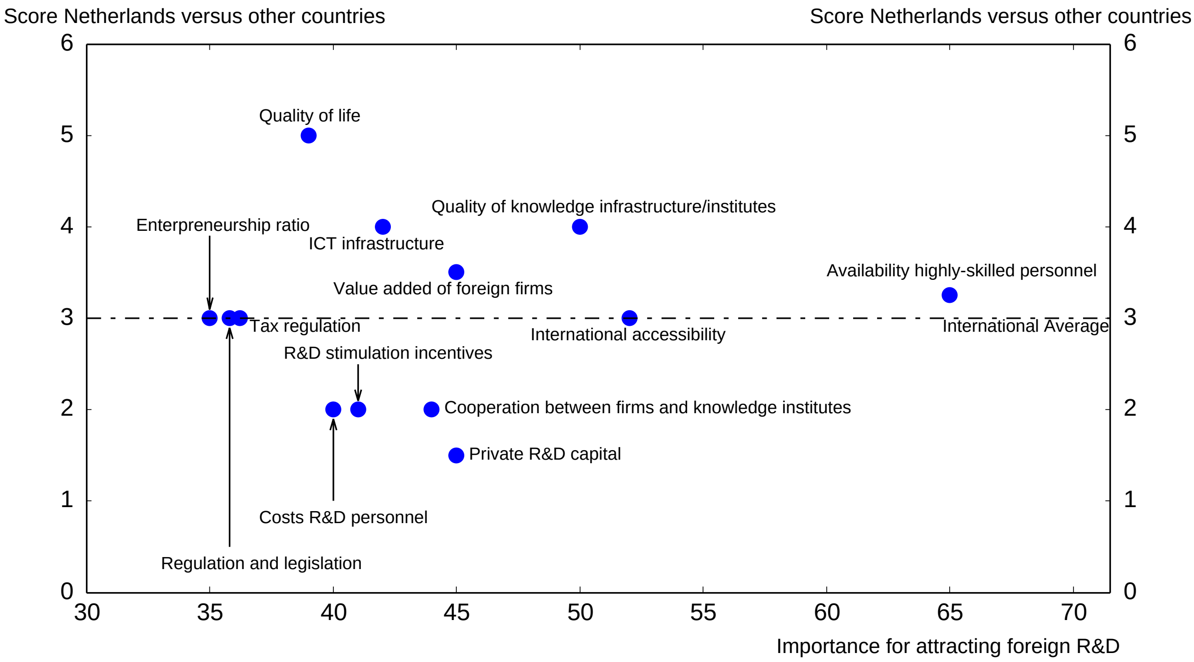


Source: OECD, (2005c), OECD Economic Outlook 78 Database, OECD (2005d), Factbook 2005: Economic, Environmental and Social Statistics.

Factors to improve the climate for business R&D

6. Based on a review of empirical results from the economic literature, a field study and an econometric analysis based on macroeconomic data, Erken, Kleijn and Lantzendörffer (2005) conclude that the most important location factors for inward R&D activities are the availability of highly-skilled (science and engineering) personnel, international accessibility, the quality of knowledge institutions, the value added of foreign firms, the stock of private R&D capital and the cooperation between firms and knowledge institutes (Figure 6). Of these factors, the Netherlands only scores below average on private R&D capital stock and cooperation between firms and knowledge institutes. Improving performance on such co-operation would strengthen both inward and domestic R&D. Similarly, strengthening performance on other location factors, notably the availability of highly-skilled personnel, which is ranked as the most important location factor, would also promote both inward and domestic R&D. The low share of tertiary graduates in younger age groups relative to the share in other advanced countries (see below) and the low share of science and engineering graduates in total graduations (see below) raise concerns about the future availability of highly skilled personnel in the Netherlands.

Figure 6. Performance of the Netherlands on the important location factors for foreign R&D investments



Source: Erken, Kleijn and Lantzendörffer (2005).

Enhance co-operation between knowledge institutions and firms

7. Co-operation between knowledge institutions and firms is vital for applying new knowledge in innovative products and processes. In the Netherlands, the share of innovative enterprises that participates in partnerships with universities or research institutes is comparatively low (Ministry of Economic Affairs (MEA) and Ministry of Education, Culture and Science (MECS), 2004a, Figure 6.6). Research institutes are a relatively important source of information for innovative enterprises but not higher education institutes (MEA and MECS, 2004, Figure 6.7). Moreover, university spin-off activity is comparatively weak (MEA and MECS, 2004, Figure 6.8) and public research organisations (PRO) own relatively few patents (Bongers, den Hertog, Vandeberg and Segers, 2003; Pain and Jaumotte, 2005). Furthermore, the Dutch patents of PRO (and businesses) seem to be less commercially exploited than in other countries (Bongers, den Hertog, Vandeberg and Segers, 2003).

8. It appears that universities are not given enough incentives to exploit their in-house knowledge and patents and have insufficient capabilities to commercialise their research. This may be related to university funding being mainly based on historical distributions, a lack of intellectual property rights (IPR) management skills in the public research domain, and salary scales that make incentive provision for technological transfer organisations (TTOs) difficult. A small step towards making university budgets more dependent on co-operation with firms in innovation activities is being taken by reallocating part of the university research budget (€100 million out of a total budget of € 2 billion) on the basis of the funds a university receives for research projects from the national research council (NWO) and third parties. It is still a matter of discussion if this is a sufficient step forward. The government has recently set-up a committee of external experts that will advise on this issue (the Chang committee). While universities have wide discretion to give incentives to staff to co-operate with firms in innovation projects, so far only a few universities have acted in this regard by implementing (on a small scale) the so-called tenure track system, in which researchers are given a clear career path with a corresponding income scale.

9. Another factor that may contribute to the limited use made of Dutch knowledge creation in business innovation is strong public sector demand for research in certain, predefined areas, which could crowd out possible public-private research networks. This conclusion is supported by evidence that the simultaneous presence of public authorities on the demand and supply side of the research market is leading to a distortion of resources away from private sector needs (Rensman, 2004). Low mobility of researchers between PRO and business enterprises also inhibits co-operation by limiting the development of personal networks and exchanges of tacit information.

10. In order to strengthen science-business linkages, a variety of institutions to support knowledge transfer has been set up (Box 2). These include the Innovation Platform (set-up in 2003), which comprises cabinet members and leading actors from PRO and business and proposes strategic plans to reinforce the Dutch knowledge economy, and four Leading Technology Institutes (Technologische Top Instituten, TTI, created in 1997), which are virtual institutes for public-private co-operation on fundamental and strategic research in applied sciences. Through the TTI, the Dutch government is trying to improve -- in cooperation with specific universities -- innovative capacity and competitive strength in industries that draw on knowledge in certain areas (telematics, agro-food, metals, and polymers). The TTI have contributed significantly to improving public-private partnerships for research and innovation (OECD, 2004). In addition, more weight is to be given to demand-driven financing of the applied research institutes (TNO) and large technology institutes (GTI).[8] To realise a joint agenda on research and innovation activities, the government has established two coordination organisations ('regie-organen') in the fields of genomics and ICT. Improving co-operation between such companies and PRO should be a priority. In this regard, a new policy instrument (the smart mix) will be launched in 2006 that provides for programmes to enhance focus and mass in excellent basic research and social and economic valorisation of this research. These programmes are to be run by consortia of organisations from the research sector, firms and social organisations.

Box 2. Institutions to transfer knowledge

Three major actors are present in the Dutch research sector to provide knowledge creation and transfer: The Netherlands Organisation for Applied Research (TNO); the Large Technological Institutes (GTI, Grote Technologische Institute); and the Leading Technological Institutes (TTI, Technologische Top Instituten).

The TNO comprises 14 specialised institutes that focus on quality of life, defence and public safety, advanced products, processes and systems, the natural and man-made environment, and ICT and services. There are currently 34 Knowledge Centres in which TNO and universities co-operate on specific themes and 50 university professors working part time at TNO. The objective of TNO is to translate scientific knowledge into applied knowledge that is useful for the private sector and government agencies. Through specific financing, the Ministry of Economic Affairs' contributions to TNO are made dependent on the extent to which the private sector is prepared to support TNO research projects. This is designed to promote more demand-driven strategic and applied research.

The GTIs (ECN, GeoDelft, MARIN, NLR, and WL/Delft Hydraulics) were set up to act as transfer institutes for the production of basic knowledge at universities and its application in society (MEA and MECS, 2004, p. 65). In the domain of aerospace, energy, hydraulics, geodesy and marine sciences, they have as their mission the transformation of scientific/fundamental knowledge into applied knowledge for industry (and the government/public administration). The government provides basic funding, as well as financial means for research linked to specific technologies and projects. The amount of this targeted funding is linked to co-funding raised by the institutes for specific projects.

The TTIs (*Technologische Top Instituten* or Leading Technological Institutes), created in 1997 and supported by the Dutch government (it provides around one half of their funding) are aimed at improving the innovative capacity and competitive strength of industry in a number of selected fields. This is achieved through industry-relevant fundamental and strategic research of an excellent international standard, in institutional partnerships between industry and the public research infrastructure. Presently there are four institutes in operation:

- Telematica Institute (situated at the Twente University campus): aims to become industry's long-term research partner to foster business innovation in telematics within and across key players.

- Wageningen Centre of Food Sciences (WCFS; situated near Wageningen Agricultural University Research Centre): concentrates on pre-competitive research, on topics key to future competitiveness of the Dutch agro-food sector, linking food and biosciences/biomedical research.
- Netherlands Institute for Metals Research (NIMR; situated at Delft Technical University): aims to achieve leadership in research and education in areas critical for the international competitiveness of the Dutch metals industry by means of cross-disciplinary research and training.
- Dutch Polymer Institute (DPI; situated at Eindhoven Technical University) has the mission to establish a leading technological institute in Europe in the area of polymer science and engineering, involving establishment of a fundamental knowledge base for industry, development of new industrial concepts and training of scientists and engineers.

11. Measures have also been taken to strengthen PRO-business interactions through greater spin-off activity. Existing instruments to support the creation of technology-based start-ups were streamlined into one programme in 2004, the TechnoPartner Action Programme. In the context of this programme, the TechnoPartner Seed Facility aims to stimulate the lower end of the Dutch venture capital market so that high-tech start-ups, including spin-offs from public institutes, have adequate access to capital. The other programme that bears directly on PRO-business linkages is the TechnoPartner Knowledge Exploitation Subsidy Arrangement (SKE), which encourages business to use scientific knowledge created by publicly financed researchers. The other part of the TechnoPartner Action Programme is the TechnoPartner Platform, which aims to stimulate technology start-ups by promoting entrepreneurship (see below) and identifying barriers that can be removed. In this respect, as noted above, Dutch universities need to become more professional in applying for patents and to transfer them more smoothly to start-ups (MEA and MECS, 2004, p. 96). Universities should be allowed to earmark funds to create facilities aimed at improving the management of their patent pool. It would also help if universities and other PRO were able to benefit from a limited international grace period for patenting (granting patents even for publicly available research not older than one year), thereby mitigating the dilemma between the desire to publish quickly and the novelty requirement for patenting.

12. The Casimir programme, which is based on the Marie Curie- and the French Cifre Schemes, has been established to foster mobility of researchers between PROs and the private sector and to make jobs in research more attractive. It gives subsidies (up to € 160 000 per project) for projects having three partners - a company, a university and an individual researcher. The programme is intended to enable academic researchers to participate in corporate R&D and industry researchers to participate in research at PRO. Project applications are considered by a cross-disciplinary assessment committee, possibly leading to cross-fertilisation. The resulting circulation of knowledge both between the public and the private sphere as well as across sectors is considered to be a pre-condition for public-private spin-offs. It should ensure greater use of existing research potential both in the public and private sectors.

13. Interaction between PRO and business is also being strengthened through the distribution of knowledge vouchers to SMEs. These vouchers (of € 7 500 each) can be used to obtain available knowledge from universities or other research institutes. So far 100 vouchers have been issued. In March 2005 an extra of 400 vouchers have been issued and in October 2005 another 600. The cabinet plans to issue 3000 in 2006. Vouchers can also be used to obtain knowledge from large companies and knowledge institutes in Flandres and Northrein-Westphalia. Requests for vouchers that fulfil the qualifying conditions are randomly accepted – equally valid requests are satisfied in some cases and not in others. This feature of the scheme facilitates evaluation as there is no systematic difference between SMEs that won the lottery and those that lost. An evaluation of the first 100 vouchers (CPB, 2005a) concluded that eight out of ten companies would not have obtained knowledge from third parties without the voucher. Other instruments to improve cooperation between higher (vocational) education institutions and SMEs include: financial support for knowledge-development and knowledge-exchange projects of higher education and SMEs; and support for intermediaries between vocational education institutions and firms and for knowledge circles

aimed at improving the external orientation of (higher) educational institutes - especially with regard to SMEs.

14. While science-industry linkages provide an important means for firms to access new knowledge provided by the public knowledge infrastructure, firm networking to share costs of knowledge creation and innovation -- such as strategic alliances -- both within the Netherlands and with foreign firms are important ways of generating and diffusing knowledge domestically and cross-country. These networks are usually slow to generate large benefits and may prove profitable only over the long-run, potentially constituting a reason for policy intervention. Dutch firms seem to lack experience and skills in innovation co-operation agreements, preferring instead to set up joint ventures for co-operative innovation projects (Duysters and De Man, 2003). This represents a major barrier to Dutch firms collaborating in innovation networks.

15. A number of institutions promote networking and cooperation. Syntens, an organisation funded by the Government, is actively involved in network activities for innovative SME's to stimulate cooperation and knowledge transfer. SenterNovem (agency of the MEA that implements innovation and sustainable development policies) is also active in the field of stimulating networking and organizing activities e.g. brokerage events. One of the major tasks of SenterNovem is to mediate and create links between and among firms and organisations in a specific field. Networking is also promoted by branch organisations, under the impact of the active role played by the Ministry of Economic Affairs. Further information facilities, sound management education and coordination efforts on behalf of chambers of commerce would help to foster such networks. Anti-trust law and merger control is not a barrier to the development of such networks as the Dutch competition authority (NMa) takes into account any impact of tight anti-trust regulation on a firm's capacity to enter into a collaboration agreement on innovation projects (article 6 of the Dutch Competition Act).

Rationalising instruments and organisations supporting innovation to enhance effectiveness

16. Over the years a plethora of instruments and organisations has been created in the Netherlands. This has led to concerns about the complexity and effectiveness of the system. In addition, high administrative costs tend to reduce the impact of financial support on business R&D - less of the budget remains to stimulate business R&D. The large number of -- partly overlapping -- instruments[9] and organisations[10] supporting innovation has resulted in high administrative costs. These are estimated to be 4%-8% for support for business R&D (Ministry of Finance, 2002). Costs tend to be higher for small specific instruments than for large generic instruments and can be very high for specific instruments supporting diffusion (up to 39%, *ibid*).

17. The Ministry of Economic Affairs has taken several steps to address these concerns, including the integration of the various initiatives to foster the creation of technology-based start-ups in the TechnoPartner Action programme and the merging of the two agencies of the Ministry of Economic Affairs that implement policies on innovation and sustainable development (Senter and Novem). Most importantly, the Ministry of Economic Affairs sent a letter to Parliament in May 2005 on the radical renewal of financial instruments (MEA, 2005). The new setup of instruments entails a reduction in the large number of instruments directed at the stimulation of R&D and innovation and a new organisational set up for the implementation of these instruments (Box 3). It aims at increased flexibility and customisation, fewer instruments with more coherence, fewer and more accessible helpdesks and lower acquisition costs and administrative burdens. An accessible and transparent basic package provides entrepreneurs with information and capital. The focus is primarily on entrepreneurs that want to innovate, export and/or engage in overseas investment. In addition, a related programme-based package offers the possibility to focus innovation resources on a limited number of fields in which the Netherlands can excel. The programme–based approach also aims at improving science-industry linkages and focus in innovation policy.

Box 3. Renewal of financial instruments

The Ministry of Economic Affairs is changing the design of its financial instruments because the existing instruments lack flexibility and coherence, funds are spread very thinly and there are too many different helpdesks. To address these problems, it will introduce a widely accessible basic package and a programme-based package (MEA, 2005). The fiscal incentive for innovation (WBSO) is not included in this renewal, because the authorities consider this fiscal incentive to be a general macroeconomic framework condition within an attractive fiscal climate. Recently, these plans were adopted by Parliament.

The basic package consists of two elements: information and advice; and capital. This package contains the generic innovation instruments (*e.g.,* innovation vouchers), (risk) capital instruments and intermediaries. A range of organisations provide the entrepreneur with information and advice: SenterNovem; Syntens; The Netherlands Patents Centre; the EVD (the Netherlands Foreign Trade Agency); and the Chambers of Commerce. The number of helpdesks will be reduced and accessibility improved. In May 2005 a 'front office' was set up for two agencies SenterNovem and EVD, providing the entrepreneur with a single point of contact. An 'Entrepreneurs Forum' will be set up in each region, where the Chambers of Commerce and Syntens will jointly offer their services. The front office will be connected in 2005 to a customer-orientated, digital source of assistance where entrepreneurs can find information on legislation and regulations from all relevant government authorities.

The programme package aims at achieving top performance in a number of areas where the Netherlands can really excel in the future. Currently, funds are divided up among a large number of projects in a variety of areas. It is expected that significant benefits could be achieved if support were more focused. Therefore, a number of financial instruments will be incorporated into an 'innovation omnibus' to support a limited number of strategic areas of innovation. Areas are chosen in close collaboration with the business sector, knowledge institutions, other departments and government authorities, politicians and the Innovation Platform. The selection will be based on the (potential) benefits for the Dutch economy and contribution to future innovations. Innovation programmes will be developed and implemented within these areas. Businesses and knowledge institutions will take the initiative to develop these programmes, setting out aims, activities and contributing to the required resources. The programmes therefore rely on the organisational skills and financial commitment of the field. The implementing organisation actively takes the lead in this process and tries to exploit opportunities and solve problems together with the parties. The MEA will offer the parties involved a customised package of support. This package could include support in the form of foreign missions, legislation and regulations and interventions with other government authorities, but it could also involve a direct financial contribution to projects and programmes.

A budget will also be made available for 'challengers'. Projects will be included in this category that do not fit in programmes, but nevertheless have considerable potential. Possible ways of encouraging these 'challengers' could be subsidies or credit facilities for high-risk projects to develop new products, processes, software or services. These challengers are expected to become an important resource for finding new themes.

18. The progressive incorporation of a number of existing instruments into an 'innovation omnibus,' [11] a legal framework on the basis of which a wide range of initiatives can be supported financially will make possible custom-made stimulation of public-private initiatives through the programme package. [12] It is envisaged that businesses and knowledge institutions will initiate innovation programmes themselves, setting out aims, activities and required resources. Each programme is intended to be unique: the participants will decide the most suitable form of organisation and action needed to reach the objectives. The best programme proposals submitted to the MEA may qualify for financial or other support that is tailored to the needs of the organisation concerned. This reform is part of a change of policy direction in the Netherlands entailing a shift from generic towards specific support for innovation (Box 5.4). However, a lack of information on external benefits of specific projects increases the risk for capture. This risk could be reduced by introducing strict sunset clauses and consulting external experts.

Box 4 More specific support

The Dutch government is moving more of its support for innovation towards specific instruments.[13] This is being done because the authorities consider that the external benefits of the relatively small Dutch budget for R&D would be greater by focusing support on specific fields that are most important to the economy. By the end of 2003, € 800 million had been invested from the FES (Economic Structure Enhancing Fund) in strengthening the knowledge infrastructure (increase public-private cooperation and focus). These funds have been spent in the five areas retained for focus: genomics (life sciences), ICT, nanotechnology, spatial planning and durable system innovation. The first three were also identified as national research priorities by the Ministry of Education Culture and Sciences (2003). The plans for renewal of financial instruments by the Ministry of Economic Affairs mentioned above consist of a basic package of information, advice and capital facilities for all entrepreneurs and a programme-based package partly subsidising specific areas. However, within the new setting of financial instruments, the generic instruments aimed at stimulating business R&D (WBSO) and innovation (innovation vouchers) will continue to have a relatively large share within the total innovation budget (over two-thirds) of the MEA. With regard to specific support, the current priorities are ICT and sustainable energy. The MEA has also launched three pilot programmes on: high tech systems and materials; water; and food and flowers. These themes were selected by the Innovation Platform after a bottom-up consultation of all parties.

The Ministry of Education, Culture and Sciences has selected its priorities based on the importance of these fields for future scientific and economic development. However, many countries have chosen comparable research priorities. Hence marginal returns may be low. The MEA has chosen its priorities in collaboration with others, based on the perceived advantages for the Dutch economy. However, it is not clear whether sectors that have the largest advantage will offer the highest external benefits. Although there is some overlap, there seems to be room for improving the cooperation of the Ministry of Economic Affairs and the Ministry of Education, Culture and Sciences with respect to selecting key areas.

While targeted support for innovation could increase external benefits compared with generic support, (it may be reasonable to conclude that research in certain areas is likely to have wide ranging applications), there is a risk of government failure. As little is known about the external benefits of specific support, it could end up going to fields or projects with relatively low external benefits. Moreover, the increased opportunities for rent-seeking behaviour with specific support raise the probability of this outcome occurring. To limit this risk, the MEA selects programmes through a bottom-up process which reveals more information. In view of these uncertainties, a cautious approach in shifting towards specific innovation support is warranted, which is the approach being adopted by the government. The programme-based approach of the MEA will only amount to approximately € 0.2-€ 0.25 billion and partly involves a shift from subsidising specific activities (*e.g.*, co-operation) to funding specific fields. This compares with a total budget for supporting innovation other than that going to universities (€ 2 billion) and the NWO (Netherlands Organisation for Scientific Research) and KNAW (Royal Netherlands Academy of Arts and Sciences) (€ 0.5 billion) of € 1.5 billion, which is presently equally divided between specific - and generic innovation policies; the WBSO (generic tax-incentive on private R&D) is the largest individual scheme, amounting to € 0.4 billion.[14] The government has little influence over the way universities spend their (main part of (university)) research funding.

Increasing financial support for innovation

19. The current government has increased expenditure on innovation considerably, reflecting the priority it gives to the knowledge economy. In its government agreement, the cabinet decided to increase the annual budget for knowledge and innovation by € 700 million (3.5% of the budget for knowledge and innovation) to foster public-private research cooperation, among other things. In addition, the already substantial WBSO tax breaks were extended further, especially for SMEs (an increase of € 100 million), innovation vouchers for SMEs were introduced and an experiment with a small business innovation and research initiative (SBIR) has been started. During Easter, the cabinet reached an additional agreement *Paasakkoord* (Easter agreement) to spend part of the windfall gains from increased gas prices on strengthening the knowledge infrastructure, *e.g.*, innovation vouchers, high quality research (nanotechnology, biotechnology, pharmaceuticals, ICT) and large research facilities. Given the estimated external benefits of business R&D (OECD, 2003c); a case can be made for increasing public support for

business R&D. However, this case is independent of gas windfalls, as should be decisions about the appropriate level of such support. Moreover, the effectiveness of different instruments to support innovation should be taken into account.

Attracting foreign scientists and engineers and encouraging those already in the Netherlands to stay

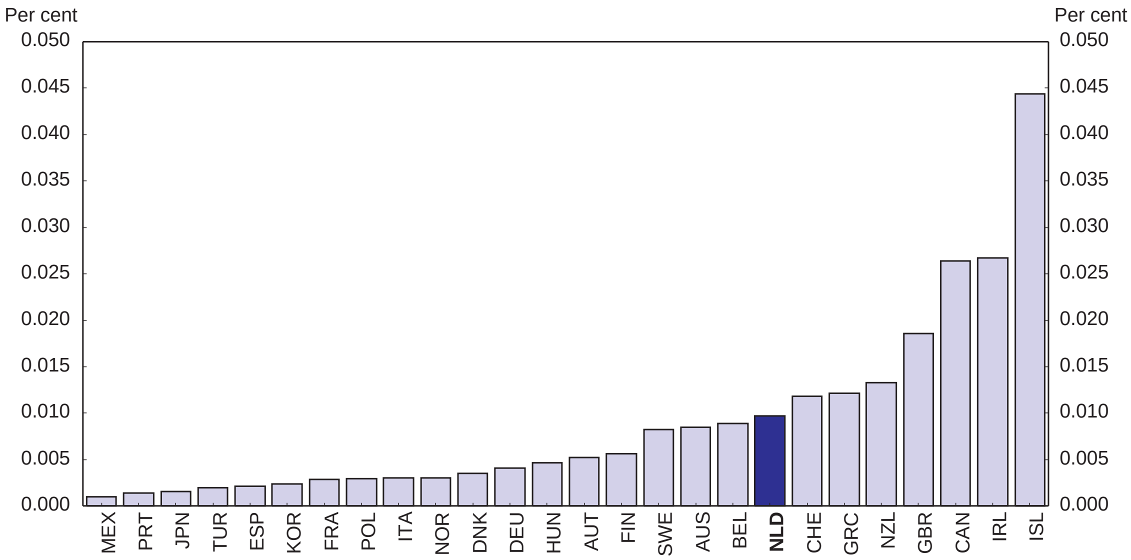
20. Increasing the number of scientists and engineers would make the Netherlands more attractive for both inward and domestic R&D. The fastest way to increase the availability of such personnel is to increase immigration of persons with such skills. This would also help to address complaints that have been made by foreign investors in the Netherlands that they have had difficulty in bringing good personnel to the country even in cases where they have been unable to find suitable personnel in the Netherlands (Erken, Kleijn and Lantzendörffer, 2005, p. 10). The Netherlands has not been very successful in attracting and retaining foreign human resources in science and technology (HRST) (OECD, 2005e, Figure A.1.1). Not only are HRST immigration flows relatively low, but such immigrants also tend not to stay in the Netherlands, regarding it as stepping stone to other destinations. In order to increase entry of 'knowledge migrants'[15] from outside the EU, the government recently took steps to facilitate their entry. It established a single point of contact, shorter procedures and limited levies for knowledge immigrants, as recommended by the Innovation Platform (IP, 2003). The government has expressed its intention to consider further steps to facilitate such immigration.[16]

21. Another means by which countries seek to attract foreign HRST is to attract foreign students and enable them to work in the country after completing their studies. Only 4% of students in the Netherlands are foreigners, compared with 18-19% in the leading countries, Australia and Switzerland (OECD, 2005e, Table C.3.1). Moreover, less than 20% of foreign students study science and engineering in the Netherlands, compared with more than 30% in a number of countries (including Australia and Switzerland) (OECD, 2005e, Figure C3.4). Following successful completion of a higher education programme (HBO/WO-level) in the Netherlands, non-EU graduates have three months to find a position that qualifies them as knowledge migrants. Otherwise, they must leave the country. The authorities should give graduates more time to find a position that qualifies them as knowledge migrants before obliging them to leave the country. More flexibility as to what constitutes a knowledge worker should also be introduced as science and engineering graduates do not always have high earnings relative to other knowledge workers.

22. The Netherlands also appears to have some difficulty in retaining highly qualified HRST. It has one of the highest numbers of science and engineering PhDs (normalised for the home country population) working in the United States among non-English speaking countries (Figure 7). Other European countries are also subject to this brain drain, with France having recently become the major European supplier of such personnel (MERIT, 2003). The main reasons cited for EU-born science and engineering PhDs to go to or stay in the United States and for US-born such persons to return home are a broader scope of activities, better access to leading edge technologies, better career advancement opportunities and better access to R&D funding in the United States (*ibid*). Concerning career advancement opportunities, a problem in the Netherlands is that tenured baby boomers occupy many posts (as in the United States) and rarely move (in contrast to the United States). According to the authorities, Dutch researchers are also hampered in their work by having to spend much more time arranging funding -- especially within universities -- for research projects than do their US counterparts. The Chang Committee that will advise on performance-based university funding (see below) will also present proposals on reducing the administrative burden of obtaining funding. Given the increasing internationalisation of R&D activities, further action to increase the attractiveness of the Dutch research climate seems to be paramount. This would include simplifying funding procedures within universities, developing centres of excellence, increasing staff mobility and increasing performance-based funding without too much administrative burden.

Figure 7. Non-US OECD citizens with science and engineering doctorates in the United States

As a percentage of the home country working age population in 1999



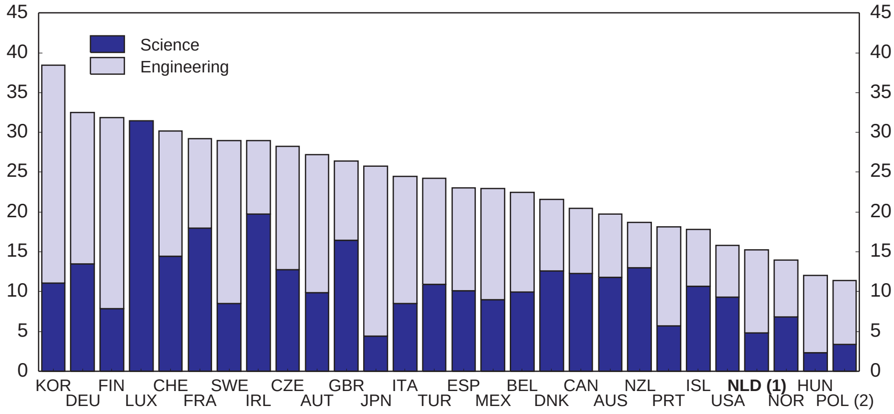
Source: OECD (2005a), *OECD Science, Technology and Industry*: *Scoreboard*.

Increasing the flow of science and engineering graduates

23. The low flow of science and engineering graduates in the Netherlands poses a threat to the country's capacity to maintain the stock of scientists and engineers near the OECD average and hence to its attractiveness for R&D activities. While in principle the low domestic inflow of such personnel could be compensated for through immigration, the Netherlands has not had much success to date in attracting such immigrants and international competition for them is becoming fiercer. The low share of science and engineering graduates in the 20-29 age-group mainly reflects the low share of these disciplines in total graduations (Figure 8). Poor career prospects in science and engineering jobs relative to those in management encourage students to pursue studies in economics, law and business, which give a better foundation for such careers than science and engineering. In addition, science and engineering studies are perceived by students as being uninteresting, difficult and entailing a heavy workload. All of these factors appear to have a stronger effect on women than on men. Indeed, the increase in the share of females in total graduations has contributed to a reduction in the share of science and engineering graduates in total graduations in the past 25 years; the share of S&E graduates in total graduates has not changed for either males or females (CPB, 2005b).

Figure 8. Science and engineering degrees as a percentage of total new degrees

2000



1. Excludes advanced research programmes.
2. Excludes tertiary-A second degree programmes and advanced research programmes.

Source: OECD (2003), *OECD Science, Technology and Industry: Scoreboard.*

24. The government is aiming to increase the domestic supply of scientists and engineers by 2010 and beyond though the 'Deltaplan'. Education in science and technology from primary schools to universities is to be made more pupil-orientated to attract a wider and more diverse range of young people, including more females. At the same time, government is working together with business to give younger people a better perspective on scientific and technological careers. A variety of measures is being taken in this respect.[17] These measures will need to be carefully evaluated as they could prove costly in relation to the small number of S&E graduates that end up in R&D work because other professions are more attractive financially (CPB, 2005b). The 'Deltaplan' also aims at increasing the attractiveness of research jobs. In addition, there are a number of policy initiatives to enlarge the influx of young talented researchers, including: the Innovation Research Incentive Scheme (which from 2005 also includes ASPASIA, a scheme oriented to women); and a Netherlands Organisation for Scientific Research (NWO) - programme oriented to persons from ethnic minorities.

Increasing foreign direct investment

25. As noted above, the FDI intensity of the Dutch economy in relation to its openness is average (see Figure 5). Some countries -- Ireland, Sweden and Denmark -- have considerably higher FDI intensity in relation to openness, suggesting that there is scope to do better in the Netherlands. Doing so would raise R&D inflows and hence R&D intensity. Following a decline in world economic growth and stagnation of the Dutch economy, FDI inflows in the Netherlands have decreased since 2000, as they have in most OECD countries (UNCTAD, 2004). However, surveys of foreign managers conducted by the MEA (2004) and Ernst&Young (2005) also suggest that the attractiveness of the Netherlands for FDI inflows has declined even abstracting from the business cycle; E&Y concludes, nevertheless, that the Netherlands remains attractive for certain types of FDI, notably European Headquarters.

26. Among the policy areas that impact on FDI patterns (Nicoletti *et a*l., 2003a), there is room for improvement in barriers to entrepreneurship, notably in the licence and permit system – which also is mentioned as one of the major problems in the questionnaire conducted by the MEA. Labour market reforms also could make an important contribution to increasing the attractiveness of the Netherlands for FDI. Respondents to both the MEA and Ernst&Young questionnaires regard Dutch labour market arrangements -- *e.g.*, EPL and working time -- as very unattractive.

27. Improving transport infrastructure -- length of motorways and number of aircraft departures *per capita* --, which is below average among OECD countries (Nicoletti *et a*l., 2003, Annex 2, Table A2.10), and/or reducing road congestion (there were complaints about this in the MEA Survey) would also help to attract FDI. Implementing road pricing, as recently recommended by the *Platform Anders Betalen voor Mobiliteit*, (2005) (Platform Paying for Mobility in a Different Way)[18] – would help in this regard. The government has decided to implement road pricing in 2012.

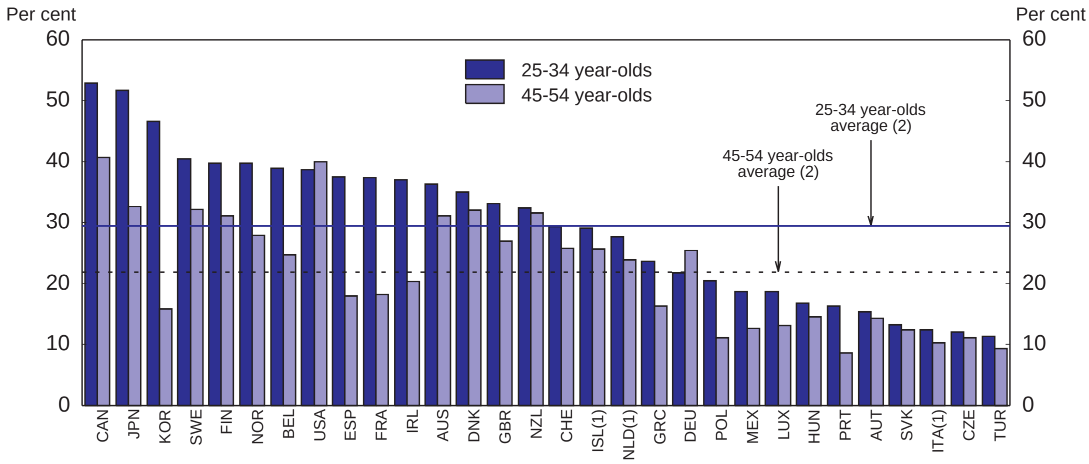
28. Finally, the Netherlands, in co-operation with continental European countries, has made substantial progress over the past decade in reducing bilateral corporate tax wedges on cross-border activities of foreign affiliates, making the Netherlands a fiscally more attractive FDI destination. In 2001, the position of the Netherlands on the effective average tax rate (EATR)[19] was relatively favourable – slightly lower than the OECD average (Nicoletti *et a*l., 2003, Annex 1, figure 18). This seems to be in line with the results of the MEA survey, where respondents described the Dutch tax system as being reasonable. In 2005, the government reduced the corporate income tax rate from 34.50% to 31.50%, with the aim of further reducing it to 30.00% by 2007. The Dutch authorities recently announced a more ambitious plan to reduce the corporate tax rate to 26.9% by 1 January 2007.

Increasing the proportion of the population with tertiary education

29. The share of tertiary graduates in the Dutch population (25-64) is the same as the OECD average (OECD, 2005e, Table A1.3a) but ranks 12th amongst the 20 high-income countries included in the European Innovation Scoreboard (see Annex 5.A1, Table 5.A1.4, first column). This relatively unfavourable position for a high income country is likely to deteriorate as the proportion of tertiary graduates in the population aged 25-34 years is below the OECD average (Figure 9). Concomitantly, the increase in tertiary attainment as younger cohorts replace older ones will be smaller than on average in OECD countries.

Figure 9. Population that has attained tertiary education[1]

2003, Per cent of age group



1. Data refers to 2002.
2. Unweighted average.
3. Tertiary education is defined as tertiary type A and advanced research programmes and tertiary type B education.

Source: OECD (2005e), *Education at a glance*.

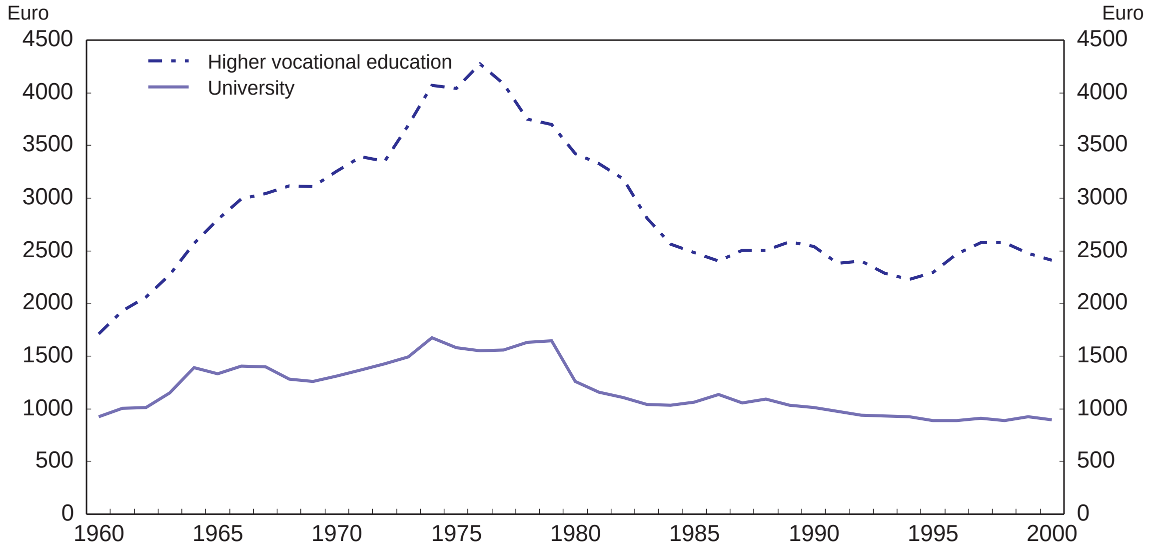
30. The below-average proportion of tertiary graduates among the young is largely explained by the absence of differentiation in the supply of tertiary education. While enrolment of students in tertiary A

(mainly theoretical programmes preparing for research and high-skill professions) programmes is at about the OECD-average, the absence of shorter (two or three-years) tertiary vocational programmes explains low enrolment in such programmes and brings down total average enrolment. The low degree of differentiation in the supply of tertiary education is also evident from fixed tuition fees, relatively long duration of programmes[20] and high barriers to entry for new suppliers of tertiary education.

31. Lower incentives for higher education institutions in the Netherlands to increase entry of students than in other OECD countries may also contribute to relatively low tertiary attainment. Funding of higher education is only partly based on performance in terms of input or output – in the university sector almost 40% of funding for education is not based on performance (CPB and CHEPS, 2001). Although a thorough international comparison is not available, it seems that countries that use performance based funding to a larger extent also perform better in terms of participation. This seems to be the case in Sweden (funding based entirely on number of students and number of study credits achieved by students) and the United States (performance-based funding and a high share of private funding by students) (CHEPS, 2001), while in Denmark the share of tertiary graduates in the 25-34 age group has increased markedly since the introduction of the taximeter model (funding entirely based on passed exams by students) in 1992; from 19% in 1991 to 31% in 2002.

32. As in many OECD countries, a steep increase in the number of students since the 1960s and cutbacks in the government budget in the 1980s has led to a marked decline in public expenditure per student (Figure 10). Currently, expenditure per student –- relative to GDP *per capita* –- is below the OECD average (Table 4) and is likely to decrease if entry rates rise – as total expenditure is more or less fixed, given the concerns over the government budget. Together with a relatively low extent of performance based funding, this factor could discourage higher education institutions from actively trying to increase entry rates.

Figure 10. Real public expenditure per student
At 1960 prices



Source: Statistics Netherlands (CBS) Statline

Table 3. Annual expenditure on tertiary education per student relative to GDP per capita (PPP US $) in selected OECD countries, 2002

The Netherlands	27
USA	51
Denmark	39
OECD	34
Sweden	28
Belgium	29
UK	31
Finland	26
France	27
Germany	25

Source: OECD (2005e), *Education at a Glance*.

33. The government is currently examining whether to introduce shorter tertiary vocational programmes. The CINOP (Centre for the Innovation of Education and Training) supported such an initiative in a recently published report commissioned by the Ministry of Education (CINOP, 2005). These programmes are expected to fill a demand -- from students as well as the labour market -- and, based on experience in other countries, - are expected to increase participation in higher education. A notable example in this regard is Finland, where higher education enrolment rates doubled between 1990 and 2000 following the creation of a new polytechnic sector that was differentiated in terms of duration of studies (shorter), content (more technically oriented, applied studies), governance (more employer, municipal, regional input), and financing (municipal, with local/regional in kind contribution of facilities).

34. The government also plans to extend performance-based funding in higher education. Students will receive 'education rights' which they can spend at an institution for higher education; this will result in funding based on the number of students and the number of diplomas. In addition, a loan facility for tuition fees with income-contingent repayments will be introduced (MECS, 2004). A larger extent of performance based funding (*i.e.*, funding per student and (to a lesser extent) per diploma) would increase the incentive to raise entry rates. To further foster the number of students receiving tertiary education, the government is currently experimenting with differentiating tuition fees and giving new institutions access to public education funding (MECS, 2005). More freedom in setting tuition fees and a more competitive environment could stimulate differentiation in quality and the development of tailor-made programmes. This might attract students who currently decide not to attend tertiary education and could reduce the number of drop outs. To receive public funding, all currently funded higher education institutions have to get approval for their new programmes from central government *(macro-doelmatigheidstoets)*. If the government deems that there are too many of a certain type of programme, it can withhold public funding. Although this might be prudent policy from a public expenditure point of view (*i.e.,* not financing programmes that have low benefits), it also limits room for entrants and competition because institutions offering a specific programme have an advantage over potential entrants and existing institutions working to offer the same programme. The government should rely more on the ability of students to choose the most beneficial programme and ease restrictions on access to public funding (at a minimum, government should provide funding for specific programmes through competition between existing and new institutions).

4. Enhancing application of new knowledge

35. As noted above, the Netherlands ranks poorly on the set of innovation indicators characterised as representing the application of new knowledge. Relatively few SMEs report making non-technological changes or introducing new products or processes either developed internally or in collaboration with other firms. Moreover, for all enterprises, sales of products new to the firm but not to the market represent a relatively low share of turnover. In addition, total innovation expenditures as a share of turnover, including not just expenditure on R&D but also on aspects related to applying new knowledge commercially -- machinery and equipment linked to product and process innovation, acquisition of patents and licenses, industrial design, training and the marketing of innovations -- is relatively low. Increasing product market competition, notably through lower barriers to entrepreneurship, and making social institutions such as labour-market regulation more compatible with non-technological change, could help to strengthen this aspect of innovation activity.

36. Strengthening science-industry linkages, as discussed above, could also enhance the use of knowledge in new products, services and processes. Similarly, the renewal of financial instruments by the Ministry of Economic Affairs (Box 3) could also help as it aims at improving information and advice services for entrepreneurs (including the promotion of networks). Such services may foster the application of knowledge and best-practices that are new to the firm. In addition, the application of knowledge -- in *e.g.,* new products -- can be part of an innovation programme that is supported by the Ministry of Economic Affairs' new instruments, although this aspect of the programme is not eligible for financial support. Other instruments to improve the linkages between firms and knowledge institutes, like the knowledge voucher scheme mentioned above, could also contribute to greater application of new knowledge.

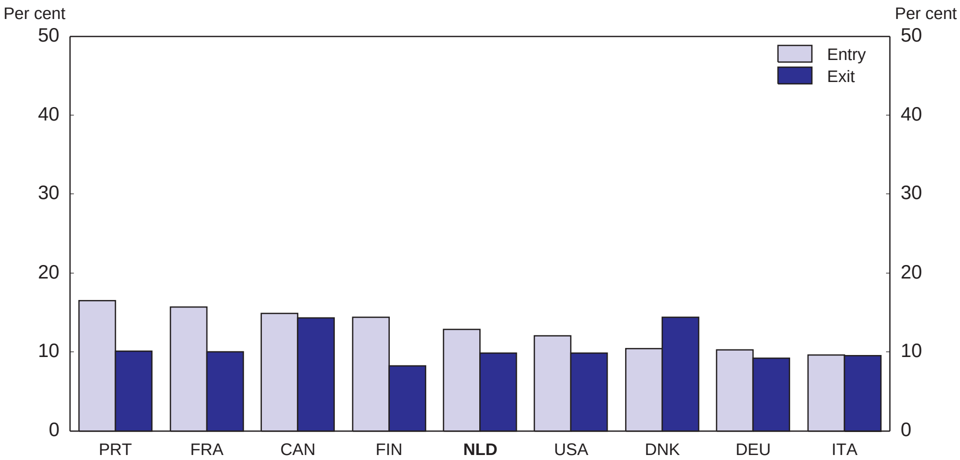
Strengthening entrepreneurship and competition

37. Theoretically, the relation between the level of competition and the level of innovation is ambiguous. Although competition may increase the incentive to innovate (to try and escape from competition), Aghion *et al.,* (2002) argue that fierce competition may also hamper innovation by reducing its benefits, especially in 'unlevelled' industries[21]. This would result in an inverted U relationship between competition and innovation, which they find in accordance with their data. However, the level of competition can be influenced by various factors and empirical work by the OECD suggests that less stringent product market regulation -- which is one of them -- favours innovation (Pain and Jaumotte, 2005). In addition, entrepreneurial activity has played a major role in radical innovation. Although it goes too far to claim that entrepreneurs are involved in all radical innovation and that all small businesses are radical innovators, Baumol (2003) shows that a lot of revolutionary breakthroughs in the United States have been made by small, independent innovators.

38. Competition intensity in the Netherlands seems to be moderate by international comparison. The Netherlands has a high degree of openness and an average score on the PMR index (see Chapter 4 of the main text). Furthermore, the entry rate of firms (start-ups and new affiliates) is comparable to other OECD countries (Figure 11). On the other hand, exits are relatively low, which may be an indication of weak competitive forces. In addition, although the entry rate is comparable, the number of people setting-up or owning a young enterprise is below the international average (Figure 12). This might indicate that a large share of entrants consists of new affiliates of existing firms.

Figure 11. Entry and exit rates in selected OECD countries, average 1989-1997

Percentage of continuing firms, firms with at least one employee

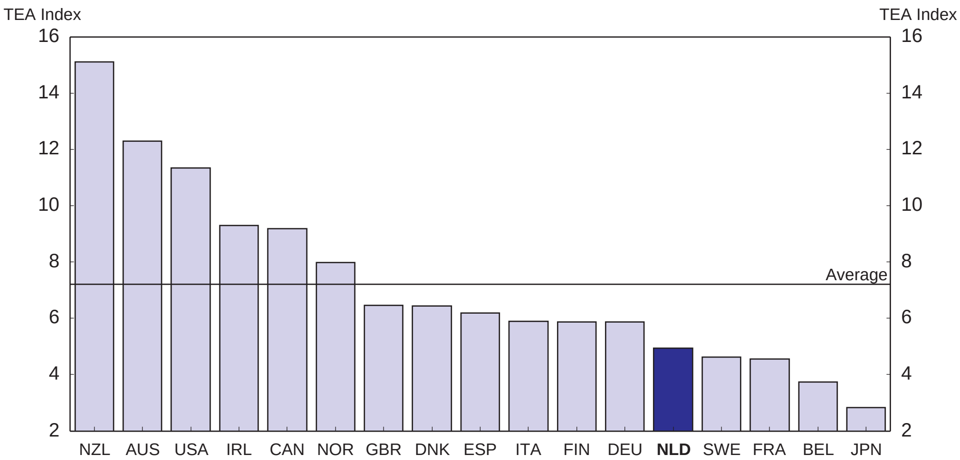


1. Denmark 1994-1997, France 1990-1996, Italy 1989-1993, USA 1989-1996

Source: Scarpetta et al, 2002

Figure 12. Total Entrepreneurial Activity (TEA) Index selected OECD countries

Average 2001-2004



1. The number of people currently setting up a business or owning/managing one existing up to 3,5 years relative to the adult population 18-64 years.

Source: Global Entrepreneurship Monitor, 2004

39. Like many other governments, the Dutch authorities aim at fostering an entrepreneurial culture through education. In 2000, the Ministry of Economic Affairs, in coordination with the Ministry of Education, launched a specific programme on Education for Entrepreneurship and introduced a subsidy scheme to promote the development of projects. From 2000 to 2003, more than 103 projects were developed for all education sectors (OECD, 2005f). Although education for entrepreneurship may foster awareness and entrepreneurial skills, risk-taking is to a large extent influenced by the institutional framework. Institutions influence the (expected) benefits of starting an (innovative) enterprise compared to the benefits of a regular job and, therefore, the willingness to make such a risky investment. Indeed, strict product market regulation -- in particular administrative regulations on entrepreneurial activities -- as well

as strict EPL are found to have a negative impact on entry of small and medium sized firms (Scarpetta *et a*l., 2002). In this regard, barriers to entrepreneurship are relatively high in the Netherlands (see Chapter 4 of the main text). This indicator includes procedures, *e.g.*, administrative and licences regulations, which constitute a much larger burden for SMEs than for larger companies and pose a barrier to entry. Although, the administrative burden -- especially on SMEs -- has been reduced considerably in the Netherlands, further action is needed to improve the licence and permit system and communication and simplification of rules.

40. Labour market regulations may pose a barrier to entry as well as to growth of enterprises. Strict hiring and firing rules make adjustments in the number of employees in case of success or a set-back more difficult and, therefore, hamper growth and experimentation by innovative SMEs. In addition, EPL raises the security of a regular job and reduces the incentive to start a company. Favourable social security benefits, *e.g.*, unemployment insurance and pensions, or other arrangements that are part of salaried employment can also add to the preference for a regular job. As mentioned in Chapter 3 of the main text, the Netherlands has strict EPL on regular contracts and labour market regulations include a number of favourable arrangements for salaried employment concerning, for example, unemployment benefits, pensions and the legal right to adjust working hours. Increasing labour market flexibility, as recommended in Chapter 3 of the main text, would also help to strengthen entrepreneurship.

41. Another barrier to entry and experimentation may be posed by bankruptcy regulation, especially when the personal costs of bankruptcy are high. In the Netherlands, a bankrupt entrepreneur is sometimes liable for his debts for the rest of his life and may find it difficult to borrow money or even rent an apartment. This makes it very difficult to try to set-up a business a second time and reduces the incentive to start an enterprise or experiment in the first place. A new law on bankruptcy will be available at the end of 2005. As is the government's intention, this law should reduce the personal costs of bankruptcy and the options for a swift re-start of non-fraudulent bankrupts, *e.g.*, through offering a clean-slate by way of discharge. It is vital that this reform be implemented effectively and that the government ensures that potential entrepreneurs are adequately informed about it.

Promoting non-technical innovation

42. The Dutch government is concerned about a lack of non-technological innovation[22], in particular a lack of social innovation, which concerns organisational change and competence management. This is seen as an important hindrance to organisations adapting new technologies and introducing new working practices that increase productivity. The lack of non-technological innovation in the Netherlands can be accounted for partly by the particular institutional setting on product and labour markets. In general, strong employment protection and seniority pay scales typical for centralised wage bargaining systems set incentives for firms to resort to internal workplace reorganisation and upgrading skills of their workforce, a strategy that may be of particular relevance for incremental innovation (Bassanini and Ernst, 2002). However, recent evidence points to the fact that in particular in service industries, reorganisation often takes place across firms more than within firms (Bosma and Nieuwenhuijsen, 2002). Consequently, tight employment protection will hamper external reorganisation, having a particularly strong impact on the service industries and their capacity for (non-) technological innovation. There is some indirect evidence for this thesis, based on the effect of employment protection on the service sector employment share: D'Agostino, Serafini and Ward (2005) find strong negative effects of EPL in particular in the telecommunications and financial sector, while the evidence is rather mixed for the impact of EPL on the overall service share (D'Agostino *et al*. (2005) find a significant negative effect, while Messina (2004) does not report such an effect).

43. In co-operation with the Ministry of Social Affairs and the Ministry of Education, the Ministry of Economic Affairs has set-up a task-force on social innovation, which recently presented its advice on how

to foster social innovation. Although it identifies a role for government, *e.g.*, reducing the number of (detailed) regulations and procedures, social innovation is seen mainly as a responsibility of the social partners. Employers, employees and their representative organisations should give more priority to discussing changes in working practices and life-long learning and making less detailed sector-wide collective agreements. Although about two thirds of all the collective labour agreements pay at least some attention to social innovation and collective agreements have become less detailed in recent years, such agreements still leave a lot to be desired. Moreover, social innovation is not a priority at times of tension between social partners, as is presently the case. The Social Economic Council (SER) will investigate how social innovation can be made a more integral part of the agenda of the social partners in its middle-long-term advice, which is due at the end of 2005.

5. Conclusion

44. Innovation activity in the Netherlands only appears to be around the OECD average despite a strong performance in knowledge creation. The main weaknesses in innovation indicators are low business R&D intensity, the low (current and prospective) share of the population with tertiary education attainment and weak performance in applying new knowledge to new products and processes. Reforms to remedy these weaknesses are summarised in Box 5.

Box 5. Policy recommendations to boost innovation activity

Boost business R&D

A key factor in increasing the business R&D intensity is to make the Netherlands more attractive for R&D investment, including for inward R&D. To this end, the authorities should:

- Continue to strengthen the linkages between firms and knowledge institutes to enhance the use of (scientific) knowledge in new products, processes and services;
- Make university funding partly dependent on performance in diffusion of knowledge to firms to strengthen linkages between PRO and firms, as the government is considering doing;
- Rationalise financial support for R&D activities, which is presently dispersed among a variety of agencies, so as to improve co-ordination;
- Make greater use of evaluations of arrangements offering financial support to business R&D in policy development;
- Take recent reforms to facilitate immigration of knowledge workers further by introducing a points system for immigrants, as in Canada, Australia and New Zealand, and by relaxing work permit rules for certain groups of non-employees, as is being considered;
- Compete more aggressively for foreign PhD students in science and engineering and relax work permit rules to make it easier for them to stay in the Netherlands after graduation; and
- Reduce the corporate tax rate to attract more FDI inflows, as planned.

Increase tertiary education

To increase the proportion of the population with tertiary education, the authorities should:

- Provide funding for universities to offer short (two-year) courses, as in most other countries and as is being considered;
- Increase the share of higher education funding based on performance in terms of inputs and outputs, as planned;

- Differentiate tuition fees, as this will provide universities with an incentive to offer courses that are more attractive to students; and
- Continue experiments with opening access to public funds for education services by allowing more private education suppliers to compete for public education funds so as to enhance the quality and diversity of courses offered.

Enhance the diffusion of innovation

To strengthen the application of new knowledge to new processes, more entrepreneurship, competition and social innovation are required. In this regard, the authorities should:

- Continue education programmes in favour of entrepreneurship;
- Reform bankruptcy law to reduce the personal costs of bankruptcy and increase options for a quick re-start of non-fraudulent bankrupts, as planned; and
- Ease EPL on regular contracts (as recommended in Chapter 3 of the main text) to facilitate workplace re-organisation in industries undertaking radical innovation.

NOTES

1. At the time of writing, Rebecca Oyomopito was a statistician and the other authors were economists in the Economics Department of the OECD. This paper draws on material originally produced for the *OECD Economic Survey of the Netherlands* published in December 2005 under the responsibility of the Economic and Development Review Committee. The authors are indebted to Patrick Lenain for comments and drafting suggestions. Helpful comments were also provided by Mike Feiner, Val Koromzay, Andrew Dean, Gernot Hutschenreiter and Gregory Wurzburg.

2. The EC (European Commission (1995), 688) gives an expanded version of this definition: innovation is defined as "the renewal and enlargement of the range of products and services and the associated markets; the establishment of new methods of production, supply and distribution; and the introduction of changes in management, work organisation, and the working conditions and skills of the workforce."

3. Ministry of Economic Affairs and Ministry of Education, Culture and Science, 2004, Table 7.1.

4. "(Factor analysis aims) to explain the most of the variability among a number of observable random variables in terms of a smaller number of unobservable random variables called factors. The observed random variables are modelled as linear combinations of the factors, plus "error" terms. The factor loadings (are) inferred from the data." http://en.wikipedia.org/wiki/Factor_analysis.

5. With respect to Box 1, the indicators are: 1.2, 1.3, 1.5, 2.1, 2.2, 2.3.1, 2.3.2, 3.2, 4.2, and 4.6.

6. With respect to Box 1, the indicators are: 3.1, 3.3, 3.4 and 4.3.2.

7. The sector composition effect on inward R&D is adjusted for by expressing inward R&D in relation to total R&D.

8. This follows the TNO/GTI evaluation that showed that more direct interaction between the demands of government, industry and society on the one hand, and the research institutions on the other was needed. The strategic plans of the TNO (2007-2010) will accommodate this structural reform of more demand driven research and finance.

9. The MEA lists 26 different instruments to support entrepreneurship, many of which are aimed at promoting innovation. In addition to the instruments listed in note 10, which will be absorbed into the new Innovation omnibus, current innovation instruments include: Knowledge Transfer Subsidy Scheme for Entrepreneurs; Knowledge Transfer Subsidy Scheme for Sector Organisations; Innovation Vouchers; and the Seed Facility (MEA, 2005, *Strong basis for delivering top performance* - renewed instruments for entrepreneurs from the Ministry of Economic Affairs). As noted above, the MEA plans to rationalise the list of support instruments.

10. Organisations involved in supporting innovation include a number of Ministries (of which the Ministry of Education, Culture and Sciences, and the Ministry of Economic Affairs are the most important), intermediary organisations that are responsible for executing support policies (*e.g.* SenterNovem and Laser) and public research institutions (e.g. NLR (National Aerospace Laboratory) and ECN (Energy

Research Centre of the Netherlands)). In addition, a number of institutions advise the government on research and innovation policy: CPB (Netherlands Bureau for Economic Policy Analysis), SER (Social Economic Council), AWT (Advisory Council for Science and Technology Policy) and the Innovation Platform.

11. The Innovation Subsidy Scheme for Cooperative Projects (IS), Foundation for Technological Science (STW), Top Technological Institutes (TTI), Innovative Research Programmes (IOP), TechnoPartner, MEDEA/ITEA and possibly the MEA programme finance of The Netherlands Organisation for Applied Research (TNO) and the Large Technological Institutes (GTI) will be gradually incorporated in the omnibus. In order to ensure continuity in policy, a number of existing instruments will continue in their present form until the omnibus comes into effect on 1 January 2008.

12. This paragraph is based on MEA (2005).

13. In 2003 the Dutch Advisory Council for Science and Technology Policy (AWT) advised the government to shift its innovation policy towards ‘backing the winners’; in close cooperation with scientists and the business community it should build on existing and potential strengths of the Dutch economy (AWT, 2003: backing winners). Reacting to this, the Royal Netherlands Economic Association (KvS) advised that government should instead ‘back the challengers’; to foster innovation, existing strongholds of power have to be challenged and knocked down (KvS 2004: Innovatie in Nederland).

14. These rough estimates are based on ‘Wetenschapsbudget 2004’, ‘IBO Technologiebeleid’ and ‘www.NWO.nl’

15. A knowledge migrant is a migrant who comes to the Netherlands at the bequest of an employer (both private companies and public organizations) to carry out salaried employment and who earns a gross income of € 45 000 or more (gross income means the gross annual salary including payable income tax, employee’s contributions and social security and pension premiums and holiday bonus, but excluding allowances, bonuses and non-monetary reimbursements. The amount is to be indexed each year). In the case of migrants under the age of thirty, the work permit obligation does not apply to incomes which correspond to the national health insurance limit (around € 32 600). The income criterion does not apply if the person concerned is to do a doctoral course at an education or research institution, nor to post-doctoral and university teachers aged less than thirty. Footballers, prostitutes and spiritual leaders or religious education teachers are excluded.

16. In particular, the government is investigating the introduction of a ‘points system’ as in most English-speaking countries (MEA/MSAE, 2004: Agenda for Growth).

17. Measures include the following: 500 primary schools will start this year with a special programme for technology and science education with the help of industry (VTb), with a similar programme being planned for secondary education (JetNet); courses are to be made more attractive by connecting science and engineering studies with problems in society and multi-disciplinary elements (which should be especially effective in attracting female students); and there are to be experiments with financial incentives in higher education to attract students to science and engineering courses.

18. This group was set up by the Ministers of Infrastructure and Finance

19. The EATR measures the wedge that a home country MNE expects to face when it invests in a host country, given tax requirements in both countries and the expected gross returns from the investment. It applies to an infra-marginal investment project that earns some economic rent, *i.e.* a project that earns after-tax pure profits.

20. The adoption of the Bologna framework, entailing Bachelors, Masters and PhD programmes with theoretical durations of three, five and eight years, respectively, should contribute to reducing actual course

duration. Stronger incentives to complete courses within the theoretical duration (see below) would also help to reduce actual duration.

21. An industry is more 'unlevel' (Aghion et al. also use the term 'less neck-and-neck') if there's a large difference (in production costs) between the technological leader and its followers. .

22. Non-technological innovation, like workplace reorganisations, is not restricted to services but may find its origins mainly in service sector firms, such as consulting companies.

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Annex A1

Factor Analysis to Identify Inter-related EIS Innovation Indicators

1. Introduction

1. While the indicators included in the European Innovation Scoreboard (EIS) Summary Index (European Commission, 2004a) are all in some way *a priori* related to innovation activity, it will help to focus the analysis in the main text by empirically determining which of these variables are in fact related to the same underlying phenomena and setting aside the other variables. The factor analysis that underpins the groups of inter-related variables selected for further analysis in the main text is described in this annex.

2. Factor Analysis to identify inter-related variables and exclude others

2. Factor analysis[23] based on 20 EIS indicators (Table A.1)[24] for the OECD 20 countries[25] shows that 45% of the common variance shared by the 20 variables can be explained by the first factor (Table A.2, "proportion" column). A further 21% of the common variance is explained by the second factor, bringing the cumulative proportion of the common variance explained to 66%. As subsequent factors add relatively little to explaining the common variance, they are set aside.

Table A1.1. Innovation Item Classification and Source of Data[26]

Innovation Item	Source of Data
1. Human resources	
1.1 S&E graduates (‰ of 20 – 29 years age class)	EUROSTAT (Education statistics)
1.2 Population with tertiary education (% of 25 – 64 years age class)	EUROSTAT (LFS)
1.3 Participation in life-long learning (% of 25 – 64 years age class)	EUROSTAT (LFS)
1.4 Employment in medium-high and high-tech manufacturing (% of total workforce)	EUROSTAT (LFS)
1.5 Employment in high-tech services (% of total workforce)	EUROSTAT (LFS)
2. Knowledge creation	
2.1 Public R&D expenditures (% of GDP)	EUROSTAT (R&D statistics); OECD
2.2 Business expenditures on R&D (% of GDP)	EUROSTAT (R&D statistics); OECD
2.3.1 EPO high-tech patent applications (per million population)	EUROSTAT
2.3.2 USPTO high-tech patents granted (per million population)	EUROSTAT
2.4.1 EPO patent applications (per million population)	EUROSTAT
2.4.2 USPTO patents granted (per million population)	EUROSTAT
3. Transmission and application of knowledge	
3.1 SMEs innovating in-house (% of all SMEs)	EUROSTAT (CIS)
3.2 SMEs involved in innovation co-operation (% of all SMEs)	EUROSTAT (CIS)
3.3 Innovation expenditures (% of total turnover)	EUROSTAT (CIS)
3.4 SMEs using non-technological change (% of all SMEs)	EUROSTAT (CIS)
4. Innovation finance, output and markets	
4.1 Share of high-tech venture capital investment	EVCA
4.2 Share of early stage venture capital in GDP	EUROSTAT
4.3.1 Sales of 'new to market' products (% of total turnover)	EUROSTAT (CIS)
4.3.2 Sales of 'new to the firm but not new to the market' products (% of total turnover)	EUROSTAT (CIS)
4.4 Internet access	EUROSTAT
4.5 ICT expenditures (% of GDP)	EUROSTAT
4.6 Share of manufacturing value-added in high-tech sectors	EUROSTAT (SBS)

Source: Trend Chart Innovation Policy in Europe (http://www.trendchart.org/scoreboards/scoreboard2004/indicators.cfm). Detailed descriptions of the indicators can be found in Hollanders and Arundel (2004).

Table A1.2 Factor Analysis Results: 20 Items

Factor	Eigenvalue[1]	Difference[2]	Proportion	Cumulative Proportion
1	8.94	4.72	0.45	0.45
2	4.22	2.13	0.21	0.66
3	2.09	0.42	0.10	0.76
4	1.68	0.52	0.08	0.85
5	1.16	0.25	0.06	0.90
6	0.91	0.48	0.05	0.95
7	0.44	0.13	0.02	0.97
8	0.31	0.06	0.02	0.99
9	0.25	0.25	0.01	1.00

1. Eigenvalue**:** An eigenvalue is the variance of the factor. In the initial factor solution, the first factor will account for the most variance, the second will account for the next highest amount of variance, and so on.
2. Difference**:** Gives the differences between the current and previous eigenvalues. .

Source: European Commission (2004b), European Innovation Scoreboard 2004 Database; own calculations.

3. Ten of the innovation indicators load onto Factor 1 with a cut-off value for the correlation between the indicator and this factor of 0.7 (Table A.3, variables identified with a * in the Factor 1 column). Considering the nature of these variables, they appear to reflect *'knowledge development'*. Four other innovation indicators load onto Factor 2 (see Table A.3, variables identified with a * in the Factor 2 column). These indicators mostly appear to reflect *'knowledge application'*.

Table A1.3. Factor loadings

Item	Loading	Factor 1	Loading	Factor 2
1.1 S&E graduates (‰ of 20 – 29 years age class)	0.53		0.06	
1.2 Population with tertiary education (% of 25 – 64 years age class)	0.78	*	-0.29	
1.3 Participation in life-long learning (% of 25 – 64 years age class)	0.73	*	-0.56	
1.4 Employment in medium-high and high-tech manufacturing (% of total workforce)	0.19		0.64	
1.5 Employment in high-tech services (% of total workforce)	0.88	*	-0.17	
2.1 Public R&D expenditures (% of GDP)	0.89	*	0.19	
2.2 Business expenditures on R&D (% of GDP)	0.90	*	0.29	
2.3.1 EPO high-tech patent applications (per million population)	0.85	*	0.19	
2.3.2 USPTO high-tech patents granted (per million population)	0.87	*	0.35	
3.1 SMEs innovating in-house (% of all SMEs)	-0.02		0.80	*
3.2 SMEs involved in innovation co-operation (% of all SMEs)	0.95	*	-0.04	
3.3 Innovation expenditures (% of total turnover)	-0.07		0.82	*
3.4 SMEs using non-technological change (% of all SMEs)	-0.33		0.74	*
4.1 Share of high-tech venture capital investment	0.35		0.25	
4.2 Share of early stage venture capital in GDP	0.89	*	-0.13	
4.3.1 Sales of 'new to market' products (% of total turnover)	0.12		0.57	
4.3.2 Sales of 'new to the firm but not new to the market' products (% of total turnover)	-0.07		0.86	*
4.4 Internet access	0.68		-0.21	
4.5 ICT expenditures (% of GDP)	0.63		0.08	
4.6 Share of manufacturing value-added in high-tech sectors	0.89	*	0.22	

Source: European Commission (2004b), European Innovation Scoreboard 2004 Database; own calculations.

4. On average the Netherlands ranks 9th out of the OECD 20 countries for the indicators of "knowledge development" (Table A.4); lowest ranks for individual indicators range from 16-20 depending on available data. The Netherlands does particularly well on EPO high-tech patent applications (item 2.3.1) and public R&D expenditure as a share of GDP (item 2.1) but scores below average on the proportion of the population with tertiary education (item 1.2) and business expenditures on R&D as a percentage of GDP (item 2.2); the Netherlands ranks around the middle of the group for the other indicators. The Netherlands does not score very well on the "knowledge application" indicators, ranking 14th equal out of 17 high-income countries for which data are available (EU15 less Ireland plus Switzerland, Norway and Iceland)) (Table A.5). It scores relatively poorly on all four indicators loaded to this factor, with especially low rankings for the percentage of SMEs using non-technological change (item 3.4) and for total innovation expenditures as a share of turnover (item 3.3); the other two indicators with low rankings are the proportion of SMEs innovating in-house (item 3.1) and sales of products that are new to the firm but not the market as a percentage of total turnover (item 4.3.2).

Table A1.4. Rankings of OECD 20 countries for innovation items that load on "Knowledge Development"

Country	Rank Item 1.2	Rank Item 1.3	Rank Item 1.5	Rank Item 2.1	Rank Item 2.2	Rank Item 2.3.1	Rank Item 2.3.2	Rank Item 3.2	Rank Item 4.2	Rank Item 4.6	Factor 1 Item Average Rank
Finland	3	7	3	2	2	1	3	1	2	3	2.7
Sweden	8	1	1	3	1	3	4	3	1	8	3.3
USA	1	n.a.	n.a.	4	5	5	1	n.a.	4	4	3.4
Japan	2	n.a.	n.a.	7	3	9	2	n.a.	n.a.	7	5.0
Iceland	10	3	2	1	6	8	5	5	7	n.a.	5.2
Switzerland	9	2	7	11	4	4	6	6	5	1	5.5
Denmark	4	6	4	8	7	7	7	2	3	9	5.7
UK	6	5	5	13	12	10	10	12	6	5	8.4
Netherlands	12	8	11	6	14	2	9	8	11	11	9.2
France	15	12	6	5	11	11	11	9	9	6	9.5
Belgium	7	10	8	15	9	12	12	7	10	10	10.0
Norway	5	4	10	10	15	15	15	4	8	14	10.0
Germany	14	14	13	9	8	6	8	10	14	12	10.8
Ireland	11	9	9	19	16	13	13	n.a.	13	2	11.7
Austria	17	11	12	12	13	14	14	11	15	13	13.2
Luxembourg	18	13	14	20	10	16	18	n.a.	n.a.	19	16.0
Spain	13	15	16	17	17	18	17	16	16	16	16.1
Italy	20	16	15	16	18	17	16	15	18	15	16.6
Portugal	19	18	18	14	19	20	20	13	12	17	17.0
Greece	16	17	17	18	20	19	19	14	17	18	17.5

Source: European Commission (2004b), European Innovation Scoreboard 2004 Database; own calculations.

Table A1.5 Rankings of OECD 20 countries for innovation items that load on "Knowledge Application"

Country	Rank Item 3.1	Rank Item 3.3	Rank Item 3.4	Rank Item 4.3.2	Factor 2 Item Average Rank
Switzerland	1	1	n.a.	2	1.3
Germany	3	2	2	1	2.0
Belgium	5	3	7	8	5.8
Finland	6	6	9	3	6.0
Portugal	7	4	6	7	6.0
Austria	8	n.a.	4	10	7.3
Luxembourg	4	12	1	14	7.8
Italy	11	8	8	5	8.0
Iceland	2	10	5	16	8.3
Greece	16	7	3	13	9.8
Sweden	9	n.a.	11	n.a.	10.0
United Kingdom	15	9	n.a.	6	10.0
Spain	14	13	10	4	10.3
France	12	5	15	12	11.0
Netherlands	10	11	12	11	11.0
Denmark	17	15	14	9	13.8
Norway	13	14	13	15	13.8
Ireland	n.a.	n.a.	n.a.	n.a.	n.a.
Japan	n.a.	n.a.	n.a.	n.a.	n.a.
United States	n.a.	n.a.	n.a.	n.a.	n.a.

Source: European Commission (2004b), European Innovation Scoreboard 2004 Database; own calculations.

NOTES

23. "(Factor analysis aims) to explain the most of the variability among a number of observable random variables in terms of a smaller number of unobservable random variables called factors. The observed random variables are modelled as linear combinations of the factors, plus "error" terms. The factor loadings (are) inferred from the data." http://en.wikipedia.org/wiki/Factor_analysis

24. Indicators 2.4.1 (EPO patent applications (per million population)) and 2.4.2 (USPTO patents granted (per million population)) have been excluded because they are highly related to indicators 2.3.1 (EPO high-tech patent applications (per million population)) and 2.3.2 (USPTO high-tech patents granted (per million population)), respectively.

25. As this procedure employs casewise deletion, meaning that information from countries with at least one missing value from the selected variables is excluded prior to performing the calculation, the EIS dataset is cut down to the OECD 20 group of countries: EU15, Iceland, Japan, Norway, Switzerland, and the United States.

26. http://www.trendchart.org/scoreboards/scoreboard2004/indicators.cfm, accessed August 2005.

27. http://www.trendchart.org/scoreboards/scoreboard2004/indicators.cfm, accessed August 2005.

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