STB/95/051
POWER Annexes
SYSTEMS

ASSESSING THE DISTRIBUTION OF NATIONAL INNOVATION

PILOT STUDY: THE NETHERLANDS

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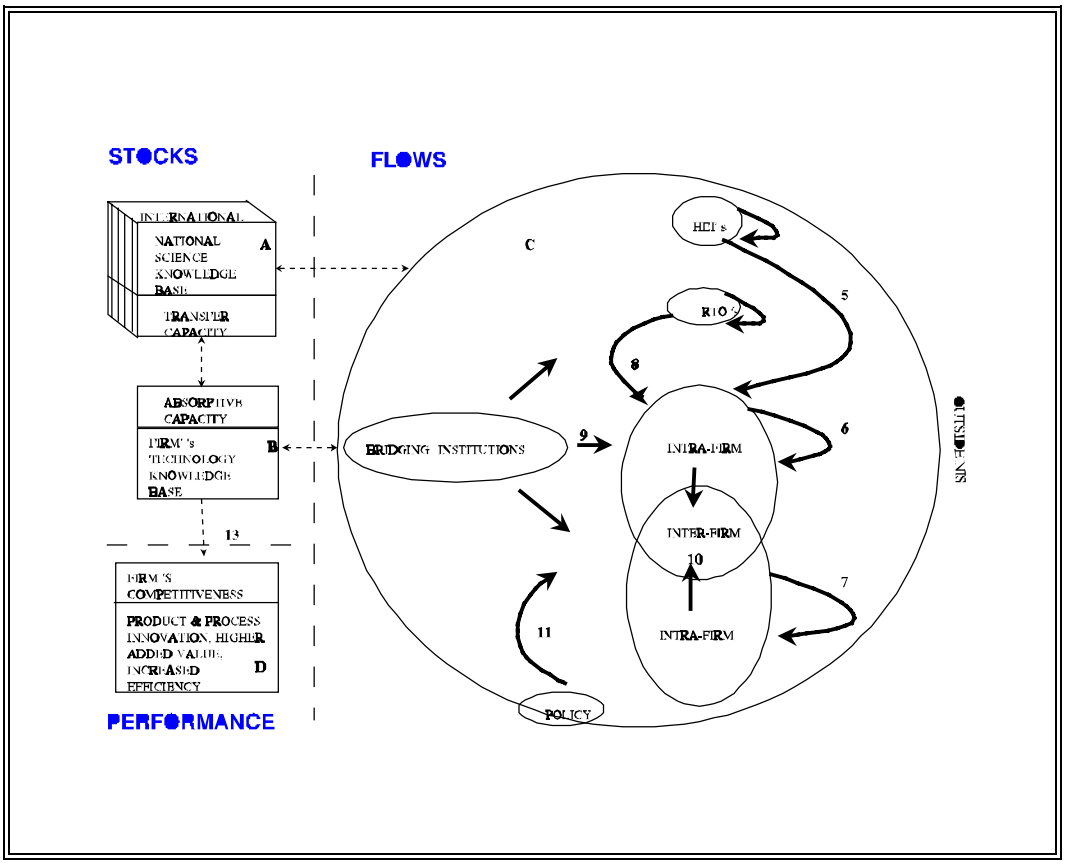
ANNEX 1: STATISTICAL ANNEX

Figure 1: Conceptual framework



* The statistical annex is structured using the conceptual framework described in section 2.2. For that reason figure 2.1, representing the conceptual model, is included in this annex as well. Numbers of tables and figures refer to boxes and arrows given in this figure.

ANNEX II: CANADA LIST

This list was used in the beginning of the project to review available sources on the basis of an indicative list of indicators provided by the OECD. Canada provided the first overview. In the mean time most participating countries have made up such a list. The list displayed here reflects the situation for the Netherlands.

SUGGESTED INDICATORS		AVAILABLE SOURCES	COMMENTS
I.	**Stocks and flows of knowledge**		This category of (mostly) 'stock' indicators is quite well established (R&D statistics, patents, scientometrics, etc.)
I.1	*Learning through training*		
I.1a	formal training provided by employers (intensity, distribution by type of firm/technology)	Various sources available: Dutch Central Statistical Office (CBS), CPB/Minne, ROA, innovation-survey	Some additional case studies available e.g. from SER, ROA, Bartels. It is expected that I.1 could be well covered using available data, type of employment possibly is the most difficult part.
I.1b	science and engineering personnel (total national stock and breakdown by sector and type of employment)	Various well established sources available: OECD/MERIT, UNESCO, CBS, Ministry of Education, Culture and Sciences	
I.2	*Learning by doing*		
I.2a	cumulative R&D expenditures (distribution by type of firm/technology)	OECD/MERIT, innovation-survey, CBS, EC-DG XIII	Distribution by technology might prove to be difficult
I.3	*Embodied knowledge (i/o-analysis)*		
I.3a	high tech capital and intermediate inputs (domestically produced/acquired from outside)	CBS	Based on CBS-material we will be able to provide technology flow matrices
I.3b	software (domestically produced/acquired from outside)	CBS	
I.4	*Disembodied knowledge (citation analysis)*		
I.4a	patents (domestically produced /acquired from outside)	OECD/MERIT, CWTS/EPO, US Patent Office, CPB	Some additional case study material e.g. Bulthuis/NEI/DNB, SER

SUGGESTED INDICATORS		AVAILABLE SOURCES	COMMENTS
I.4b	scientific papers (domestically produced/acquired from outside)	CWTS/various international databases	A joint effort may pay off here.
II.	**Forms of knowledge sharing and transfer** 1 - 6 : universities, research institutes and industry 7 - 11: between suppliers and users		
II.1	*University-industry research centres (UIRC's)*	CBS, Technology Foundation (STW)	Although some statistics are available, especially the CBS-data seem to be promising, This is one of the most problematic indicators because of definitional problems (what are exactly UIRC, can we include RTOs) and lack of detailed data e.g. to cover II.1c/d Obtaining a systematic overview of relevant organisations proves to be quite difficult
II.1a	number and technological specialisation of UIRC's		
II.1b	magnitude of R&D effort associated with UIRC's		
II.1c	number and type of university faculty, research scientists and students associated with UIRC activities		
II.1d	importance of educational functions of UIRC's (number of students affiliated with UIRC's being hired by participating firms)		

SUGGESTED INDICATORS		AVAILABLE SOURCES	COMMENTS
II.2	*Bridging institutions*		
II.2a	Type and economic importance of bridging institutions	Innovation-survey	Additionally mainly qualitative material is available which need to be obtained from a great many sources.
II.3	*Personnel mobility*		
II.3a	Rates of mobility from university and research institutes to enterprise sector	No statistics available	Only some indications from case studies. This is one of the areas for which for the Netherlands additional data gathering would be needed.
II.3b	recruitment and destinations of university personnel when leaving university		
II.3c	partial mobility (sabbatical?, contract research, mixed-research positions)		A possibility would be to survey universities and research institutes, but it is expected that no statistics will be available at such a desegregated level.
II.3d	spin offs (firms created by academic researchers)		
II.4	*Revealed advantage in transfer and engineering sciences*		
II.4a	share of scientific publications in transfer science	CWTS using various (inter)national databases	

SUGGESTED INDICATORS		AVAILABLE SOURCES	COMMENTS
II.5	*Methods of learning in university-industry relations: importance of following sources or methods for learning about research conducted in universities for a business firm*		
II.5a	university publications (for business firms)	Some incidental input from the innovation-survey, Ministry of Education, Culture and Sciences, Algemene Rekenkamer (General Accounting Office), universities and RTOs like TNO/GTI's as well as indications of joint R&D e.g. involvement in European Research Programmes	These indicators could only be covered by using various less well established statistics and incidental case studies. Most of the relevant organisations have not collected these sort of data systematically. Especially II.5a/c/d/e are difficult to cover.
II.5b	conferences		
II.5c	trained staff		
II.5d	informal contacts		
II.5e	temporary exchanges		
II.5f	contract R&D		
II.5g	joint R&D		
II.6	*University research output, delivered in suitable form for industrial use*		
II.6a	Intensity and specialisation of universities' patenting activities	CWTS/EPO	
II.6b	% of researchers from universities having published studies (!) and patent applications	CWTS using various (inter)national databases	
II.6c	Amount of technical knowledge (e.g. software) produced and distributed without charge by universities		
II.7	*Producer-user interactions*		

SUGGESTED INDICATORS		AVAILABLE SOURCES	COMMENTS
II.8	*Research cooperation within and between enterprises; Firms reporting research cooperation by partner*		
II.8a	Intra-firm cooperation (between business units)	Innovation-survey, MERIT data on Dutch participation European Framework Programmes	Especially the innovation survey data cover most of the indicators mentioned for 1992. Quite a few (case) studies with some quantitative indications e.g. Bartels, Moerdijk & Van Oosten on outsourcing and cooperation in research. II.8a/d/e/g may prove to be difficult to cover as data have not been identified yet.
II.8b	between firms: horizontal		
II.8c	between firms: vertical (supplier-user cooperation)		
II.8d	consultants		
II.8e	technical research institution in specific industries		
II.8f	relative importance of institutional forms of co-operative research, like: *joint ventures, *technological cooperation in specific industry (e.g. LEI) *large cooperative programmes involving multidisciplinary research		
II.8g	importance of informal networks, as a key mechanism for sharing knowledge		

SUGGESTED INDICATORS		AVAILABLE SOURCES	COMMENTS
II.9	*importance of property right system in knowledge transfer & distribution*		
II.9a	% business R&D expenditures resulting in intellectual property rights		Data mainly close to II.9a, II.9b/c proves to be difficult
II.9b	economic effects of intellectual property rights		
II.9c	cross-licensing activities		
II.10	*participation in standardisation activities*		No data available
II.11	*orientation of technology and innovation policy towards diffusion*		
II.11a	relative amount of money allocated towards diffusion at both national and regional levels	Ministry of Economic Affairs, MERIT, TNO, Bartels	Mainly qualitative material is available e.g. Holland (technology policies in the region).

SUGGESTED INDICATORS		AVAILABLE SOURCES	COMMENTS
III. Effectiveness of knowledge sharing and transfer: 1 - 3: universities, research institutes and industry 4 - 5: among competitors and between supplier & users (technology diffusion through flows of embodied R&D and market distribution of patented knowledge)			
III.1	*Intensity of university knowledge-base by business firms*		
III.1a	importance of technical knowledge obtained from universities to the innovative activities of business firms	For III.ib CWTS/EPO	
III.1b	academic citations: frequency used in corporate patents		Additional data gathering is needed.
III.2	*Co-operative R&D between university and industry*		
III.2a	number of formal co-operative projects between university and industry		Annual reports from individual universities may give an indication. Comprehensive overview is difficult as not all projects will be reported in the same way. Use of the (new) WBSO-scheme (SENTER) might give insight.
III.2b	joint turnover of III.2.a		
III.2c	intensity of co-patenting between universities and industry	CWTS/EPO	
III.2d	technological specialisation of III.2c		
III.2e	intensity of co-publication between university and industry	For III.2e CWTS using various (inter)-national databases	
III2f	technological specialisation of e.		

SUGGESTED INDICATORS		AVAILABLE SOURCES	COMMENTS
III.3	*Industrial contribution to basic research*		
III.3a	share of business firms in total expenditure on basic research	MERIT/OECD	
III.3b	number of relevant publications by industrial researchers	CWTS using various (inter)national databases	
III.4	*Distribution of knowledge among competitors and between suppliers and users*		
III.4a	diffusion rate of new products and processes	CBS (National Accounts), innovation-survey	
III.4b	diffusion rate of specific high-tech products		

ANNEX III: APELDOORN LIST

* This list reviews themes and topics on which well defined indicators and structured data are missing. In the first column those themes and topics proposed by the OECD (see annex II) that are (hardly) available for the Netherlands are given. The second column identifies relevant themes and topics that are not included in this OECD-list.

A. (INTER)NATIONAL SCIENCE KNOWLEDGE BASE	
Themes/topics proposed by OECD - R&D-effort associated with universities - detailed indicators on role/importance of transfer sciences - intensity and specialisation of universities' and RTOs patenting activities	*Possible other themes/topics* - (under)utilisation of available stocks (unemployed R&D personnel, working of labour market) - opportunities for on the job training and learning - expertise and skills of labour force - internationalisation of and especially accessibility and ability to use the international science knowledge base - availability and effectiveness of transfer mechanisms (e.g. transfer bureau of HEIs)
B. FIRMS' TECHNOLOGY KNOWLEDGE BASE	
Themes/topics proposed by OECD - intensity and specialisation of firms' patenting activities - economic use of patents/scientific papers	*Possible other themes/topics* - (under)utilisation of available stocks - formal training and professional career of R&D personnel (e.g. previous employer) - firms' ability to introduce and profit from investments in new equipment and materials - level of internationalisation and opportunities to benefit from international technology knowledge base

C. FLOWS IN NIS	
Themes/topics proposed by OECD	*Possible other themes/*topics C sources and destination of R&D financing at cluster level
5. number and technological specialisation of university related research institutes primarily working for industries 5. co-operative or joint HEI-industry R&D 5/6/8 transfer by S&E-personnel mobility or recruitment 5/8. temporal exchanges of personnel/mixed research position s of R&D-staff 5/8. HEI/RTO research publications for business firms/HEIs-RTOs-industry conferences 5/8. cross-licensing activities	5/8. contract-research of HEIs/RTOs per cluster 5/8. product and process innovations used by industry originated from HEIs/RTOs per cluster 5/8. co-publications of firms and HEIs/RTOs per cluster
6. on the job training per cluster	6. intra-concern R&D flows per cluster
8. co-operative or joint RTO/industry R&D 8. RTOs training programmes	8. percentage contract research performed for business firms by RTOs and cluster
9. firms' use of bridging institutions in innovation activities 9. use of consultants in R&D-activities	9. use of patent information per cluster 9. type of information and advice provided by bridging institutions per cluster 9. role of bridging institutions in education and training per cluster 9. role of bridging institutions in demonstrating new technologies and new practices per cluster 9. role of bridging institutions in building (informal) networks and exchanging experiences per cluster

10. joint R&D with engineering companies 10. institutional forms of inter-firm R&D-co-operation (joint ventures, large (EC)co-operative research programmes) 10. informal networks (OECD II8g) 10. mobility of S&E-personnel between companies 10. cross licensing activities 10. participation in standardisation activities	10. technology balance of payment per cluster
	11. magnitude and effectiveness of various diffusion oriented policy instruments 11. availability and effectiveness of technology policy instruments aimed at technology foresight, demonstration and networking
D FIRMS' COMPETITIVENESS	
Themes/topics proposed by OECD	*Possible other themes/topics* - percentage of turnover realised with products/processes introduced last three years by cluster - competitiveness by cluster - exports by cluster

ANNEX IV: MEGA-CLUSTERS

* A more detailed analysis is included in H. van der Gaag (1995), *Clusters economisch en technologisch bekeken. Een verkenning van de statistische identificatiemogelijkheden*, STB-95-039, TNO-STB, Apeldoorn.

Although there are various methods to identify clusters, two main-types can be discerned e.g. mono-graphical case studies and more statistical studies. By combining the two a picture emerges of the economic structure of a country in terms of networks of industries (at various levels of aggregation) and specialisation patterns.

Based on multiple sector studies conducted by TNO-STB and quantitative methods using data on products and services and technology flows[1] between sectors, nine mega-clusters were identified. These clusters are displayed in figure IV.1. Not only manufacturing industries can be placed in the cluster chart, also services with activities in specific industry can thus be allocated to one of the clusters. It shows how the various economic activities relate to each other. Of course there are overlaps between the clusters and some industries can not be easily classified in one of them. Table IV.1 gives a more detailed description of the economic activities included in the different mega-clusters.

[1] For the Dutch case we estimated 'embodied' intermediate innovation flows using the following data sources and methods:
- make- and use-tables containing detailed information on making and using intermediate products at an aggregation level of about 650 categories of products and about 230 economic sectors;
- cluster analysis, identifying networks of strongly interconnected value chains;
- Dutch Innovation Survey 1992, containing detailed information on innovation performance and on the share of new products in economic sectors' turnover.

Figure IV.1. Mega clusters in the Dutch economy

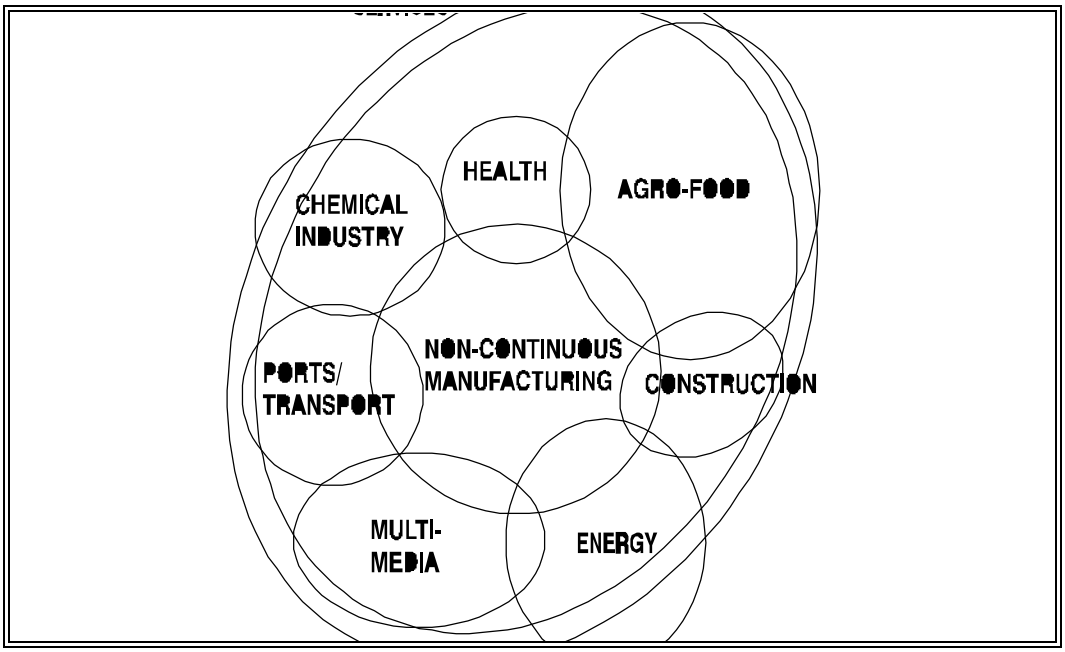


Table IV.1. Clusters in the dutch economy

Cluster	*Value Added (million guilders)*	*Main economic activities*
Construction	79.929	Manufacture of building materials, earthenware; Construction and installation on construction projects
Chemical industry	18.078	Chemical basic products industry, manufacture of artificial and synthetic yarns and fibres; Chemical final product industry; Rubber and plastic-processing industry; Petroleum Industry
Services	214.409	Commercial (Trade; Hotels, restaurants, etc; Business services; Cleaning services etc) and non-commercial (Education,Public Administration, Corporate Business Organs, Social Services etc)
Energy	27.012	Electricity generation, Gas distribution, Water supply, Crude Petroleum and natural gas production and exploration.
Health	29.731	Health and veterinary services (hospitals, nursing homes, general practitioners services, Dentist, Psychiatric institutions and other medical services; Manufacture of pharmaceutical and antiseptic dressings, Manufacture of Medical instruments
Agro-food	34.788	Agriculture; Horticulture, Forestry; Fishing,;Meat processing industry; Flour processing; Canning, preserving and processing of fruits and vegetables; Animal feed, Oils and fats, Manufacture of dairy products, Starch, Sugar industry, Beverages and Manufacture of chocolate and confectionary.
Multi-media	13.967	Printing, publishing and related industries, Photo studios and Film & Foto-laboratories, Computer services; Advertising and Publicity Agencies; Theatres, Cinemas; Movie Organisations.
Manufacturing industries (mainly including discrete production)	59.741	Electrotechnical industries, Automobile industry, Manufacture of transport, Basic metal industry; Manufacture of metal products, Machinery; Manufacture of instruments and optical goods; Wood and furniture industry;Paper and cardboard industry; Paperware and corrugated cardboard industry; manufacture of glass and glass products; Textiles industry.
Transport & Ports	36.532	See and Air transport, Railways, Tram and Bus services, travel agencies, shipping and other transport and storage

ANNEX V: PARTICIPANTS NATIONAL EXPERT MEETING

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