

Measuring Intangible Investment

National Efforts to Measure Intangible Investment

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OVERVIEW

1.1 Sources of data

Of the six countries which reported national efforts to measure intangible investment to the 1992 Workshop on the Measurement of Intangible Investment, described in Chapters 2-7, two, Finland and Norway, had undertaken more than one special survey using a tailor-made questionnaire. In the case of Sweden, additional questions, on software and R&D and on marketing, had been added to a regular industrial survey. The studies for France, the Netherlands and the United Kingdom were a straight compilation exercises combining data from existing sources. Two further efforts, reported to the Conference on New S&T Indicators for a Knowledge-based Economy, are reproduced in Annexes 1 and 2.

These compilation exercises covered all industry, whereas the surveys covered large firms in manufacturing (Sweden), mining and manufacturing (Norway) and mining, manufacturing and utilities (Finland).

1.2 Coverage of intangible investment

As can be seen from Table 1, all the exercises included investment in **R&D**. In all cases except Norway and Sweden the data used were the results of national R&D surveys. Only in the case of Norway do they seem to have been adjusted to match the special requirements of intangible investment.

France, the United Kingdom and the Netherlands also included purchase of foreign licences as registered in the Technology Balance of Payments (TBP). In the first two countries, purchase of foreign licences in the TPB was treated alongside R&D, whereas in the Netherlands it came under the "rights" heading.

All exercises included investment in **software**. The United Kingdom included only supplier-based expenditure by the software services industry.

Training was included by all except Sweden. French data is collected as part of the implementation of the compulsory training incentive. Data for the Netherlands and the United Kingdom were derived from one-off surveys. In Norway training is described as "competency development".

Some aspects of **marketing** was included by all. Finland specified only long-term marketing, while the Norwegian category was wide enough to cover the organisation of the firm. The figures based on compilations of data control advertising, usually supplier -- reported plus commercial investment abroad in France and market research in the Netherlands.

Rights, other than the TBP as mentioned above, were variously treated. They are a specific category in the Netherlands. In Finland they are treated under "other intangibles". Both include goodwill.

Only Finland treated mineral exploration as an intangible investment, although the relevant industry was included in the Norwegian survey. The data was available in the Netherlands but could not be quoted for reasons of confidentiality.

Both Finland and Norway included other items. Finland specified "the organisation of the firm" whereas Norway named "working environment development".

1.3 Industry of size of company

The three countries which undertook surveys published breakdowns by industry and Finland and Norway also gave a distribution by the size of firms. Norway attempted a breakdown by region which was not without problems. The studies based on data compilation could at best provide a breakdown between manufacturing and total industry.

Table 1.1 Coverage of intangible investments in six country studies

	Finland	France	Netherlands	Norway	Sweden	UK
R&D	x	x	x	x	x	x
Training	x	x	x	x		x
Software	x	x	x	x	x	x
Marketing	"Long- term marketing"	Advertising Commercial investment	Advertising external market	"Market development"	Marketing	Advertising
Rights	Goodwill patenting	TBP	-patents -copyright -licences (TBP)	incl. in market development		TBP
Mineral exploration	(included in other)		(confidential)			
Other	Development of organisation		Services of management consultants	Working environment development		
Source	R&D survey Special survey	Compiled	Compiled	Special survey	Added questions to regular investment survey	Compiled
Coverage	- other mining - manufacturing - electric gas and - steam	Total industry	Total industry	- oil extraction - mining and quarrying - manufacturing	Firms with over 500 employees in manufacturing	Private sector
Years	1985 1987 1989	1974 1981 1985 1989	Total 1975-88 manufacturing 1985-88	1986-90	1987-91	1988 or nearest year available
Classifications	- industry - size	None	of which manuf.	- industry -size - region	- industry	of which manuf.
Comparison with tangible investment	x	x	x	x	x	x

1.4 Comparisons with tangible investment

All six exercises include some comparisons between tangible and intangible investment. The ratios vary between countries, probably mainly because of differences in the components of intangibles. Spending on intangibles does not appear to have grown systematically or more rapidly than traditional investment.

THE INTANGIBLE INVESTMENT OF INDUSTRY IN FINLAND¹

2.1. Introduction

The idea of the survey was suggested by political considerations of the need to increase intangible investments, a Swedish survey on the subject, and an annual survey on intangible investments by an economic magazine in Finland. The basic concepts were mainly derived from accounting practices in some big companies and experience from other surveys.

A pilot questionnaire was developed in 1985 and tested by interviewing over 20 companies about their difficulties in providing the data requested. The first survey was launched in 1986 in respect of 1983. This covered all intangible investments. The second survey in respect of 1987 did not cover R&D, for which data were taken from our regular R&D survey. It was repeated in respect of 1989, but the results have been published in Finnish only.

2.2. Definitions

Intangible investment refers to an enterprise's long-term operating costs incurred in research and development, long-term marketing, education and training, and other activities aimed at the development of the enterprise. The statistics also include the acquisition costs of fixed assets related to intangible investment.

Research and development refers to systematic activities undertaken to increase the body of knowledge and to the use of knowledge in efforts to produce new applications.

Long-term marketing expenditure contains the marketing costs of new products, the marketing cost of gaining new market areas or segments, and the cost of improving the enterprise's strategic competitive position.

Education and training refers to any education or training programme planned in advance and lasting at least one day. The term does not cover on-the-job training or other forms of human resource development.

Other intangible investment includes the following expenditures:

- the acquisition cost of computer software acquired from outside the enterprise or developed internally which is not part of any research project and whose useful life is at least a year;
- the cost of developing the organisation or the overall functioning of the enterprise;
- the goodwill of purchased enterprises;
- patenting costs;
- subscriptions to data banks;

- remuneration for innovative ideas;
- the cost of exploring for natural resources;
- human resources development not included in education and training expenditure;
- other intangible investment not elsewhere specified.

2.3. Data sets

The data are based on the pilot survey concerning intangible investment carried out by the Central Statistical Office (CSO) of Finland. The data on research and development derive from CSO statistics concerning research and development in enterprises.

The data relate to enterprises in the following industries with more than four employees:

- Other mining (ISIC 2);
- Manufacturing (ISIC 3);
- Electricity, gas and steam (ISIC 4).

The 1987 questionnaire was sent to all industrial enterprises with more than 100 employees. A simple random sample was selected from among other industrial enterprises,. A total of 656 enterprises were included in the survey, of which 79.7 per cent responded. As regards enterprises with more than 100 employees, the coverage of the survey was about 75 per cent as by personnel size and about 79 per cent as measured by turnover. The estimates for industry as a whole have been calculated by raising the values of the data by size category in proportion to turnover and personnel size.

In a departure from the previous survey, information was requested on the cash value of marketing expenditures. Education and training expenditures were reported exclusive of the wages and salaries of persons receiving education or training, which were estimated on the basis of average wages and salaries. In addition, information was asked on the number of persons receiving education or training. The data on education and training expenditure are more accurate than the corresponding data for 1985. As regards other intangible investment, separate information was asked about the acquisition cost of computer software. The cost of human resource development not included in education and training expenditure was added to other intangible investment.

2.4. Main results of the 1987 survey and highlights for 1989

The intangible investment of industry was estimated at about Mk 8.2 billion in 1987, about 7.5 billion of which was accounted for by manufacturing industries. Intangible investment accounted for about 3 per cent of the turnover of industry.

Of the intangible investment, about 41 per cent was for research and development, about 22 per cent for marketing, about 14 per cent for education and training, and 23 per cent for other intangible investment. Other intangible investment included about Mk 437 million in acquisition costs for computer software, along with the cost of on-the-job training and other forms of human resource

development. In 1989, R&D was 45 per cent, marketing 18 per cent and training 16 per cent. Perhaps one-quarter of the remaining 21 per cent was for software.

Intangible investment was concentrated in large enterprises, which accounted for about 72 per cent of the total. Of the intangible investment of large enterprises, about 46 per cent was for research and development. The intangible investment of small enterprises consisted mainly of marketing expenditures and of other intangible investment. This was confirmed by the results for 1989.

Between 1985 and 1987 industry's Gross Fixed Capital Formation grew faster than its intangible investment. However, between 1987 and 1989 they grew at the same rate, about 20 per cent. In 1987 total investment by industry amounted to Mk 29.4 billion, about 28 per cent of which was accounted for by intangible investment, with the same percentage in 1989. In the manufacturing industries, the proportion of intangible investment was about 31 per cent, slightly less than in 1985.

Table 2.1 Intangible investment of industry by size group of personnel, 1987
Mk million

Size group	Total	R&D	Marketing	Education, training	Other intangible investment
Total	8 213.4	3331.5	1 808.5	1 152.2	1 921.2
5-99	1 237.3	186.4	566.7	130.4	353.6
100-499	1 052.2	411.5	236.9	180.0	224.9
500+	5 923.9	2 733.6	1 005.9	841.8	1 342.7

85 per cent of all enterprises responding to the questionnaire reported expenditures classified as intangible investment

56 per cent of the respondents reported marketing expenditures, 81 per cent education and training expenditures, 68 per cent acquisition costs for computer software, and 61 per cent other intangible investments.

Marketing investment has remained at the level of the 1985 survey, which may partly be explained by the more tightly specified questions.

Large enterprises accounted for about 72 per cent of education and training days per employee. The wages and salaries of persons receiving education and training accounted for about 40 per cent of the education and training expenditure. The latter also contains the acquisition costs of fixed assets related to education and training, costs reported by about 16 per cent of the respondents reporting education and training expenditures.

Table 2.2 Education and training in industry: size of enrolment and number of person days by size group of personnel, 1987

Size group	Enrolment	Person days
Total	182 656	782 000
5-99	26 664	106 706
100-499	26 734	111 846
500+	129 258	563 448

Table 2.3 Acquisition cost of computer software in industry by size group of personnel, 1987
Mk million

Size group	Acquisition of software
Total	436.9
5-99	97.1
100-499	72.7
500+	267.1

About 40 per cent of personnel are estimated to have received education or training during the year. This may be a slight overstatement due to the questioning technique. The number of education and training days per person receiving education and training was estimated at about 4.3 on average, slightly less in small enterprises.

In addition, about 29 per cent of all respondents reported expenditures on human resources development not included in education and training expenditure. The monetary value of these cannot, however, be estimated.

In small enterprises with less than 100 employees, the proportion of other intangible investment in total intangible investment was the largest, about 29 per cent. The figure for small enterprises is influenced by the large (for the under 100 size class of personnel) size of the responding enterprises.

Furthermore, the figure may also include certain research development expenditures. The other intangible investment of small enterprises averaged about Mk 50 000, of medium-sized enterprises about Mk 100 000 and of large enterprises Mk 700 000.

In 1989 the five major spenders on intangible investment were the electrical/electronic industry with Mk 1.7 billion, chemicals and pulp and paper with Mk 1.3 billion, the machinery industry with Mk 1.2 billion and the textile and footwear industry with Mk 1.1 billion.

Table 2.4 Units reporting other intangible investments as a proportion of units reporting intangible investments, 1987

Object of investment	Percentage
Total	71.1
Development of enterprise	53.6
Paid goodwill	7.4
Patenting	23.8
Data banks	6.8
Remuneration for innovative ideas	24.1
Exploring for natural resources	2.5
Human resource development	33.1
Other	4.4

INVESTMENT IN INTANGIBLES: THE FRENCH EXPERIENCE²

3.1 Introduction

In an economy which is becoming increasingly intangible, productive investment (i.e. excluding financial investment) is also becoming more intangible. On a wider scale one can also speak of "intellectual investment" as opposed to the classic concept of tangible or physical investment (Gross Fixed Capital Formation in National Accounts terminology).

3.2 Definitions

Intellectual investment is difficult to comprehend. To begin with, there is no precise definition which is generally recognised either at the level of the firm or of the economy as a whole. The concept of intangible investment is based on three criteria. It is an expenditure by the firm which: *i*) improves its production capacity; *ii*) accumulates in the form of depreciable capital which can be used in future production; and *iii*) has an asset value which can be traded. This is the generalised concept of intangible investment. In practice intangible investment can only be identified in four major areas, research and experimental development (R&D), the software component of computing expenditure, commercial activities and training. Limiting oneself to these four major categories no doubt underestimates intellectual investment. Efficient management of a firm is often accompanied by investment in working methods and in strategic analysis. Measurement is delicate. The importance to firms of R&D and software has led to changes in accounting practice. Henceforth firms may enter expenditures on applied research and experimental development and on software developed in-house or purchased separately from equipment. Commercial investment is more difficult to identify and current accountancy standards remain very prudent on its inclusion in the balance sheet. The practice of valuing companies for example at the time of mergers, restructuring, or of public offers to purchase sometimes lead to assigning high values to the commercial balance of the firms and notably to "goodwill". Major discrepancies can be noted with the net results declared by the company, for example from 1 to 10 in the case of the first French television channel. Similarly, the training efforts of firms are difficult to measure in full. The present exercise is limited to a single simple indicator, professional training covered by government regulations.

Comparisons between industries or countries are difficult as the categories listed are not exclusive. Thus, software purchased for training purposes may be counted twice, both in software and in training.

3.3 The accelerator effect of R&D

A set of data has been available to track R&D expenditures for many years. These data, which are collected in most developed countries, permit international comparisons. Studies have shown the efficacy of such expenditures. For example, in the electrical and electronic industries it has been proved that investment in R&D was twice as productive as investment in the purchase of equipment. In France

expenditure on R&D performed by industry corresponds to 12-13 per cent of tangible investment or to the same amount as investment in transport equipment (FF 87 billion in 1989).

In order to strengthen its technology portfolio, an enterprise may acquire patents and licences or participate in technical co-operation. Here one is talking about international transfers of technology. Purchases of patents and licences can be seen as intangible investment. They currently come to about 2 per cent of tangible investment.

In the case of computing expenditures, software now outstrips hardware. In fact software associated with hardware is included in expenditures on hardware.

Total software expenditures come to about 11 per cent of total tangible investment, almost as much as R&D. Software is the component of intangible investment which has grown the most rapidly over the last 15 years.

3.4 Commercial functions are becoming stronger

Certain commercial expenditures, such as establishing a brand, setting up a commercial network, setting up abroad or institutional communications are durable in character. In all cases it is necessary to distinguish the capital element from current expenditures. A publicity campaign to launch a new brand or product may be an investment. On the other hand, regular expenditures to support the brand image or product should be treated as current service activities. Using total advertising figures as an incomplete and doubtful indicator of commercial efforts, one comes to a figure of about 9 per cent of tangible investment. One should also mention commercial investment abroad which corresponds to setting up foreign subsidiaries.

Training is the last of the four major components. Taking into consideration only those professional training expenditures which are legally obligatory, gives a sum equivalent to 4 per cent of total tangible investment.

3.5 The balance is swinging towards intangibles

During the 1980s the take-off of investment in intangibles partly compensated for a slowing in tangible investment. In consequence total investment was maintained at about 20-30 per cent of value added. The similarity in the trends underlines the complementarity between the intangible and tangible elements of investment which are often closely linked. Expenditure on R&D leads to purchases of equipment; purchase of new equipment such as numerical machine tools requires expenditure on training, etc.

Table 3.1. **Growth in intangible investment in France, by category**

	1974	1980	1985	1989
Tangible investment (billion current FF)	175	334	477	709
Intangible investment (billion current FF)	38	89	181	275
Intangible investment (as a % of GFCF)	21.5	26.5	38.8	38.7
<i>Of which:</i>				
R&D	8.0	9.2	13.0	12.1
Purchase of patents & licences	1.0	1.3	1.8	1.6
Software	3.2	6.0	10.8	11.0
Advertising	5.8	6.1	8.4	9.2
Commercial investment abroad	0.5	0.5	0.2	0.5
Training	3.0	3.4	4.6	4.3

Source: INSEE, SESSI, Credit National.

INTANGIBLE INVESTMENT BY DUTCH FIRMS⁶

4.1. Introduction

During the last decade, interest in the influence of technology and knowledge on the development of the firm and the economy as a whole has stimulated demand for data on investment in intangible fixed assets. The OECD in particular stressed the importance of information on investment in this category and took the initiative to investigate the possibilities for both a theoretical framework and statistics on this topic (Kaplan, 1987; Vosselman, Paper 4)(See “Selected Bibliography for references). The inclusion of some intangible assets in investment was discussed at length during the revision of the System of National Accounts (SNA), the UN handbook for the compilation of national accounts. The Dutch Central Planning Office asked the CBS explicitly for quantitative information on investment in intangible fixed assets.

4.2 Definitions and coverage

This paper presented a first estimate of total investment in intangible assets by firms. Intangible investment was defined as outlays for impalpable products that constitute knowledge, market power or strength of the internal organisation. Based on the CPC, the following products (services) were selected:

1. Research and development (R&D)
2. Software
3. Marketing
4. Training
5. Rights (licences, copyrights, patents)
6. Other services (exploration of natural resources, management consulting, distribution and knowledge networks, goodwill).

As a large part of the outlays related to these services are not activated on the balance sheet, the estimate of total intangible investment was constructed by summing up the outlays for these services. Data was obtained from several statistical sources, both official and non-official. Where necessary, allowances were made for missing data (population differences) and double counting.

4.3 Data sources

The **R&D data** are based on the results of the annual R&D surveys of enterprises undertaken by the Central Bureau of Statistics. They cover both intramural and extramural R&D by firms, including those with under 50 employees.

The **software data** are based on the results of the annual CBS survey of Automation Statistics. They cover the labour costs of software developers and the cost of purchased standard and specific software (adjusted to eliminate double counting).

The **training** data come from a special CBS survey of 1986 with a supplementary survey in 1990. It covers in-house and external training plus the cost of working hours lost.

The **marketing** data cover advertising and market research as reported by supplier branch organisations.

The **rights** component covers the registration of patents and brands, licences, and copyright. Data services are built up from various sources including Central Bank data on international trade in rights and surveys of the service industries concerned.

4.4 Main results

The table shows that in the period 1985-88 total intangible investment amounted to about Gld 22.5 thousand million, of which 55 per cent by manufacturing industry. Expenditure grew on average by 7 per cent per year, with no difference between industry and total firms.

The total is broken down into two sub-totals. The first contains the items R&D, training, marketing and software, the second, patents, licences, rights and other intangible investment. Data relating to the first "large items" are sometimes used for international comparisons; they constitute 80 per cent of total intangible investment. Annual growth for these items amounted to an average 8 per cent. The shares of the various items remained stable during the period under observation. Except for training good-quality data is available from the mid-1970s onwards.

The "small items" account for 15 to 20 per cent of total intangible investment. It should be stressed that these figures are of poorer quality than those for the other group; there is a lack of clear statistics, the population differences are immense, there is a serious risk of double counting, etc.

4.5 Comparison with tangible investment

Leaving aside the activation problems, the figures in the above table can be compared with data on investment in material fixed assets. The next table gives this comparison.

Intangible investment for total firms appears to correspond to about 42 per cent of investment in material fixed assets. For manufacturing industry, this percentage rises to 70 per cent. Both percentages were stable during the period 1985-88. As far as we know, this stability is not due to our estimation techniques.

Table 4.1. **Intangible investment by firms, 1985-88**
Million Gld

	1985		1986		1987		1988	
	Total	Man. industry	Total	Man. industry	Total	Man. industry	Total	Man. industry
Total outlays	20 655	11 625	21 865	12 100	23 440	13 025	24 900	13 775
Sub-total	17 655	8 985	19 325	9 930	20 470	10 575	21 685	11 085
<i>Of which:</i>								
R&D	5 760	5 105	6 395	5 710	6 740	6 065	7 030	6 300
Training	2 190	695	2 300	730	2 380	760	2 455	780
Software	2 765	650	3 110	740	3 295	805	3 450	805
Marketing	6 940	2 535	7 520	2 750	8 055	2 945	8 750	3 200
Sub-total	3 070	2 650	2 540	2 170	2 970	2 450	3 215	2 690
<i>Of which:</i>								
Patents	85	80	85	80	90	85	90	85
Copyright	890	705	825	655	1 065	685	995	760
Licences	1 950	1 850	1 475	1 365	1 615	1 495	1 900	1 760
Other intangible inv. ¹	145	60	155	70	200	85	230	85

1. Management consultancy only.

Table 4. 2. **Comparison intangible versus tangible investment, 1985-88**
Million Gld

	1985		1986		1987		1988	
	Total	Man. industry	Total	Man. industry	Total	Man. industry	Total	Man. industry
Investment								
- tangible ¹	48 930	16 350	54 400	17 420	54 920	18 180	60 560	19 750
- intangible absolute	48 930	11 625	21 865	12 100	23 440	13 025	24 900	13 775
% of tangible	42	71	40	69	43	72	41	70

Source: National Rekeningen 1989, investment of firms excl. exploitation of houses.

The data do not support the idea that intangible investment is growing faster than investment in goods, but it should be noted that, during the period under consideration, the growth rate of tangible investment was rather high.

Table 4.3. Intangible investment in the Netherlands, 1975-90
Million Gld

Intangible investment											Total intangible invest. as a percentage of:	
Total							Other intangible investment				Tangible investment ¹	Gross Domestic Product
Total marketing			R&D	Software	Training	Total	Licences	Patents	Other			
1975	8 405	7 335	3 210	2 630	525	970	1 070	540	45	485	32.3	3.8
1976	9 585	8 240	3 555	2 930	645	1 110	1 345	715	45	585	35.7	3.8
1977	10 620	9 290	4 235	3 010	795	1 250	1 330	670	45	615	32.7	3.9
1978	11 645	10 230	4 705	3 165	960	1 400	1 415	730	50	635	32.4	3.9
1979	12 770	11 145	5 095	3 375	1 120	1 555	1 625	845	50	730	33.2	4.0
1980	13 950	12 165	5 500	3 680	1 275	1 710	1 785	970	55	760	35.8	4.1
1981	14 915	12 890	5 690	3 980	1 430	1 790	2 025	1 125	55	845	41.0	4.2
1982	15 985	13 915	6 060	4 215	1 750	1 890	2 070	1 210	55	805	43.2	4.3
1983	17 040	15 030	6 275	4 715	2 075	1 965	2 010	1 120	60	830	42.8	4.5
1984	18 495	16 110	6 565	5 010	2 480	2 055	2 385	1 400	65	920	43.3	4.6
1985	20 725	17 655	6 940	5 760	2 765	2 190	3070	1950	85	1 035	42.4	5.0
1986	21 870	19 325	7 530	6 395	3 110	2 300	2 545	1 475	85	985	40.2	5.1
1987	23 445	20 470	8 055	6 740	3 295	2 380	2 975	1 615	90	1 270	42.7	5.5
1988	24 900	21 690	8 750	7 030	3 450	2 460	3 210	1 900	90	1 220	41.7	5.5
1989*	28 170	23 585	9 585	--	4 470	--	4 585	--	--	--	42.9	5.9
1990*	28 945	24 950	--	--	--	--	3 995	--	--	--	40.3	5.7

1. Source: Dutch National Accounts, gross investment of firms, excl. exploitation of houses.

*. Provisional

NORWAY: INTANGIBLE INVESTMENT IN MANUFACTURING INDUSTRIES, 1986-90¹

5.1 Introduction: why measure intangible investment?

The two Norwegian surveys were undertaken in order to throw light on the ongoing discussion on whether Gross Fixed Capital Formation was a sufficient measure of changes in economic conditions such as production possibilities, activities and the business cycle. More specifically, the survey was intended to provide indicators which could assist in stimulating the restructuring of Norwegian industry in order to reduce the economy's dependency on oil extraction, notably towards "competency-intensive industries" which are believed to have relatively high intangible investment and to be characteristic of very highly developed economies.

5.2 Definition of intangible investment

Intangible investments are the cost of innovative activities **stimulating production and promoting sales**, new activities with a long-term profit horizon. They do not include costs of routine activities. They are divided into four broad categories.

- **R&D** is defined within the context of the OECD *Frascati Manual* (OECD, 1994). R&D is innovative basic research and applied research as well as innovative development: manufacturing new materials, products, services, processes, methods and systems.
- **Market development** is strategic position in markets or innovative vertical and horizontal integration in markets. It includes efforts to improve the infrastructure, market knowledge and goodwill in existing or new distribution channels, market organisations and firms. Accordingly, market development includes net purchases of firms, agencies, licences, patents, certificates, establishing new units and introducing new products, etc. The intangible investment of net acquisition of firms is the difference between the purchase price and the accounting balance sheet value of lasting production and construction assets.
- **Programme and systems development** is innovative development of electronic programmes and systems for operating the unit in a completely new manner. Activities improving the administration and control of the entire organisation, administration and production are to be registered here, as for instance administrative data processing and data-assisted production and construction. Upgrading of standard programmes and systems intended to accomplish routine tasks in the unit are not to be included. Similar activities for R&D purposes are given separately.

- *Competency development* involves innovative development of personnel in all levels of the organisation. It comprises courses in organisational and leadership development, but excludes the training of staff to accomplish routine tasks.
- *Working environment development* encompasses efforts to improve the physical and psychological conditions for employees. Absence caused by lack of well-being and illness can be reduced, thereby increasing productivity. It comprises primarily the health services' **preventive** measures such as physical check-ups and costs for ergonomics, fitness training, sports clubs, leisure cabins, outdoor activities and special initiatives for the internal environment. Activities relating to *curing* illnesses and injuries caused by accidents and working conditions are *not* to be included.

Intangible investment covers expenditures on these activities both executed by the unit internally or purchased externally from consultants who perform them. It does not include acquisition of physical assets for the activities listed above.

Internal intangible investment covers salaries and social welfare costs for the staff, shares of costs for rent, electricity, fuel and office services directly connected to the above-mentioned activities. Estimates of costs for time lost during recruiting and training, for travel, meetings and administrative personnel directly connected to these activities are also to be included.

5.3 The surveys

The Central Bureau of Statistics has undertaken two sample surveys to measure the extent of intangible investments in oil extraction, mining and quarrying and manufacturing for the years 1986-90.

The statistical observation and reporting unit was the kind of activity unit (KAU). The 1989 survey comprised a cut-off sample of units with varying employment limits per industry group plus a random sample of those below these units. In 1987 the sample covered 1 275 kind of activity units gross, 915 net, the latter representing 50 per cent of employment in oil extraction, mining and quarrying and manufacturing. The majority of those surveyed were contacted by telephone and were assisted with their responses.

The results of the surveys were grossed up to allow for the original sample structure and non-response, on the basis of intangible investment per employee, on an industry-by-industry basis and were tested in various ways for coherence and plausibility. The final set of data covers the years 1986-89 with preliminary estimates for 1990.

5.4 Data collection problems

Respondents had difficulty in distinguishing the "investment" component of activities, i.e. the elements of novelty and long-term profit horizon, except in the cases of basic and applied research. Their main problem was to find information which corresponded to the overall concept of intangible investment or to its components in their own accounts. Even where such projects could be identified, respondents had difficulty isolating and excluding related investment in physical capacity.

The Norwegian survey also identified a range of problems in measuring intangible investment activities (notably R&D and marketing) which were undertaken centrally in firms or in branch institutes

financed by members' fees which would be applied by production units elsewhere. These difficulties hindered the regional analysis, which was an important aspect of the study.

The R&D data are believed to be the most accurate as firms were used to participating in regular official surveys. They had some difficulty in excluding fixed capital expenditures.

Market development data are probably the least satisfactory. Although one or two firms had profound market development strategies, the vast majority had no apparent concept of innovations in marketing and hence were unable to distinguish between their investment and routine marketing costs.

The reports of competency, working environment and on programme and systems development also revealed difficulties in separating routine from innovative activities. There was a further minor problem in distinguishing between the performers of R&D and those applying it, in order to avoid double counting.

5.5 Main results

5.5.1 Total

In oil extraction, mining and quarrying and manufacturing, total intangible investments were estimated at NKr 7.5 billion in 1989 or MKr 24 000 per employee. This corresponded to 33 per cent of traditional investment. The survey indicated that intangible investments are more stable over time compared to Gross Fixed Capital Formation, which tends to vary erratically over the business cycle.

5.5.2 Main activities

R&D was the dominant component of intangible investments, with a share of 53 per cent. Market development was the second largest, with 21 per cent of intangible investments.

5.5.3 Breakdown by size of unit

Large units with more than 150 employees had the highest intangible investments: both as a total of NKr 5.5 billion and twice as much as the smallest units per employee, amounting to NKr 34 000 in 1989. The smallest units with less than 70 employees had the lowest intangible investments per employee. However, they were conducting almost a fifth of the total intangible investments, equalling as much as 43 per cent of their traditional investments.

The composition of the large units' intangible investments was distinguished by having the highest share of R&D and the lowest shares of other types of intangible investments. R&D made up 58 per cent and market development 14 per cent of the large units' intangible investments. The case was the opposite for the smallest units, with 42 per cent market development and 32 per cent R&D.

5.5.4 The oil industry

The oil industry's intangible investments amounted to NKr 1.4 billion, or NKr 106 000 per employee in 1989, equivalent to 14 per cent of the traditional investments of this very capital-intensive

industry. They consisted mainly of R&D (63 per cent), competency, programme and systems development.

5.5.5 Total manufacturing

Manufacturing industry undertook NKr 6.5 billion of intangible investments in 1987 and NKr 6.3 billion in 1989. This fall in nominal intangible investments is linked to the fact that the investment consists mainly of costs related to personal and employment fell considerably over the period. **Intangible investment per employee was fairly stable** but showed a slight increase, from NKr 20 300 in 1987 to NKr 21 800 in 1989.

Intangible investment made up 31 and 49 per cent of industrial Gross Fixed Capital Formation in 1987 and 1989, respectively. The considerable increase in this share was mainly due to the major fall in traditional investments during the period.

The composition of the industry's intangible investments changed during the period. The shares of R&D and of competency development fell while the shares of development of market and working environment rose from 1987 to 1989. R&D, however, remained the dominant type of intangible investment, with market development ranking second.

5.5.6 Industrial breakdown

In 1989, as in 1987, the distribution of intangible investments by manufacturing industry displayed great variations. Extensive intangible investments were reported in competency-intensive industries, such as manufacture of electrical apparatus and supplies (SIC 383), machinery (382) and other chemicals (352), referred to henceforth as the electronical, machinery and technical-chemical industries. More than half of intangible investment in manufacturing industry was performed by the competency-industries. They had high intangible investments per employee and differed fundamentally from others by having an especially large share of R&D.

The electronics industry undertook the most intangible investments, with NKr 1.4 billion in 1989. This was equivalent to as much as NKr 79 000 per employee and more than twice the industry's traditional investments. The sample covered 68 per cent of employment in the industry. The 17 largest units, which represented 76 per cent of the employment in their group, dominated the electronics industry, spending as much as NKr 1.1 billion or NKr 103 000 per employee. But even the 57 smallest units which covered 43 per cent, spent almost NKr 30 000 per employee.

The composition of intangible investments in the electronics industry was very unlike the rest of the industries, especially the large units which spent 86 per cent on R&D and not more than 6 per cent on market development. Small units had a similar profile, although they spent barely 67 per cent on R&D and 14 per cent on market development.

Intangible investments in the machinery industry came to NKr 1.1 billion or NKr 30 000 per employee in 1989, well above the industrial average. The sample covered 63 per cent of the employment in the machinery industry in the two surveys.

The technical-chemical industry had the highest intangible investments per employee with NKr 135 000 in 1989, a considerable increase on NKr 78 000 in 1987. Total intangible investments

increased from Nkr 0.5 billion in 1987 to 0.8 billion in 1989. This was more than three times the value of traditional investments, which were somewhat low in 1989. The 24 units in the survey covered 55 per cent of the employment in the industry in 1989.

Within technical-chemical industry, as much as 40 per cent of the intangible investments were market development, Nkr 54 000 per employee in 1989. The composition of intangible investment in this industry was rather atypical considering the high share of 50 per cent R&D.

The small instrument industry (385) spent more than Nkr 75 000 on intangible investments per employee in 1989, mostly for R&D and market development.

The other divisions of manufacturing industry performed less intangible investment per employee. The breakdown between types of intangible investments was generally more even and quite different for the competency-intensive industries, some of which had considerably lower shares of R&D.

The industry divisions with the lowest levels of intangible investment per employee (31-34) had low shares of R&D and high shares of market development. There was a rather high share of market development in the food, beverages, and tobacco industry (31). This was the case especially for the smallest units of this industry, which had as much as 71 per cent market development.

5.6 Concluding remarks

The experience of the Norwegian survey agency suggests that for inquiries of such complexity, it would be more helpful for both respondents and survey staff, if a questionnaire were constructed with more detailed items rather than providing only vague definitions. It would be helpful for example to specify some of the major sub-groups of internal intangible investments in the questionnaire, as for instance: salaries and social welfare costs for staff; shares of costs for rent, electricity, fuel and office services; estimates of costs for lost time recruiting and training, travel, meetings and administrative personnel directly connected to these activities.

As long as it is accountants in the enterprises or units who reply to the questionnaires, it would in addition be very advisable to refer directly to actual account numbers in the business accounting standard.

Given that intangible investments are more stable than traditional investments, the practice of qualified extrapolated estimates and considering the burden of reporting on the firms it is envisaged that such surveys should not be carried out frequently, unless required by special circumstances.

A BROADER CONCEPT OF INVESTMENT EXPERIENCE FROM INQUIRIES ON INTANGIBLE INVESTMENT IN SWEDEN⁶

6.1 Introduction

In 1986, Statistics Sweden started a voluntary pilot study concerning investment in intangible assets. Investment as a concept limited to buildings and machinery was being called into question. There was a growing demand for new information concerning the total strategy of the firm, specially in a society undergoing rapid technology change. This was the reason why the regular investment survey was expanded to include questions about expenditure for R&D, marketing and EDP systems (software not sold with equipment). The primary aim was to throw some light on the ongoing discussion about changes in the structure of investment.

6.2 The surveys

The pilot study was also intended to test firms' capacity and willingness to report this data and to identify problems in collecting such data. Although the pilot study covered a limited number of enterprises, it included the most important ones in Sweden, employing more than one quarter of all employees in manufacturing industry and contributing one-third of turnover.

Given the positive experience of the pilot study, Statistics Sweden decided to enlarge the inquiry and since 1988 the exercise has covered all manufacturing enterprises with more than 500 employees and has been compulsory. Unfortunately, Statistics Sweden has not been able to extend the inquiry. The intention was, and still is, to cover all manufacturing companies in Sweden in a first step, and then to gradually extend the investment survey to all enterprises. Lack of resources in Statistics Sweden has prevented this so far. In regard to topics, it has not been possible to widen the inquiry to include questions about training, education and know-how.

The exercise is still linked to the quarterly investment survey and once a year complementary questions about other investments than investments in fixed capital are included. Along with the questions about intangible investment, figures on leased assets are sought. The problems with partial non-response for the supplementary questions are decreasing. The rate of non-response is less than 2 per cent in the regular investment survey. The rate for the supplementary questions is still somewhat higher and differs between activities and between variables. This higher non-response rate results from the greater difficulties of demarcating investment other than fixed capital formation and on lack of basic data within the enterprise.

6.3 Results from the Swedish surveys

The study undertaken in 1992 showed that intangible investment was of considerable importance. Total intangible investments in 1991 (SKr 38.5 billion) were even higher than material ones

(SKr 24.3 billion). While investments in fixed assets dropped for the second year in succession, intangible investments were stable in fixed prices since 1990.

Between 1990 and 1991 there was a minor decrease in R&D expenditure of 1 per cent in fixed prices.

Marketing costs were also down in 1991 compared to 1990. The fall was about 5 per cent in volume. Industry manufacturing consumer goods had, not unexpectedly, the highest share of the marketing costs.

6.4 Concluding remarks

The concept of intangible investment is still evolving in the light of experience and comments on the survey guidelines from companies involved in the inquiry, some of which contribute to developing the concept. There are also international papers presenting experience and discussing recognition, measurement and disclosure of components in respect to intangible investment. This is an ongoing process that will make data more appropriate and comparable. But it is also necessary to find out if these figures satisfy the needs of different users and what are the information needs of the government for economic or accounting regulation purposes.

Table 6.1 **Total investments in manufacturing by industry 1991¹**
Billion SKr

Industry	Buildings, machinery equipment	R&D	Marketing	EDP systems
Basic industry	3.9	0.8	0.8	0.1
Manufacture of intermediate goods	7.9	3.7	3.0	0.2
Investment goods	8.6	16.1	9.8	0.5
Construction material	0.5	0.1	0.3	0.0
Consumption goods	3.4	0.3	2.8	0.0
Total	24.3	21.0	16.7	0.8

1. Figures refer to activities in Sweden. Investments of foreign subsidiaries are not included.

Table 6.2 **Total investments by manufacturing industry, 1987-91**
Billion SKr

Investment in:	1987	1988	1989	1990	1991
R&D	15.1	15.8	18.3	19.3	21.0
Marketing	14.7	13.7	15.6	15.6	16.7
EDP systems	0.7	0.8	0.9	0.8	0.8
<i>Sub-total</i>	<i>30.5</i>	<i>30.3</i>	<i>34.8</i>	<i>35.7</i>	<i>38.5</i>
Buildings, machinery and equipment	26.2	26.2	30.3	29.9	24.3
Total investment	56.7	56.5	65.1	65.6	62.8
<i>% Intangible</i>	<i>53.8</i>	<i>53.6</i>	<i>53.5</i>	<i>54.4</i>	<i>61.3</i>
<i>% Tangible</i>	<i>46.2</i>	<i>46.4</i>	<i>46.5</i>	<i>45.6</i>	<i>38.7</i>

MEASUREMENT OF INTANGIBLE INVESTMENT BY UNITED KINGDOM FIRMS⁶

7.1. Introduction

This paper outlines work done in the Department of Trade and Industry (DTI) on the measurement of the level of intangible investment by UK firms. It discusses the quality of the component measurements and some of the associated problems.

A company makes an investment in intangibles when it undertakes expenditure which has a long-term pay-off but acquires no physical assets. This paper will concentrate on certain components of intangible investment: research and development (R&D), licensing payments, training, advertising, software and information systems. There are of course other examples of intangible investment such as design, marketing, organisational change and purchase of outside expertise, e.g. management consultancy.

Although the incomplete nature of the data does not permit the construction of a reliable time series for intangible investment as a whole, it is clear that the relative importance of such investment is increasing.

The valuation of intangible assets is also of increasing importance, not least for those service sector companies whose assets are largely intangible. Not only is there goodwill derived from advertising outlays but also R&D has a positive influence on the valuation of a firm. The existence of complementarities between intangible assets, however, makes the valuation of individual components of the assets problematic.

7.2 United Kingdom investment in intangible assets

Government plays an important part in building up a stock of intangible assets in the economy. Apart from providing support to some of the activities in Table 7.1 below, the government, also, among other things:

- a) funds the education system and the science base;
- b) provides a framework of measurement standard, commercial regulation, legislation, health, safety and environmental standards, etc;
- c) provides information on export markets, on technology, and on management practises.

Table 7.1 shows estimated expenditure by UK firms in 1988 on those areas of intangible investment that can be separately identified. Some of the estimates are subject to considerable uncertainty; they should not be quoted as though they were authoritative government estimates. Nevertheless, we believe that they provide a useful indication of relative orders of magnitude. Investment in fixed assets is given for comparison. Identified investment in intangible assets exceeds tangible investment for

manufacturing though it is of a similar order of magnitude. This competitiveness. The reverse is true for the private sector as a whole which reflects the importance of investment in private dwellings.

The following paragraphs summarise the available information in respect of the kinds of intangible investment specified in Table 7.1.

7.3 Research and development

The figures given in Table 7.1 for R&D are derived from the Central Statistical Office's (CSO) annual surveys of R&D conducted in the UK. The CSO statistics of R&D are based on definitions given in the *Frascati Manual*. About 20 per cent of the R&D carried out by businesses is financed by government, of which most is for defence purposes. The surveys of firms classified to production and construction are restricted to those with more than 200 employees. The CSO surveys provide reliable time series for R&D conducted in the United Kingdom. Expenditure on R&D or training may include purchases of fixed capital assets which would also be included in fixed investment. However, in practice the proportion of such expenditure is relatively small.

On the accounting front, more and more UK companies are reporting R&D expenditure in their annual accounts according to rules laid down in Statement of Standard Accounting Practice (SSAP) 13. A league table of R&D expenditure for United Kingdom listed firms is published annually in the United Kingdom R&D Scoreboard.

7.4 Licensing expenditure

The figures given in Table 7.1 for licensing expenditure represent only a part of the expenditure which firms expend on acquiring technology from elsewhere. They are derived from the United Kingdom Balance of Payments statistics and so only include technology licensed from abroad. Secondly, the cost of the actual licence is only part of the cost of acquiring technological information from elsewhere, which may include contacts with customers, suppliers, competitors, colleges, trade and research associations, government, visits abroad, subscriptions to publications, reports and databases. Nonetheless, the United Kingdom Balance of Payments data provide a reliable time series for royalty payments abroad, which stood at £1.385 million in 1991.

7.5 Training

Training is important in human resource development, but no regular study of expenditure on training in United Kingdom industry exists. There was a one-off major study of industrial training conducted by the Training Agency which covered the financial year 1986-87. This study estimated that the total amount spent on training in 1986-87 was £18 billion. Three-fifths of this took place in the private sector, one-third of which was in manufacturing. The personal sector also finances training on its own behalf.

7.6 Advertising, marketing and design

Companies use various strategies to develop and improve the market for their products. In addition to advertising, basic product design and marketing arrangements are also important. In the United Kingdom expenditure on advertising is relatively high as a percentage of GDP. Advertising expenditure

data in the United Kingdom includes the advertising of imported goods. The CSO surveys press advertising and an alternative source is the Advertising Association annual expenditure surveys.

A recent accounting development has been a move by some firms to include brand names on their balance sheets. Although this sets problems for accountants, it does place an identified economic and commercial value on an important area of intangible investment. However accountants, where they are prepared to value intangible assets, seem only willing to do so on the basis of identified acquisition costs.

7.7 Software

The development of computer software consists of an investment in an intangible asset though it may be sold to the user in a tangible form such as a disk or integrated circuit. Development of software takes place in three main areas: in computer service companies or software houses, in so-called systems companies such as computer manufacturers, and in user companies. The available CSO data only cover the first of these, including sales by systems companies of software developed in the computer services industry. Even so, the data as collected needs considerable adjustment to allow for the very large numbers of non-reporting companies. An allowance has also been made in Table 7.1 to exclude software developed for the public sector.

The figure given in Table 7.1 represents software developed by the United Kingdom computer services industry and commerce as a whole. The true investment in software by the latter is almost certainly considerably larger than the table indicates. The omission of user-developed software is of itself a major shortcoming in the data.

Table 7.1. Expenditure on intangible assets as a percentage of value added in the United Kingdom, 1988

	Manufacturing	Private sector
R&D	6.3	2.1 ¹
Training	3.9 ²	3.8 ²
Licensing expenditure	0.7 ³	0.7 ³
Software	0.9 ⁴	0.9 ⁴
Advertising	2.2 ⁵	1.0 ⁵
Total of above	14.0	8.5
Gross domestic fixed capital formation as a % of value added	12.2	23.9

1. Excludes charitable foundations and trusts such as the Welcome Trust.

2. 1987 figure, derived from Training Agency Funding Study.

3. Royalty payments by manufacturing industry, 1986. No separate figure for the private sector.

4. Estimate of private sectors' purchases. No separate figure available for manufacturing.

5. Figures for all advertising in the United Kingdom, i.e. include advertising of imported goods.

7.8 Conclusion

Available data only covers part of the expenditure by UK firms on intangible assets. Some progress is being made on the accounting front to recognise the value of intangible assets such as R&D and goodwill. Identified expenditure by UK manufacturing firms on such assets was in 1988 greater than its gross fixed domestic capital formation.

ANNEX 1. AUSTRIA⁷

A1.1 Extent of intangible investments

Detailed data on intangible investments are only available for the area of research and development. The R&D expenditure of companies is ascertained in the Chamber of Commerce's survey, which is carried out every two years.⁸ In 1993 total expenditure amounted to Sch 17.63 billion, of which the internal company share accounted for 90 per cent (Sch 15.76 billion). The annual growth rate between 1991 and 1993 stood at a recession-led 7.3 per cent under the annual growth rate of the GDP in the same period; the ratio of R&D expenditure to turnover (research coefficient) has, however, continually risen in recent years and reached a level of 3.6 per cent in 1993.

Nevertheless, Austria is, as it always has been, a latecomer in the field of research and development.⁹ Thus, the ratio of R&D investments to GDP even sunk from 1994 to 1995 and at 1.5 per cent clearly stands below the EU average of 2.1 per cent. Also, state subsidies for the support of the economy's R&D requirements, at 5.6 per cent of the research total, are lower than in comparable European countries.¹⁰

In contrast to R&D, there is only very meagre national or international statistical material available on company *further education*. Estimates of the further education expenditure of Austrian companies can be derived from several studies of the Institute for Educational Research in the Economy (*Institut für Bildungsforschung der Wirtschaft*). For 1992 there was a cautiously estimated figure of Sch 10 billion, which includes, in addition to seminar fees, trainers' fees, travel and material costs, the costs for lost working time.

Companies spend about Sch 4 200 per employee on further education, although the further education costs per employee do decrease as the size of the company increases. The relationship between the internal and external share has reversed in recent years. In the mid-1980s further education was still carried out externally, but in 1992 the internal share accounted for about 60 per cent of further costs.

For the area of *market research*, data only exist for the external share (= turnover of the market research institutes). With annual growth rates of approximately 10 per cent, turnover more than doubled from 1987 to 1992 (Sch 820 million compared to Sch 407 million). Austria has a share on the overall European market research market of about 2 per cent: Germany, France and the United Kingdom are in the leading positions with shares of approximately 20 per cent.

In contrast to other intangible investments, the *advertising expenditure* of Austrian companies has to be calculated by using the advertising media. The advertising costs for the classic media (= advertising on television, radio, billboards and in the print media) amounted to approximately Sch 15.5 billion in 1994. This, however, does not represent the complete advertising volume, since the share of the non-classic media is at least as high as that of the classic media and will continue to increase in the coming years. Thus, in disregard of the production costs, the intangible share of advertising

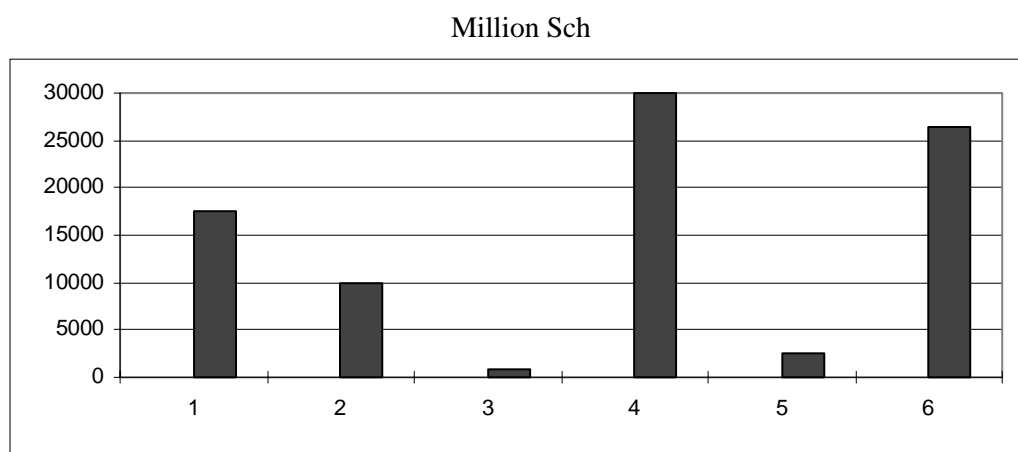
expenditure can be cautiously estimated at Sch 30 billion. Compared to the rest of Europe Austria is, with regard to advertising expenditure, among the bottom third, both on a *per capita* basis and in absolute terms.

Public relations, as the youngest area in marketing, has grown strongly in recent years. The Public Relations Association of Austria (PRVA) estimated PR expenditure at approximately Sch 2.5 billion in 1992. Included in this amount are fees for PR agencies and consultants, which amount to approximately Sch 390 million. That means that 85 per cent of public relations activities are accounted for by the internal share. The general trend is definitely going in the direction of outsourcing, which resulted in a 10-15 per cent growth rate in the PR sector at the beginning of the 1990s.

For the last category of intangible investments -- *software* -- only estimates are available. According to the Working Group on Data Processing and Information Technology, the domestic computer market achieved a turnover of Sch 43.5 billion in 1994; software accounted for Sch 26.4 billion. Compared to 1993, representing a growth rate of 6 per cent; however, in cases where software is acquired by private consumers, calculation is not possible.

In total, the extent of intangible investments is cautiously estimated at Sch 87 billion or approximately 43 per cent of all business investments.

Graph A1.1. Intangible investment: spotlight on Austria



Total: Sch 87 300 million

- 1 Research and development (1993).
- 2 Further education (1992).
- 3 Market research (1992).
- 4 Advertising (1994).
- 5 Public relations (1992).
- 6 Software (1994).

Source: Hammerer/Herzog/Schwarz, 1996.

A1.2 Survey of the electronics and electrical engineering industries

Since only estimates are available for the separate components of intangible investments, IWI decided in 1994 to carry out the first systematic survey of intangible investments in Austria. In view of the fact that this was a pilot study, it was carried out in one area only -- the electronic and electrical engineering industries.

In drawing up the questionnaire, the provisional survey guidelines of the OECD were observed to guarantee international compatibility and comparability with possible future studies in OECD Member countries. However, the concept developed on the basis of evolutionary theories and the taxonomic classification derived from it has left an extensive mark on the investigation.

The survey was carried out in co-operation with the Association of the Electronic and Electrical Engineering Industries (*Fachverband der Elektro- und Elektronikindustrie*), and some 276 members of the Association were questioned. The rate of return of questionnaires was, in view of the new style of questioning and effort required in answering the questions, reasonably satisfactory, at least in the area of medium-sized and large companies (in the group of companies with over 100 employees, a third of the companies, representing 54 per cent of all employees, responded).

With a total turnover of Sch 55.22 billion, the companies questioned spent Sch 5.52 billion (= 10 per cent) on intangible investments. Material investments amounted to just Sch 3.49 billion; thus, intangible investments easily amounted to 1½ times the amount of tangible investments.¹¹ This is mainly due to the extremely high R&D expenditure linked to this industry and cannot easily be generalised. In total, R&D account for 80 per cent of expenditure on intangible investments, education and further education for 5 per cent, advertising and market research for 10 per cent and software for 5 per cent.

There are clear differences between the components when deciding to produce internally or buy from outside. While practically all R&D is carried out internally, outsourcing is dominant in advertising and market research. Also, differences appear according to size of firm. Whereas large firms stand out for their investments in R&D, education and further education, small firms spend more, in percentage terms, on market research. Generally, the hypothesis of the ever increasing importance of intangible investment components was confirmed.

ANNEX 2. EXPENDITURES IN RELATION TO THE KNOWLEDGE-BASED ECONOMY IN TEN OECD-COUNTRIES¹²

A2.1 Concepts and expenditures on the Dutch knowledge base

This section discusses the following questions: What is a useful empirical definition for the knowledge industry, for transfer of know-how, and for education? And which data are available for the Netherlands?

Knowledge industry

Spending on new knowledge should encompass all expenditures needed to launch new products and original ideas which provide welfare. From this abstract definition it follows that the knowledge industry covers more than business-enterprise R&D. This type of R&D is limited to exact and natural sciences of the business laboratories of manufacturing firms according to the official statistics. This way of registration neglects the creativity, know-how and 'experience in the rest of the economy, including the services and the government.

The production of know-how in universities, research institutes, software and marketing also belongs to the knowledge industry. Governments largely finance university research and research institutes carry out research for governments as well as firms. The purchase of standard and tailor-made software delivered by software houses is also an investment in knowledge production, because application of software facilitates the production of new ideas and the supply of products and services which perfectly fit the individual wishes of the clients (e.g. CAD/CAM-software). There are two reasons why expenditure on marketing belongs to the knowledge industry. First, marketing is required to inform potential customers of the launch of new products, which are different from existing ones. Second, marketing departments make R&D more effective as they can reallocate R&D by giving the development and design centres information about the wishes of the clients. Marketing is a broader notion than advertising. In the Netherlands, for example, expenditure on advertising are less than half that on marketing.

Using this empirical definition, the Netherlands spent almost Gld 30 billion (1992) on intangible investment in new know-how, while business enterprise R&D, with Gld 5.5 billion (1992), was a fraction of that amount. On top of that, investment in computer hardware helps generate new ideas rapidly and efficiently. The Netherlands invested Gld 5 billion in computer hardware (Table 1).

Manufacturing industries differ considerably in their R&D and marketing intensities. The electronics, chemicals and specialised machine industries have the best technological opportunities in the exact and natural sciences; therefore their R&D intensities are high (Table 2). It is noteworthy that the electronics industry is a significant developer of original software which is embodied in new products. In the Netherlands, almost a third of all product innovation is regarded as software (CBS/CPB, 1995), concentrated in the electronics industry. Philips Research claims to spend 55 per cent of its R&D on developing new software.¹³

In particular, the food industries spend a lot of money on advertising, especially the beverage, tobacco and snack industries. In these industries sales have stagnated in litre or kilogramme terms; higher welfare is obtained through brand choice. In addition, the detergent industry is a big advertiser (Table 3). Only the detergent industry and the CD-video industry invest heavily in R&D as well as in advertising.

The empirical definition of intangible investment in the knowledge industry of R&D, software and marketing considerably underestimates the real efforts required to bring new products and ideas to market. This definition does not take account of expenditures on, e.g., test production, engineering, almost all product development in the services industries and commercial application of social sciences and humanities (such as management styles, organisation of logistic systems).

Knowledge transfer

What are the costs involved in accessing external information? This question is of current interest for several reasons. First, the deregulation of telecom companies will lead to lower communication prices and more telecom products. Second, the exploitation of Internet facilitates the exchange of ideas and provides cheaper access to existing databases in distant locations. Moreover, Internet may transform some tacit know-how into public knowledge, which has another impact on endogenous growth.

Which indicators are available for the Netherlands? First, payments on foreign patents are registered, but the data sources disagree on the amount. The national statistics show an amount of Gld 2.5 billion, while the OECD indicates Gld 10 billion (Table 1, note 2)! On top of that, Holland invests Gld 2.9 billion in telecom equipment.

The costs of knowledge transfer are in fact higher. For instance, the costs of the institutions, which stimulate the exchange of ideas between universities and enterprises or the transfer of know-how to small firms is not taken into account. The same holds for the organisational costs which are needed to make an R&D alliance a success. Moreover, e.g. the media transfer know-how among their readers, listeners and TV audiences and these costs also should be incorporated.

Education

The concept of education provides the least problems with regard to the total costs involved. OECD countries have measured their expenditures on public education for quite some time. The Netherlands invested Gld 33.5 billion in education in 1992. Of this, public education takes by far the largest part; nevertheless, expenses on private education and education of personnel payed by their employers, are also important.

However, there are implicit costs of education, which are not taken into account: the students could have worked for money instead of going to college. These missed and unregistered earnings mean that the education data underestimate the true efforts of education.

In conclusion, Dutch society pours a lot of money into its knowledge base. In total, spending on intangible investment amounted to over Gld 63 billion (1992), and there are strong indications that this figure by far underestimates the real efforts. In addition, the Netherlands spent Gld 8 billion on tangible investment directly related to its knowledge base.¹⁴

Total intangible investment in the knowledge base amounts to at least half of total tangible investment by enterprises and government together, i.e. machines, constructions, roads and canals. The size of this figure alone indicates that intangible investments should not be neglected from a macroeconomic point of view.

Table A2.1 Investment in the Netherlands, 1992¹

Billion Gld

Intangible		Tangible	
Total	63.4	Total	114.3
<i>Knowledge industry</i>	28.6		
R&D	10.5		
<i>of which:</i>		<i>of which:</i>	
Business enterprises	5.5	Computers	5.0
Universities	2.7		
Research institutes	2.0		
Software	5.3		
Marketing	11.8		
<i>of which:</i>			
Advertising	5.0		
<i>Knowledge transfer</i>			
Foreign patents ²	2.5	Telecommunications	2.9
<i>Human capital</i>			
Education	33.5		
<i>of which:</i>			
Public primary/secondary	19.6		
Public tertiary	5.7		
Private education	2.0		
Business enterprise education	3.4		

1. CBS/CPB, 1995.

2. CBS, *Speur- en Ontwikkelingswerk* 1993, staat 1, p.43. The OECD database indicates Gld 10.8 billion for 1992 (OECD, *Basic Science and Technology Indicators*, 1995, p.299; OECD, *Main Science and Technology Indicators*. There has been a revision in the OECD series since 1982-83.

Table A2. 2 **Top 10 manufacturing industries in R&D in the Netherlands, 1995¹**

	% Share in gross production
1. Electrotechnical industry/computers/scientific instruments	10.5
2. Basic chemicals	6.5
3. Textile machines	3.3
4. Soap, detergents	2.7
5. Paper machines	2.7
6. Agricultural machines	2.3
7. Coaches and trailers	2.1
8. Metal working machinery	1.8
PM Aircraft	n.a
PM Pharmaceuticals	n.a

1. Approximation.

Source: CBS, *Productiestatistieken* (enterprises > 50 employees), Tables on "other operating expenses". The R&D data cover only the operating expenses and outsourced R&D. Therefore, wages of R&D personnel and investment in laboratories and scientific equipment are excluded. Total R&D expenditures are approximated by multiplying the operating expenses by 1/0.4, where 0.4 is the share of operating costs in total business enterprise R&D according to CBS, *Speur- en Ontwikkelingswerk* (enterprises > 50 employees).

Table A2.3 **Top 15 manufacturing industries in advertising in the Netherlands, 1993**

	% Share in gross production
1. Beer	11.4
2. Tobacco	10.9
3. Soap, detergents	10.9
4. Spirits, wine	8.0
5. Publishers	5.3
6. Food (other)	5.1
7. Coffee, tea	5.1
8. Vegetable and food processing	4.8
9. Chocolate	4.1
10. Snacks	3.6
11. CDs, video	3.4
12. Potato-chips	3.3
13. Paint	2.9
14. Ornaments	2.8
15. Sport equipment	2.7

Source: CBS, *Productiestatistieken*, Table on "Other operating expenses". Not listed for reasons of confidentiality: margarine, pet foods, soft drinks.

A2.2 Comparison of knowledge-based expenditures across ten OECD countries

This section compares spending of the United States and nine European countries on their knowledge base during 1985-92.¹⁵ Together these expenditures determine for a large part OECD's economic perspectives in the long run. A cross-country comparison is useful, because their relative spending informs on the comparative advantages of these nations on their way to knowledge-based development. The reason is that the knowledge industry is probably more human capital intensive than tangible production of investment and consumption goods. Moreover, labour is the least mobile factor of production. Therefore, the comparative abundance of educated people determines for a large part the pattern of international trade and relative welfare levels across countries.

In order to guarantee the best possible international comparison, expenses on private education and education by enterprises are left out because data are lacking for most countries. Marketing expenditures are limited to advertising, for the same reason. In order to obtain the best results, data gathered by the OECD are used wherever possible. Nevertheless, the comparability of software and advertising remains doubtful.

Nominal intangible investment is scaled by nominal Gross Domestic Product to improve international comparison, because it corrects for differences in country size and inflation rates.

The countries spend 8-11 per cent of their GDP on intangible investment as defined above. Sweden invested the greatest amounts in 1985 as well as in 1992, while Austria and Germany bring up the rear (Table A2.4).

During 1985-92 Norway was the runner-up, followed by the United States. Some countries had a declining intangible investment to GDP ratio, particularly Germany and Belgium. In Europe there has been a geographical shift in the favour of the Nordic countries, with intangible investment increasing in Sweden, Norway and Denmark. By contrast the old EEC-6 (except France) and the United Kingdom have dropped their expenditures on their knowledge base.

Expenditures on public education dominate intangible investments. Norway leads, with Sweden in second place. Germany performs worst in public education, but it pours high amounts into its business apprentice-system which is not counted as public education (Table A2.5). Consequently, Germany performs better than the data suggest.

In the knowledge industry, Sweden and the United States lead. The United States is the biggest spender, ranking first for business enterprise R&D, advertising and spending on computer hardware. Moreover, it is striking that the Anglo-Saxons (the United States, the United Kingdom) stand out in advertising and the Netherlands in software (Table A2.6). Austria falls behind in university and research institute R&D.

In investment in knowledge transfers, Belgium invests heavily in foreign patents. The position of the Netherlands depends on the data source; it scores third position according to the national statistics, according to the OECD database, however, the Netherlands even outperforms Belgium. Germany is first in telecommunications, probably due to heavy infrastructure investments linked to reunification.

In conclusion, the prospects for economic growth in Germany, the Netherlands, Belgium and the United Kingdom are less promising than for the Nordic countries and the United States.

Table A2.4 **Intangible investment**
% share in GDP

	1985	1992¹
Sweden	10.1	11.0
Norway	8.6	10.8
United States	9.6	10.2
Netherlands	10.0	9.6
Belgium	10.1	9.4
Denmark	8.9	9.4
France	8.9	9.2
United Kingdom	9.3	8.8
Austria	8.2	8.5
Germany	8.9	8.2

1. CBS/CPB (1995).

Table A2.5 **Investment in knowledge transfers and public education, 1992¹**

	Knowledge transfers/ payments on foreign patents	Telecommunications (tangible)	Public education
Sweden	0.05 ³	0.50	6.45
Norway	0.15	0.50	7.30
United States	0.10	0.40	5.15
Netherlands	0.45 ⁴	0.50	5.45
Belgium	1.20	0.35	5.25
Denmark	0.10 ²	0.30	5.95
France	0.20	0.45	5.20
United Kingdom	0.25	0.35	4.60
Austria	0.20	0.70	5.45
Germany	0.50	0.90	3.40

1. CBS/CPB (1995).

2. 1990.

3. 1991.

4. See Table 3, note. This figure is based on national CBS statistics.

Table A2.6 **Investment knowledge industry, 1992'**
% share in GDP

	Intangible			Tangible		
	Total	R&D firms	Universities/ institutes	Advertising	Software ³	Computers ³
Sweden	4.7	2.05	0.95	0.70	1.05	0.70
Norway	3.5	1.05	0.90	0.75	0.85	0.60
United States	5.0	2.05	0.75	1.25	1.00	1.00
Netherlands	3.8	0.95	0.90	0.90	1.10	0.75
Belgium	3.0 ²	1.10	0.55	0.60	0.75	0.65
Denmark	3.3 ²	1.00	0.70	0.80	0.85	0.80
France	3.9	1.50	0.90	0.70	0.80	0.60
United Kingdom	4.0	1.45	0.75	1.10	0.75	0.75
Austria	2.9	0.90	0.65	0.75	0.60	0.55
Germany	4.1	1.70	0.80	0.90	0.65	0.60

1. CBS/CPB (1995).
2. 1990.
3. 1991.

A2.3 Conclusions and suggestions for future work

Economic theories on the knowledge-based economy point to the creation of new knowledge, the transfer of existing know-how and education as the main driving forces behind growth.

Dutch society pours a lot of money into its knowledge base, amounting in total to at least Gld 63 billion in intangible investment in 1992, and there are strong indications that this figure by far underestimates the real effort. In addition the Netherlands spent Gld 8 billion on tangible investment which is directly related to its knowledge base.¹⁴ Total intangible investment in the knowledge base amounts to at least half of total tangible investment by enterprises and government together, like machines, constructions, roads and canals. The size of this figure alone indicates that intangible investment should not be neglected from a macroeconomic point of view.

The expenditures indicate that the prospects for economic growth in Germany, the Netherlands, Belgium and the United Kingdom are less promising than the Nordic countries and the United States.

However, new knowledge, transfer of know-how, and education are not clearly defined from an empirical point of view. An international agreement on the definition of the knowledge industry and the types of spending related to knowledge transfer is essential to assess prospects of economic development, gather data, test and model relations in the knowledge-based economy, and predict patterns of international trade. Furthermore, deflators are necessary to partition nominal development into a volume and a price component. The economic significance is that the efficiency of the knowledge-based economy can be taken into account.

This paper pleads for a broad concept of knowledge. Policy makers should not restrict their instruments to enhancing knowledge production and education, and to stimulating the transfer of know-how in the physics and chemicals fields. Rather, all know-how which contributes to social welfare should be taken into account. As a consequence, data gathering should focus on this broad field.

NOTES

For full references, see Selected Bibliography (Paper 16)

1. The following text is based on *Intangible Investment in Finland 1987* a newsletter issued by the Finnish Central Statistical Office in 1991 (CSO Finland, 1991). Results for 1989 were added by the Secretariat, on the basis of the oral presentation to the 1992 Workshop by the Finnish delegate, Mikael Åkerblom.
2. This note by Benjamin Camus of INSEE and Jean-Paul François of the SESSI was published in a series of articles on intangible investment in *La France des Entreprises*, a special issue of *L'Entreprise*, published in October 1991 (Camus and François, 1991). The paragraph on international comparisons has been omitted.
3. This is based on the author's summary (augmented by the Secretariat) plus selected tables and commentary from Vosselman (1991).
4. This is a shortened version of the paper of the same name presented to the 1992 Workshop by Geir Frengen and Frank Foyn of the Norwegian Central Bureau of Statistics. It also draws on their earlier papers for the Voorburg Group (Frenge, 1989).
5. This reproduces the text of the paper of the same name by Gunila Nockhammar of Statistics Sweden for the 1992 Workshop augmented with data from earlier papers for the Voorburg Group (Koll and Nockhammar, 1989; Nockhammar, 1990).
6. This is the full text of a paper contributed to the 1992 Workshop by the Department of Trade and Industry. One graph, showing internal R&D as a percentage of GDP, has been omitted.
7. Based on Hammerer (1996), paper presented to the 1996 Conference on New S&T Indicators for a Knowledge-based Economy.
8. The results of the last survey (1995) will be published by the Federal Statistical Office in Summer 1996.
9. In addition to the small proportion of military research, the main reason stated is the lack of research-intensive (large) companies.
10. Top is France with 19.3 per cent, followed by the United Kingdom (17.2 per cent) and Italy (16.7 per cent).
11. With a share of over 60 per cent of total investments, the intangible factors have taken first position over the tangible factors.
12. Taken from Minne (1996), paper presented to the 1996 Conference on New S&T Indicators for a Knowledge-based Economy.
13. R&D director Bulthuis in *de Ingenieur*, 17 February 1994.
14. Data on knowledge-based investments in the Netherlands over a long period as well as a breakdown are listed in Minne (1995).
15. See CBS/CPB (1995), for the original annual data.