

# **KEY DATA ON THE DUTCH INFORMATION AND COMMUNICATION CLUSTER**

## **Contribution to the OECD Cluster Focus Group Workshop**

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This paper is the result of an ongoing research interest in the innovativeness and competitiveness of the Dutch Information and Communication cluster. The research reported here is largely based on the ClusterMonitor Multimedia performed for the Dutch Ministry of Economic Affairs (see den Hertog et al.) as well as research performed within the framework of 'RTOs in the Service Economy' (RISE) project performed under the Targetted Socio Economic Research Programme, which also focusses on the Information and Communication cluster. This paper is mostly quantitative and provides background material that is being used in the various projects on the Dutch Information & Communication cluster. An analysis of the multimedia cluster which is partly based on these data is reported elsewhere (den Hertog, Brouwer & Maltha, 2000). The work was performed at Statistics Netherlands 'Center for Research of Economic Microdata (CEREM)'.

\* The views expressed in this paper are those of the authors and do not necessarily reflect the policies of Statistics Netherlands.

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# 1 INTRODUCTION

There is a need in both academic research projects as well as policy-making for dependable information on (chiefly) basic characteristics, functioning (largely innovation related items) and performance of the Information and Communication Cluster. This paper intends to meet this need. With a view to the limited amount of time available, we chose for a paper in the form of a 'book of tables' and concentrate on the actual tables and their interpretation. The objective of this paper can be formulated as follows:

- to bring together a number of tables that provide an insight into the characteristics , functioning (including innovation style characteristics) and performance of the Information and Communication Cluster, and to compare them with the total scores for all businesses in the Netherlands<sup>1</sup>;
- to present a preliminary interpretation, item by item, of the tables to be generated (interpretation guide).

For these key figures we decided to make use of the R&D, innovation and regular production data collected by the CBS and those of the so-called microlab (CEREM) which – under certain terms and conditions – are accessible to outside researchers. These are not only reliable sources, time series will in time become available for both R&D and especially innovation data<sup>2</sup> which will make more dynamic analyses ('over the course of time') possible. The data have been broken down mostly into four sub-clusters, namely: ICT Hardware; IT Services; Telecom services and ICT Content. See annex 2 for the precise breakdown<sup>3</sup> of the four sub-clusters. Also included is the category 'Other Sectors', plus the total of all sectors together (Industry, Services and Others). Most of the tables – in addition to the absolute figures (e.g. the number of collaborating businesses) – present the data in three different ways in relative terms, i.e.: a percentage in respect of all businesses (whether or not they are engaged in R&D activity or are innovative); a percentage in respect of all innovative businesses<sup>4</sup>, and a percentage in respect of all businesses engaged in R&D activities.

As the most extensive data gathering was performed for the ClusterMonitor study performed for the Dutch Ministry of Affairs we will organize the material around the relationmodel used for this study and produced in figure 1 below. This model has been used as the basis for collecting both qualitative (see Den Hertog et al., 2000) and quantitative data. The relation model, and the nine dimensions set out therein, offer an initial stepping stone to better describe the basic characteristics, the functioning and the performance of the cluster. The main objection is that the data – in addition to the fact that they can be out-of-date for a cluster like multimedia – hardly covers the multimedia activity found at the core of the cluster outlined below. This is not only because it frequently concerns young, fast-growing businesses, but also because the statisticians do not have the correct classification to incorporate the businesses referred to in the regular statistics. The tables are more likely to give an insight into the activities in the broader Information and Communications cluster, of which the multimedia cluster is a sub-set.

Following in the footsteps of the CBS, a differentiation is drawn between four sub-clusters, namely: ICT hardware, telecommunications services, IT services, and content.

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<sup>1</sup> Only those businesses with more than ten people on their payroll.

<sup>2</sup> Possibilities and limitations of especially the innovation related data are given in annex 1.

<sup>3</sup> This breakdown is comparable with the one used in various CBS publications, see e.g. CBS, 1999.

<sup>4</sup> Innovative businesses are businesses that market products in 1994-1996 or started to use production processes which were either better in the technological sense or were new (technologically) to the business.

The following indicators are covered:

#### **Basic characteristics IC cluster**

- The number of (innovative) businesses;
- Size structure;
- Level of concentration;
- Firms with government subsidies for innovation;
- Importance of foreign firms;
- National and International R&D cooperation;
- Foreign Direct Investments;

#### **Functioning IC cluster**

- Number of new firms;
- Ratio investments/depreciation;
- Innovation expenditure
- R&D<sup>5</sup> expenditure;
- R&D man-years;
- R&D intensity;
- R&D formalisation / permanent and incidental R&D;
- Usage of sources of information for the purpose of innovation;
- R&D outsourcing;
- Internal / external R&D networks;
- Public / private R&D collaboration;

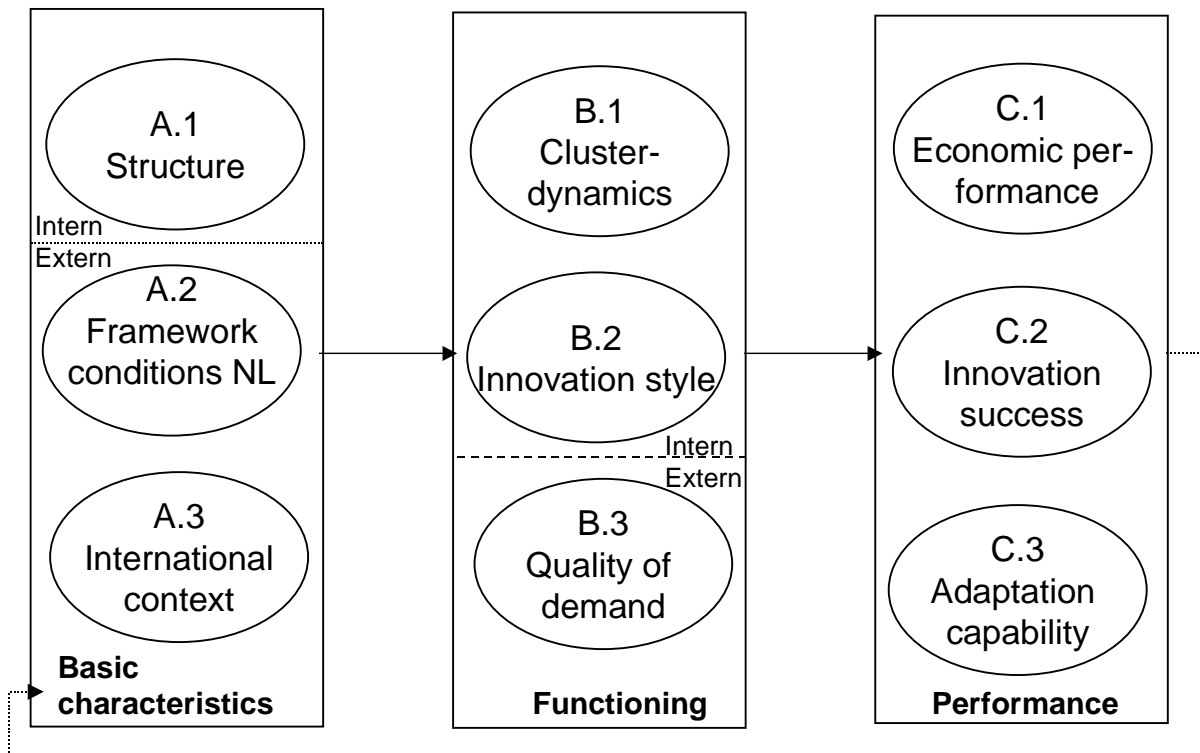
#### **Performance IC cluster**

- Turnover and growth in turnover;
- Value added and growth value added;
- Export and export growth;
- Number of employees;
- Firms with improved competitiveness (through technological innovations);
- Turnover from products that are either new to the firm or new to the branch;
- Non-technological innovations.

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<sup>5</sup> The CBS uses two definitions for determining whether a business is or is not engaged in R&D activities. The so-called 'hard' definition and a 'mild' version. The mild definition relates to all R&D mentioned in the innovation survey. This is referred to as businesses with 'expenditure on internal research'. The hard definition relates to the R&D figure that results from applying a number of selection criteria to businesses with expenditure for internal research. These figures are referred to as R&D expenditure on one's own personnel. The selection criterion for industry is as follows: businesses with products which are new to the market or businesses that have been involved in R&D activities over a period of ten working years. The selection criterion for those businesses that had responded to previous R&D surveys was less critical: they must have been engaged in R&D activity for at least one year. For the services sector no questions were asked relating to products new to the market. For this sector the ruling was adhered to that a business must have been engaged in R&D activity for at least ten years. An exception was made for a few knowledge-intensive business groups: commercial mediation; telecommunication; computer services and information technology businesses; architects offices and engineering firms, and environmental services. All R&D businesses in these groups with one or more working years in R&D are included.

Figure 1: Relationmodel as used in the ClusterMonitor study



In reporting the data we will follow the numbering of the dimensions included in figure 1. It should be noted that for some of the dimensions e.g. quality of demand, framework conditions or adaptation capability none or hardly any indicators are available.

## 2 KEY DATA ON THE INFORMATION AND COMMUNICATION CLUSTER

The tables for those indicators referred to in section 1 on the Dutch information and communication cluster are given in the following. In certain cases, several indicators are included in some of the tables. Following every table is a guide to interpreting the table, plus several noteworthy outcomes. All major firms are included unless specified otherwise.

### 2.1 KEY DATA ON 'BASIC CHARACTERISTICS' OF FIRMS IN THE DUTCH IC CLUSTER

*Table A.1.1 Total number of businesses, innovative businesses and businesses engaged in R&D activity according to sub-cluster in the Netherlands for 1996*

	Total number	Number innovative firms	Number of firms with R&D-activities	% innovative firms	% firms with R&D activities
ICT Hardware	276	210	170	76%	62%
Telecom Services*	664	481	377	83%	63%
IT Services*				72%	56%
Content	1476	672	242	46%	16%
Other sectors	44517	15831	8417	36%	19%
<b>Total</b>	<b>46933</b>	<b>17193</b>	<b>9206</b>	<b>37%</b>	<b>20%</b>

\* Numbers for Telecom Services and IT services are taken together  
Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: There are 276 businesses with more than 10 workers in the ICT Hardware sub-cluster, 210 of which are innovative (76% of the total) and of which 170 are engaged in R&D activity (62% of the total).
- Businesses in the Information and Communication cluster – with the exception of the Content sub-cluster – are on average twice as innovative and perform three times more R&D when compared with all businesses in the Netherlands. An average of three out of four businesses in the ICT Hardware, Telecom Services and IT Services sub-clusters may be regarded as innovative businesses. The total number of innovative businesses and businesses engaged in R&D in the Content sub-cluster is nearer to the average.

*Table A.1.2 Percentage of businesses by size according to sub-cluster in the Netherlands for 1996*

	10-19 employees	20-49 employees	50-99 employees	100-199 employees	200-499 employees	500 and more employees	Total
ICT Hardware	43%	26%	16%	7%	5%	3%	100%
Telecom Services	51%	17%	20%	3%	6%	3%	100%
IT Services	50%	29%	12%	3%	4%	2%	100%
Content	51%	32%	9%	4%	2%	1%	100%
Other sectors	50%	33%	10%	4%	2%	1%	100%
<b>Total</b>	<b>50%</b>	<b>32%</b>	<b>10%</b>	<b>4%</b>	<b>2%</b>	<b>1%</b>	<b>100%</b>

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: 43% of all businesses in the ICT Hardware sub-cluster has a workforce of 10 to 20 employees. All rows add up to 100%.
- In the IC cluster it is mainly in the ICT Hardware and Telecom Services sub-clusters (in this case with the exception of businesses with 100-199 workers) that relatively more businesses are to be found in the size category of 50 workers upwards compared with all businesses. The size category structure of the Content sub-cluster is comparable with the average pattern.

*Table A.1.3 Concentrationratio(C-10) of the subclusters in the Netherlands*

	CONCENTRATION RATIO	
	Based on turnover	Based on number of employees
ICT Hardware	46,0%	41,4%
Telecom & IT services	69,3%	55,8%
Content	24,7%	13,1%
Total cluster	43,6%	26,7%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: 46% of the turnover ICT hardware sub-cluster is realised in the 10 largest firms. In the ICT hardware sub-cluster 41,4 % of all employees employed in the ICT sub-cluster are employed by one of the 10 largest ICT hardware firms.
- Noteworthy is the fact that due to the larger number of smaller firms concentration ratio's in the content sub-cluster are considerably lower. Further the differences between concentration ratio based on number of employees and concentration ratio's on turnover, i.e. the latter are considerably higher, indicate that turnover per employee in the top-10 firms are considerably higher compared to the other firms in the specific sub-cluster. This is most clear for the content sub-cluster.

*Table A.2.1 Businesses that received state grants in the Netherlands for 1996*

	Number of firms	As a % of all firms	As a % of all innovative firms
ICT Hardware	140	51%	67%
Telecom Services & IT Services	70	10%	14%
Content	43	3%	6%
Other sectors	3994	9%	25%
Total	4245	9%	25%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: 140 ICT Hardware businesses received financial support from the government within the framework of various technology instruments<sup>6</sup>.
- It can be stated that an above average number of businesses in the IC cluster – with the exception of the Content sub-cluster – made use of the various innovation policy instruments. If we look at the group of innovation businesses alone, then this observation applies to businesses in the ICT Hardware sub-cluster only.

<sup>6</sup> Such as WvA/S&O, PBTS, TOK, KIM, T&U, etc., see CBS, Kennis en Economie, pp. 76-77.

Table A.3.1: Share export in turnover in the Netherlands for 1997

Subclusters	Total net turnover in Dfl. mln. (only manufacturing)	Exports 1997 in Dfl. mln. (only manufacturing)	ratio export and turnover (only manufacturing)
ICT Hardware	19.660	15.063	76,6%
Telecom services	n.a.	n.a.	n.a.
IT services	n.a.	n.a.	n.a.
Content (incomplete)	17.902	1.998	11,2%
Total Cluster	37.562	17.061	45,4%
Total	330.472	168.701	51,0%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: 76,6% of turnover is exported in the ICT hardware subcluster
- This indicator suffers from the fact that data are only available for manufacturing industries. What can be learned is that the ICT hardware sub-cluster has a high export orientation. This is not only due to the position of Philips, but can also be explained by the fact that quite a number of European distribution centres of ICT hardware firms are located in the Netherlands.

A.3.2. Relative importance of foreign firms in the Dutch Information and communication cluster in the Netherlands for 1996

	% foreign firms (= Number of firms with headquarters abroad)	R&D of foreign firms as a % of all R&D manyears in NL	% employees of foreign firms as a % of employees in NL
ICT-hardware	13,6%	22,2%	17,7%
Telecom services	12,3%	4,3%	1,6%
IT service	27,1%	12,6%	27,9%
Content	5,6%	5,0%	7,9%
Total Cluster	8,6%	19,7%	14,7%
Total	7,7%	23,4%	16,0%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: in the IT services sub-cluster 27,1% of the total number of firms have their headquarters abroad. These firms are responsible 12,6% of all R&D in this particular sub-cluster and account for 27,9% of all employees in the IT services sub-cluster.
- Most remarkable is possibly the fact that in the ICT hardware and telecom sub-clusters 'foreign firms' are relatively more R&D intensive compared to the Dutch firms, at least they employ more R&D personnel than could be expected if number of employees are considered. For the IT services and content sub-clusters the opposite is found.

*Table A.3.3 Percentage of national and international R&D networks according to sub-cluster in the Netherlands for the year 1996*

	Only national	Only international	National and international	None	Total
As a % of all firms					
ICT hardware	12%	5%	9%	74%	100%
Telecom services	15%	14%	17%	54%	100%
IT services	11%	2%	13%	74%	100%
Content	3%	1%	1%	95%	100%
Other sectors	5%	1%	2%	91%	100%
Total	5%	1%	2%	91%	100%
As a % of all innovative firms					
ICT hardware	15%	7%	12%	65%	100%
Telecom services	18%	16%	20%	46%	100%
IT services	15%	3%	18%	64%	100%
Content	6%	2%	2%	90%	100%
Other sectors	15%	3%	6%	76%	100%
Total	15%	3%	7%	76%	100%
As a % of all firms with R&D activities					
ICT hardware	19%	9%	15%	57%	100%
Telecom services	23%	22%	27%	28%	100%
IT services	19%	4%	23%	54%	100%
Content	16%	6%	6%	72%	100%
Other sectors	28%	5%	12%	54%	100%
Total	28%	5%	12%	55%	100%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: of all businesses in content sub-cluster, 3% has a national R&D network only, 1% only an international R&D network and 1% both. The remaining 95% has no R&D network at all. All rows add up to 100%.
- The R&D networks of businesses in the Telecom Services sub-cluster, and to a lesser extent also those businesses in the ICT Hardware and IT Services sub-clusters, are more often internationally oriented than businesses in the content sub-cluster or other sectors. This confirms the image of a strongly internationalised cluster in which innovation and R&D are also very much internationally determined. This strong international orientation is apparent in the telecom sub-cluster in particular. In line with the emergence of a relatively greater number of larger businesses it is only logical that we see more international R&D networks.

*A.3.4. Foreign Direct Investments (FDI) in the Dutch Information - & Communication cluster in the Netherlands for 1996*

Subclusters	FDI (inward)	FDI (outward)	ratio inward/ outward FDI
ICT Hardware	1155	4.548	3,94
Telecom services	547	1.047	1,91
IT services	567	1.341	2,37
Content	458	3.833	8,37
Total Cluster	2727	10.769	3,95
<b>Total</b>	<b>73.038</b>	<b>145.620</b>	<b>1,99</b>

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: outward FDI in the ICT hardware sub-cluster is almost four times as high as inward FDI in the same sub-cluster.
- This figure gives a first impression of the degree to which the IC cluster is internationalized. Problematic is the fact that in the table only figures for 1996 are given as FDI can strongly fluctuate due to one or a few large takeovers. Nevertheless it can be noted that in all four sub-clusters outward investments exceed inward investments. It is well known that the high ratio for the content sub-cluster is explained mostly by a series of big acquisitions of the major publishers (Elsevier, Wolters Kluwer, VNU). More recently the entertainment industry (e.g. Endemol) and AV industry (e.g. NOB) are operating at an international scale as well. Figures over 1999 indicate that more than half of 85 new foreign firms that invest in the Netherlands are ICT firms and created in 1999 2750 new ICT jobs. Especially American ICT (mainly Internet related) firms are interested in particular to the Amsterdam region. Not only because of the high quality infrastructure, but also because a large number of other (competing) ICT firms are located here (Telegraaf, 1/02/2000).

## **2.2 KEY DATA ON 'FUNCTIONING' OF FIRMS IN THE DUTCH IC CLUSTER**

### *B.1.1. Share newly established firms over the period 1992-1997 in the Netherlands*

	% firms established between 1992-1997
ICT Hardware	9,3%
Telecom services	47,1%
IT services	18,4%
Content	7,8%
Total Cluster	11,3%
<b>Total</b>	<b>9,7%</b>

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: at the end of 1997 nearly half of the number of firms in the telecom services subcluster were established over the period 1992-1997.

- The number of newly established firms over the preceding years is a simple indication for the dynamics of a (sub-)cluster. It can be noticed from the table that the number of new telecom service firms (liberalisation of telecom markets!) and IT service firms were expanding rapidly over the period 1992-1997. ICT hardware and content sub-clusters score below average.

*B.1.2. Investments in fixed assets and depreciation for the Dutch IC cluster in 1997*

Subclusters	Total investments in fixed assets	total depreciation	ratio investments in fixed assets and depreciation
	in mln	in mln	
ICT Hardware	1146	906	1,26
Telecom services	4590	3288	1,40
IT services	465	491	0,95
Content	1159	979	1,18
Total Cluster	7360	5664	1,30
Total	61793	41697	1,48

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: in the IC cluster investments in fixed assets amounted to Dfl. 7.360 million in 1997, while total depreciation amounted to Dfl. 5.664 million. This indicates a growing trend in terms of investments in fixed assets, illustrated by a ratio of 1,40.
- From the table it appears that telecom service firms are investing heavily in fixed assets. Almost 12% of investment of all private firms in the Netherlands are made by firms that are part of the IC cluster. However, the ratio for the all private firms indicate that investments in fixed assets exceeds total depreciation even further in the total of other sectors. This could imply that investments in the IC cluster stay behind in relative terms or that depreciations are relatively higher. For 1997 depreciation exceeded investments in fixed assets in IT services, although this typically is a cluster in which investments in intangible assets such as human resources are relatively more important.

Table B.2.1 Total and average innovation expenditure for the Dutch IC cluster for the year 1996

Expenditures	ICT Hardware	Telecom Services	IT Services	Content	Other sectors	Total
Total expenditures of all firms						
	In Dfl. mln.	In Dfl. mln.	In Dfl. mln.	In Dfl. mln.	In Dfl. mln.	In Dfl. mln.
Purchase of equipment	546	299	186	376	7551	8959
Own R&D	2110	131	188	30	5572	8031
Outsourced R&D	300	3	16	8	1220	1548
Industrial design	60	5	37	7	884	994
Licences, advice	9	182	85	2	551	829
Marketing	111	6	59	16	871	1062
Training	28	5	146	13	1170	1361
Total innovation expenditures	3164	630	717	453	17820	22783
Average expenditures of all all firms						
	In k. Dfl.	In k. Dfl.	In k. Dfl.	In k. Dfl.	In k. Dfl.	In k. Dfl.
Purchase of equipment	1978	8554	295	255	170	191
Own R&D	7643	3733	299	20	125	171
Outsourced R&D	1088	78	25	6	27	33
Industrial design	218	135	60	5	20	21
Licences, advice	32	5187	135	2	12	18
Marketing	403	170	93	11	20	23
Training	101	131	233	9	26	29
Total innovation expenditures	11462	17988	1140	307	400	485
Average expenditures of all innovative firms						
	In k. Dfl.	In k. Dfl.	In k. Dfl.	In k. Dfl.	In k. Dfl.	In k. Dfl.
Purchase of equipment	2600	10323	411	560	477	521
Own R&D	10045	4505	416	45	352	467
Outsourced R&D	1429	94	35	12	77	90
Industrial design	286	163	83	11	56	58
Licences, advice	42	6261	187	3	35	48
Marketing	529	205	130	23	55	62
Training	133	158	324	19	74	79
Total innovation expenditures	15065	21709	1586	674	1126	1325

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide<sup>7</sup>: the higher third of the table indicates absolute innovation expenditures of firms in the four IC sub-clusters. Innovation expenditures in the IC cluster in 1996 amounted to almost Dfl. 5 billion (Dfl. 22.783 – Dfl 17.820 million), which is more than 20 % of all innovation expenditures by firms! The rest of the table provides a picture of innovation expenditures of an average firm and an average innovative firm in the various subclusters. It is important to note that one or a few firms can influence this picture considerably.
- This table shows that the main aspect of innovation efforts in each sub-cluster can differ considerably. A relatively large component of the innovation expenditure of businesses in

<sup>7</sup> Own research refers to the ‘mild’ definition of R&D, see footnote 5 and CBS, 1999, p. 211.

the ICT Hardware cluster is spent on internal research. In the Telecom Services sub-cluster the knowledge embedded in capital goods is again relatively important and in the IT Services sub-cluster a substantial part of the innovation expenditure is spent on training personnel. Seeing that Philips is included as a whole in the sub-cluster ICT Hardware, this will result in an overestimation of several categories given that not all Philips' activities belong in this sub-cluster.

- If we take a look at the average expenditure of all businesses then we see that the expenditure in the IC cluster, less that in the content sub-cluster, is on average higher than in Other Sectors. This indicates a considerable innovation effort over the whole breadth, even though it must be taken into account that this can partly be explained by a differing size structure. If we look at the innovative businesses only, then we see that IT Services show a more general pattern, even though the expenditure on industrial design, licences/advice, marketing and training in particular are above average. It is quite remarkable to see that virtually all the innovation expenditures in the Content sub-cluster are lower than the average expenditure when compared with the average expenditure of all businesses as well as the average expenditure in innovative businesses.

*Table B.2.2 R&D expenditure and man-years on in-house personnel and R&D expenditure as a percentage of GDP for the Dutch IC cluster for the year 1996*

	R&D expenditures (own personnel) in Dfl. Mln.	R&D manyears (own personnel)	R&D intensity <sup>1)</sup>
ICT Hardware	2090	8900	27.0%
Telecom Services	130	750	1.3%
IT Services	180	1240	2.5%
Content	10	150	0.1%
Other sectors	4930	28440	0.8%
<b>Total</b>	<b>7360</b>	<b>39500</b>	<b>1.1%</b>

Source: ClusterMonitor Database CBS/Diallogic, 2000

1) R&D intensity is calculated by dividing the R&D expenditure of the businesses by the GDP. The R&D intensity for the total is consequently exclusive of universities in the Netherlands (0.60% of GDP) and the research institutes (0.39% of GDP). The total for the Netherlands is the sum of 1.1%, 0.60% and 0.39% and therefore equals 2.09%.

- Interpretation guide: In the IT services sub-cluster Dfl 180 mln. was spent in 1996 on own R&D personnel. The number of own R&D personnel amounted to 1240. The R&D intensity (R&D expenditure divided by value added) of the same sub-clusters is 2,5% . The 'hard definition' was used for R&D here (see footnote 5). The R&D efforts for the ICT Hardware sub-cluster is somewhat overestimated because Philips was accounted for the full 100% in this sub-sector.
- Of note is especially the R&D intensity in the ICT Hardware sub-cluster, the IT Services sub-cluster, and to a lesser extent the Telecom Services cluster. Because of Philips, the R&D intensity of the sub-cluster ICT Hardware is very high. The Content sub-cluster scores very low here. The fact that R&D is carried out only occasionally was already indicative of this.

Table B.2.3 The formalisation of R&D in the Dutch IC cluster for the year 1996

	% of firms with permanent R&D	% of firms with R&D on an incidental basis	Firms without R&D-activities	Total
As a % of all firms				
ICT Hardware	50%	12%	38%	100%
Telecom Services	49%	14%	37%	100%
IT Services	46%	11%	44%	100%
Content	7%	10%	84%	100%
Other sectors	11%	8%	81%	100%
Total	12%	8%	80%	100%
As a % of all innovative firms				
	% of firms with permanent R&D	% of firms with R&D on an incidental basis	Firms without R&D-activities	Total
ICT Hardware	66%	15%	19%	100%
Telecom Services	59%	17%	24%	100%
IT Services	64%	15%	21%	100%
Content	15%	21%	64%	100%
Other sectors	32%	22%	47%	100%
Total	32%	21%	46%	100%
As a % of all firms with R&D activities				
	% of firms with permanent R&D	% of firms with R&D on an incidental basis	Firms without R&D-activities	Total
ICT Hardware	82%	19%	0%	101%
Telecom Services	77%	23%	0%	100%
IT Services	81%	19%	0%	100%
Content	41%	59%	0%	100%
Other sectors	59%	41%	0%	100%
Total	60%	40%	0%	100%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: 49% of all telecommunication services businesses are engaged permanently in R&D activities, 14% carry out R&D occasionally, and the remaining 37% pursue no R&D activities whatever. These data are also given in the table as percentages of all innovative businesses and percentages of businesses that carry out R&D respectively. For instance: 77% of businesses in the Telecom Services sub-cluster that carry out R&D are engaged in R&D on a permanent basis. All rows add up to 100%.
- As was noted in table A.1.1 already, businesses in the information and communication cluster are generally more innovative and more involved in R&D activities. Innovative businesses in the IC cluster – with the exception of the Content sub-cluster – are more likely to be engaged in R&D on a permanent basis than those in the other sectors. The R&D carried out in those businesses engaged in R&D in the three mentioned sub-clusters is likely to be on a more permanent basis (obviously, considering the overlap of the two subsets).

Table B.2.4 Usage of information sources for the Dutch IC cluster for the year 1996 in % of all innovative businesses

	ICT Hardware	Telecom services	IT services	Content	Total Cluster	Total
<b>Innovation ideas within own firm or within same concern</b>						
Source not used	53%	34%	43%	62%	54%	54%
Somewhat important	9%	0%	9%	10%	9%	10%
Important/very important	38%	66%	48%	28%	37%	36%
<b>Innovative ideas through clients</b>						
Source not used	14%	24%	8%	41%	25%	32%
Somewhat important	22%	28%	24%	31%	27%	25%
Important/very important	63%	48%	68%	29%	48%	43%
<b>Analysis of competing products</b>						
Source not used	36%	20%	30%	37%	34%	39%
Somewhat important	28%	41%	32%	31%	31%	30%
Important/very important	36%	40%	38%	32%	35%	31%
<b>Consultancy and research firms in the market sector</b>						
Source not used	65%	25%	59%	71%	65%	64%
Somewhat important	25%	42%	20%	16%	19%	21%
Important/very important	9%	33%	22%	13%	16%	15%
<b>(Semi)-governmental research institutes</b>						
Source not used	59%	63%	73%	85%	77%	73%
Somewhat important	20%	23%	17%	10%	14%	16%
Important/very important	20%	14%	10%	4%	9%	11%
<b>Universities, including allied institutes</b>						
Source not used	61%	71%	63%	91%	76%	81%
Somewhat important	21%	25%	23%	5%	14%	12%
Important/very important	19%	3%	14%	4%	10%	7%
<b>Innovationcentres; regional governmental advisory agencies for innovation</b>						
Source not used	64%	77%	83%	89%	83%	82%
Somewhat important	18%	17%	15%	6%	11%	12%
Important/very important	13%	6%	0%	5%	6%	6%

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**Innovation ideas through analysing patents**

Source not used	77%	77%	91%	97%	92%	88%
Somewhat important	16%	20%	6%	2%	6%	8%
Important/very important	7%	3%	3%	1%	2%	4%

**Computer-info; innovation ideas through databases**

Source not used	62%	26%	41%	70%	58%	73%
Somewhat important	28%	47%	36%	20%	27%	16%
Important/very important	10%	27%	23%	10%	15%	11%

**Innovation ideas through trade journals and trade exhibitions**

Source not used	27%	20%	13%	25%	21%	28%
Somewhat important	45%	35%	39%	45%	43%	51%
Important/very important	28%	44%	48%	30%	36%	21%

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Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: in the ICT Hardware sub-cluster we see that 38% of the innovative businesses rate innovation ideas from within the own firm or within same concern as 'important' to 'very important'. It should be noted that the figures presented in this table are given as a comparison with all innovative businesses. Each column ( information source) adds up to 100%.
- Without discussing the table in full we would like to mention a number of significant outcomes. First of all it should be pointed out that innovative ideas generated in one's own business or own concern in the sub-clusters ICT Hardware, Telecom Services and IT Services are rated as 'important' relatively more often than in the Content sub-cluster and Other Sectors. Innovative ideas coming from clients are relatively 'very important' in the IC cluster – again with the exception of the Content cluster. An indication that to a significant extent ICT is also a source of innovation for users, and that a large number of the (innovative) businesses innovate together with their clients. On average, the Telecom services and IT services sub-clusters are more likely to state that consultancy firms and research firms in the market sector are a major source of information. If we take a look at the (semi) public research institutes and universities, then it is evident that innovative Content businesses are less likely to indicate these two categories as sources of information. Furthermore, it would seem that the ICT Hardware sub-cluster see these sources relatively more often as 'important'. The fact that businesses in the Telecom Services sub-cluster do not seem to use the universities (including their affiliated institutes) as sources of information is quite remarkable. The innovation centres are seen more often as a relevant source of information by the businesses in the ICT hardware sub-cluster. As far as the other sources of information are concerned, it is remarkable to see that the IT services give 'trade journals and trade exhibitions' as a major source.

*Table B.2.5 Businesses that outsource R&D according to sub-cluster for the year 1996 by number and in guilders*

	Number of firms with R&D outsourcing	As a % of all firms	As a % of all innovative firms	As a % of all firms with R&D activities
ICT Hardware	71	26%	34%	42%
Telecom Services 1) & IT Services	119	18%	25%	32%
Content	123	8%	18%	51%
Other sectors	4378	10%	28%	52%
<b>Total</b>	<b>4691</b>	<b>10%</b>	<b>27%</b>	<b>51%</b>

	Total outsourced in Dfl. mln.	Average for all firms in k. Dfl.	Average for all innovative firms in k. Dfl.	Average for all firms with R&D activities in k. Dfl.
ICT Hardware	300	1087	1429	1765
Telecom Services 1) & IT Services	15	28	39	48
Content	8	5	12	34
Other sectors	1220	27	77	144
<b>Total</b>	<b>1547</b>	<b>32</b>	<b>90</b>	<b>168</b>

Source: ClusterMonitor Database CBS/Dialogic, 2000

1) Excluding KPN.

- Interpretation guide: there are 71 businesses in the ICT Hardware sector that outsource their R&D. This is 26% of all ICT Hardware businesses, 34% of all innovative businesses and 42% of all businesses engaged in R&D activities. A total of NLG 300 million is outsourced in this sub-cluster. On average this is more than NLG 1 million per business in this sub-cluster, and almost NLG 1.8 million for all businesses engaged in R&D. Because of Philips, the amounts are relative and certainly much higher than in the other sub-clusters.
- Of note is that, when compared with all businesses and in comparison with all innovative businesses, the ICT Hardware and IT Services & Telecom Services sub-clusters on average outsource their R&D more often. If we look at the score compared with all businesses engaged in R&D activities then we see that these two sub-clusters, outsource their R&D relatively less often.
- Measured in accordance with the average of outsourced R&D, in the IC cluster only the ICT Hardware sub-cluster outsources its R&D above the average when compared to all three populations.
- This confirms the view that when R&D is outsourced in this sub-cluster it generally involves more substantial sums. This is partly related to the size structure.

Table B.2.6 Usage of internal and external R&D networks for the Dutch IC cluster for the year 1996

	Only internal	Only external	Internal and external	None	Total
As a % of all firms					
ICT Hardware	1%	8%	17%	74%	100%
Telecom Services	0%	24%	22%	54%	100%
IT Services	4%	4%	18%	74%	100%
Content	1%	1%	3%	95%	100%
Other sectors	1%	2%	6%	91%	100%
Total	1%	2%	6%	91%	100%
as a % of all innovative firms					
ICT Hardware	1%	11%	23%	65%	100%
Telecom Services	0%	28%	26%	46%	100%
IT Services	5%	6%	25%	64%	100%
Content	2%	1%	7%	90%	100%
Other sectors	2%	6%	16%	76%	100%
Total	3%	6%	16%	76%	100%
as a % of firms with R&D activities					
ICT Hardware	1%	13%	28%	57%	100%
Telecom Services	0%	37%	35%	28%	100%
IT Services	6%	7%	32%	54%	100%
Content	5%	4%	19%	72%	100%
Other sectors	5%	11%	30%	54%	100%
Total	5%	11%	29%	55%	100%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: ‘internal collaboration’ refers to collaboration with a business that is part of the same group of companies (e.g. a subsidiary company). ‘External collaboration’ refers to collaboration with other actors such as clients, suppliers, competitors, consultancies, research institutes or universities (CBS, *Kennis en Economie*, 1998, p 219 question 4). 17% of all businesses in the ICT Hardware sub-cluster makes use of both internal and external networks. It is evident that relatively few businesses make use of their internal R&D network alone. All rows add up to 100%.
- Particularly businesses in the ICT Hardware and Telecom Services sub-cluster use external R&D networks more often.
- For all their business activity, the innovative businesses and businesses engaged in R&D activities use both internal and external R&D networks more often (and this is not simply because they are engaged in R&D activities relatively more often). It is worthy of note that the Content businesses are more likely not to make use of R&D networks, even if they are innovative and engaged in R&D.

*B.2.7. Firms with public and/or private R&D-cooperation for the Dutch IC cluster for the year 1996*

	Only public	Only private	Both	None	Total
ICT Hardware		27%	9%	64%	100%
Telecom services		49%	9%	43%	100%
IT services		12%	9%	79%	100%
Content		5%	0%	95%	100%
Total Cluster	0%	10%	4%	87%	100%
Total	0%	9%	2%	89%	100%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: In the IT services sub-cluster 79% of firms has no R&D-cooperation. Of the 21% of firms in this sub-cluster that do so, more than half only does private cooperation.
- With the exception of the content-subcluster firms in the IC cluster use private and public partners average. Most remarkable is probably the fact that firms in the content sub-cluster does not use public Partners.

*B.2.8. 'Completeness' of innovation networks in the Dutch Information- and Communication cluster for the year 1996*

	ICT Hardware	Telecom	IT services	Content	Total Cluster	Total
No network	39%	49%	22%	67%	58%	77%
Only equipment	52%	41%	64%	33%	38%	21%
Suppliers and clients important	6%	3%	14%	0%	2%	2%
Suppliers, clients and competitors important	1%	4%	0%	0%	1%	1%
Suppliers, clients, competitors and public knowledge infrastructure important	2%	2%	0%	0%	1%	1%
Total	100%	100%	100%	100%	100%	100%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: firms that are capable to rely on more sources of information for innovation are believed to dispose of more complete innovation networks. In the ICT hardware sub-cluster 39% of firms do not dispose of any network at all, 52 % is largely dependent on suppliers of equipment for information on innovation, while very few seem to be capable to combine various sources of information for innovation.
- Firms in the ICT hardware, telecom services and IT services sub-clusters seem to be more often capable to combine various information sources for innovation, especially if compared to firms in content sub-cluster<sup>8</sup>.

<sup>8</sup> The issue whether more complete networks result in more innovation success or a better economic performance needs econometric modelling.

## 2.3 KEY DATA ON 'PERFORMANCE' OF FIRMS IN THE IC CLUSTER

### C.1.1. Total and average netto turnover 1997, net turnover growth (only manufacturing) for the Dutch Information- and Communication cluster over the period 1996-1997

Subclusters	Total net turnover '97 in Dfl. mln.	Average net turnover in 1997 in Dfl. mln.	Net turnover growth 97-96 (only manufacturing)
ICT Hardware	34.565	119	7.8%
Telecom services	17.922	344	n.a.
IT services	14.144	21	n.a.
Content	26.129	17	3.4%
Total Cluster	92.760	34	5,9%
Total	1.217.207	28	8.7%

Source: ClusterMonitor Database CBS/Diallogic, 2000

- Interpretation guide: total net turnover of firms in the ICH hardware sub-cluster amounted to Dfl 34.565 mln. Per firm this is an average Dfl. 119 mln., a figure which is of course very sensitive to the size structure of the cluster. Over 1997 firms in the ICT hardware sub-cluster realized an average growth in net turnover of 7,8%.
- About 7,5% of turnover in all private firms can be attributed to firms in the IC cluster. This again illustrates the importance of the IC cluster in the economy as a whole. As the figures for 1996 are only available for manufacturing, figures can only be used for the ICT hardware sub-cluster and therefore this column is hardly useful.

### C.1.2. Total and average gross value added 1997, gross value added growth for the Dutch Information- and Communication cluster for 1996-97 (only manufacturing)

Subclusters	Total gross value added 1997, in Dfl mln.	Average gross value added 1997, in Dfl mln.	Gross value added growth 1996-'97 (only manufacturing)
ICT Hardware	8.217	29	6.2%
Telecom services	9.410	117	n.a..
IT services	7.348	11	n.a..
Content	10.082	7	4.8%
Total Cluster	35.057	12	5,4%
Total	293.727	7	4.9%

Source: ClusterMonitor Database CBS/Diallogic, 2000

- Interpretation guide: in a similar way as in C.1.1 this table indicates the relative importance of the IC clusters and its sub-clusters within the Dutch economy by giving value added figures.
- The share of the IC cluster in the gross value added generated by all firms in the Netherlands – due to amongst other factors the high value added in telecom services - is almost 12%. As the figures for 1996 are only available for manufacturing, growth figures

can only be used for the ICT hardware sub-cluster and therefore this column is hardly useful.

*Table C.1.4 Exports of products and services for the Dutch Information- and Communication cluster for the years 1995-1998.*

	Export in current prices (mln fl.)				Volume-Index 1995=100		
	1995	1996	1997	1998	96	97	98
Total ICT Hardware	8213	8392	9361	11073	103	115	136
Of which							
Office machinery/computer ind.	2490	2440	2339	3168	100	98	134
Insulated wire and cable	658	590	674	762	91	103	120
Electronic components	2567	2529	2785	3335	98	109	127
App. For telephony/telegraphy	903	959	1231	1285	106	134	144
Audio and video equipment	222	269	338	301	120	151	132
Instruments and appliances for Measuring, navigation etc.	1373	1605	1994	2222	117	145	161
ICT services	2265	2690	3540	4246	123	162	198
Of which							
Telecom services	635	697	841	1034	124	155	214
Computerservices	1630	1993	2,699	3212	122	164	193
o.w. automation services	983	1193	1,513	1797	118	148	172
o.w. software on cdrom/tapes, intra EU	448	637	868	1060	147	200	243
o.w. software on cdrom/tapes, extra EU	199	163	318	355	87	169	188
Total Content	2877	2879	3164	3370	100	110	117
Of which							
Books, directories	436	426	428	487	97	100	114
Magazines	48	43	43	53	90	88	102
Printing	1368	1294	1277	1310	95	95	97
Recorded media (CD's, cassettes etc.)	584	573	693	695	98	118	124
Advertising	311	398	510	563	126	157	168
Motion pictures and rel. activities	130	145	136	176	112	105	132
News agencies	0	0	0	0			
Libraries, museums etc.	0	0	77	86			
Other	369266	388125	433672	454252	105	114	121
Total Dutch economy	382621	402086	449737	472941	105	114	121

Source CBS (2000): *ICT-markt in Nederland 1995-1998* (tables 2.3.2a, 2.3.6. and 5.7 for ICT Hardware, ICT Services and Content subclusters respectively).

- Interpretation guide: these figures provide export figures for the period 1995-1998. Unlike the other tables (with the exception of table C.1.5) these figures relate to businesses with at least 20 employees. The underlying source is the National Accounts which only uses data that relates to businesses with at least 20 employees<sup>9</sup>. These figures, contrary to those in the other tables, relate to services and products and therefore not to sub-sectors.

<sup>9</sup> Another difference with the CIS survey is that businesses and organisations in the public sector are included (hence in the totals and Other Sectors too).

- The table shows that, with the exception of the Content sub-cluster, the Dutch information and communication cluster had an above average performance in the period 1995-1998 as far as exports were concerned. Strong peaks in this cluster were achieved by Telecom Services and IT Services, although starting from a low base.

*Table C.1.5 Total number of workers for the Dutch Information- and Communication cluster for the years 1995-1998*

	1995	1996	1997	1998
	Manyyears * 1000			
Total ICT Hardware	75	76	78	75
Of which				
Office machinery/computer ind.	8	8	9	9
Insulated wire and cable	3	3	3	3
Elektrotechnical industry	47	47	47	44
Instruments and appliances for Measuring, navigation etc.	17	18	19	19
Telecom Services	36	37	41	42
IT Services	52	67	80	91
Total Content	185	184	188	192
Of which.				
Publishing and printing	92	90	91	93
Reproduction of recorded media	2	3	3	3
Advertising	28	30	31	32
RTV broadcasting	39	41	42	42
Video rental	1	1	1	1
Motion pictures and rel. activities	5	5	5	5
Libraries, museums, etc.	17	14	15	15
News agencies	1	1	1	1
Other	5315	5444	5581	5728
Total Dutch economy	5663	5808	5968	6128

Source CBS (2000): *ICT-markt in Nederland 1995-1998*.

- Interpretation guide: these figures provide number of workers for the years 1995-1998. Unlike the other tables (with the exception of table C.1.4), these figures relate to businesses with at least 20 employees (see also footnote 9). The underlying source are the National Accounts which only uses data that relates to businesses with at least 20 employees.
- While the number of workers in the ICT Hardware sub-cluster (measured in working years) appears to be more or less constant during the period between 1995 and 1998, an upward trend can be observed in the other three sub-clusters. The main peak to be seen is obviously in the IT Services sub-cluster which shows a 75% increase in employment over a period of four years! The publicity and advertising agencies and the Radio and TV sectors display the strongest growth in the Content sub-cluster.

*Table C.2.1 The number of businesses with a sales market that has been improved thanks to innovation<sup>10</sup>, for the Dutch Information- and Communication cluster for the period 1996-1994*

	Firms with improved position sales market as a % of		
	All firms	All innovative firms	All firms with R&D*
ICT Hardware	50%	66%	71%
Telecom Services	51%	62%	73%
IT Services	47%	65%	70%
Content	24%	52%	62%
Other sectors	18%	51%	57%
<b>Total</b>	<b>19%</b>	<b>52%</b>	<b>58%</b>

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: in 24% of all companies in the Content sub-cluster has the position on the sales market been improved through innovation. A total of 51% of the innovative businesses in the same Content sub-cluster has seen their position on the sales market improve, and 62% of the businesses engaged in R&D activity in the Content sub-cluster has also improved their position on the sales market. Businesses not engaged in R&D activities can also have an improved position on the sales market through innovation. This is why the number of businesses in the last column, in those cases where the sales market has improved, is largely made up of businesses engaged in R&D activities.
- As far as the number of businesses that have improved their sales market are concerned, businesses in the IC cluster have performed above average. It is far easier to improve the position on the sales market in a period in which the sales market for the businesses in the IC cluster is growing so strongly at the level of the individual business (in terms of size) than in a period of static sales markets or low economic activity. If we take a look at the innovative businesses or those businesses engaged in R&D activity only, then this percentage increase is even higher – yet this is a generally expected trend. Considering the already relatively large number of innovative businesses or businesses engaged in R&D in the IC cluster, the percentage cannot increase much more by looking only at the group of innovative businesses or businesses carrying out R&D. This is (more) feasible for the group of Other Sectors.

<sup>10</sup> This measure was chosen because the customary general indicator of 'percentage of sales achieved from products new to the company' and 'percentage of sales achieved from products new to the branch' is not available for all service sectors. This was possible however in the innovation survey for 1998.

*Table C.2.2 % turnover realised with products new for the industry (only manufacturing) for the Dutch Information- and Communication cluster for the year 1996*

	% firms with turnover realised with new products	Turnover with products new to the firm as a % of all turnover	% firms with turnover realised with products new to the industry	Turnover with products new to the industry as a % of all turnover
ICT-hardware	66,0%	45,6%	38,3%	10,5%
IT services	n.a.	n.a.	n.a.	n.a.
Telecom	n.a.	n.a.	n.a.	n.a.
Content (incomplete)	34,9%	7,4%	11,1%	0,9%
Total (incomplete)	41,1%	26,9%	16,5%	5,8%
Total	34,8%	18,5%	16,0%	4,6%

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: 66% of all firms in the ICT hardware cluster have realised turnover with new products in the period 1994-1996. Turnover with new products to the firm and new to the industry in ICT hardware sub-cluster was respectively 45,6% and 38,3% of total turnover. As figures are only available for manufacturing firms, reliable figures are not available for the other three sub-cluster and hence the IC cluster as a whole.
- The figures for the ICT hardware sub-cluster indicate that turnover realised with new products more often than not is new to the industry, which indicate a fairly high innovativeness.

### *C.3.1 Firms with non-technological innovation for the Dutch Information- and Communication cluster for the year 1996*

	Non-technological innovation	innovative strategy	Innovative marketing	Innovative reorganisation	Innovative management
ICT Hardware	74%	54%	37%	38%	27%
Telecom services	83%	77%	66%	51%	26%
IT services	79%	69%	45%	41%	15%
Content	58%	45%	33%	32%	12%
Total Cluster	68%	53%	37%	35%	15%
Total	23668	18043	11250	12890	5334

Source: ClusterMonitor Database CBS/Dialogic, 2000

- Interpretation guide: of all IT service firm, 79% report non-technological innovation, most often in the form of an innovative strategy (69% of all IT firms), innovative marketing (45%), innovative reorganisation (41%) and innovative management (15%).
- The table at least gives a first impression as to what degree firms in the IC cluster are involved in non-technological forms of innovation. Most remarkable is possibly the high score of telecom service firms.

### 3 MAIN FINDINGS

Without wishing to impair the detail of the information represented or the differences within the IC cluster, we have set out a number of more general findings below that relate to the characteristics, functioning (particularly innovation) and performance of the Dutch IC cluster. It must be borne in mind that the analysis mostly pertains to the years 1996 and 1997 and to businesses with 10 (and in some cases, 20) or more workers. This means that some of the, often very dynamic and rapidly growing businesses in the IC cluster have not (at least not for the time being) been taken into consideration. Nor has the Content sub-cluster been fully covered, and sometimes this relates to those sectors in particular (Radio and Television) that are becoming more and more important within the IC cluster. That the Content sub-cluster, in terms of innovation characteristics, tends to be more in line with the average in Dutch trade and industry than with the businesses in the other three sub-cluster is quite remarkable.

#### Basic characteristics

- Businesses in the IC sub-cluster – with the exception of businesses in the Content sub-cluster – are on average twice as innovative, and carry out R&D activities on average twice as often, when compared with the figures for the rest of Dutch trade and industry.
- Particularly in the ICT Hardware and Telecom Services sub-clusters are relatively more businesses active in the size categories of businesses with more than 50 workers.
- Concentration ratios (C-10) are highest in in the combined Telecom and IT services sub-cluster and lowest in the content sub-cluster
- An above average number of businesses in the IC cluster (with the exception of the Content sub-cluster) make use of innovation policy instruments.
- Ratio export/turnover is with a 76,6% exceptionally high in the ICT hardware sub-cluster.
- Foreign firms are important in the Dutch IC cluster, both in terms of employees (14,7% of all employees are employed by foreign companies) and R&D (19,7% of all R&D manyears), although the differences between sub-clusters are remarkable.
- Businesses in the IC cluster (with the exception of the Content sub-cluster) make more than average use of national and international R&D networks. This applies in particular to the Telecom Services sub-cluster.
- Outward FDI exceeds inward FDI in all four subclusters (at least in 1996).

#### Functioning

- The number of recently established firms is particularly high in telecom services sub-cluster and (although to a lesser extent) IT services sub-cluster.
- Almost 12% of investments in fixed assets in the Netherlands are made by firms that are part of the IC cluster
- The main aspects of innovation expenditure differ from one sub-cluster to another, certainly if we look at the average expenditure of all (or only the innovative) businesses do we see an innovation effort which is (far) above average. Exceptions in the negative sense are those

businesses in the Content sub-cluster.

- The R&D intensity in the IC sub-cluster is (once again with the exception of the Content sub-cluster) is above average, and in the ICT Hardware sub-cluster even exceptionally high (although there is a slight overestimation here because of the weight of Philips).
- The innovative businesses in the IC cluster (with the exception of the Content sub-cluster) are to a much larger extent than businesses in other clusters and sectors engaged in R&D activities on a permanent basis.
- The usage of information sources for the purpose of innovation differs per source of information and per sub-cluster. Quite remarkable are the mutual differences in how much use is made of the public knowledge infrastructure. In quite a substantial number of cases, consultancy firms and research firms are more often denoted as important sources of information than innovation centres for instance. With the exception of the Content sub-cluster, the IC sub-cluster rates innovative ideas originating from their clients as 'important' more often than in the average innovative business.
- R&D outsourcing is above average, particularly in the ICT Hardware and Telecom Services sub-cluster. This is because of the higher percentage of businesses that perform R&D in any case.
- Businesses in the IC cluster (with the exception of the Content sub-cluster) make more use of internal and external R&D networks, not only because they engage, on average, more often in R&D activities.
- With the exception of firms in the content sub-cluster, firms in the IC cluster use private and public sources for innovation above average.
- Especially 'innovation networks' of ICT hardware and telecom service firms are more likely to dispose of more 'complete networks' i.e. use various information sources for innovation at the same time.

## **Performance**

- About 7,5% of turnover in all firms can be attributed to firms in the IC cluster.
- The share of the IC cluster in the gross value added generated by all firms amounts to almost 12%.
- The Dutch IC cluster performs above average in terms of exports. In some cases the growth percentages can be said to be quite spectacular; however, the relatively low figures in the base year could be one of the reasons.
- Employment in the IC cluster stands at 400.000 working years in 1998, and in the period between 1995 and 1998 (by 75%) the level of employment grew particularly thanks to employment in the IT Services sub-cluster.
- Businesses in the IC cluster perform above average in terms of the number of businesses that have improved their position on the sales market. However, the above average market growth also plays a role here.
- Although all 4 IC sub-clusters score above average on non-technological innovation, the telecom services sub-cluster performs particularly well on this indicator.

## REFERENCES

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## **ANNEX 1 THE POSSIBILITIES AND LIMITATIONS OF CIS II DATA**

With a few exceptions most of the tables given in this paper have been taken from the Community Innovation Survey (CIS II) which was carried out for the Netherlands by the CBS (Central Bureau of Statistics). This innovation survey contains questions relating to the period 1994-1996. Businesses and institutes belonging to the following sectors were surveyed: Agriculture; Hunting and Forestry; Fishing; the Extraction of Minerals; Industry, the Generation and Distribution of Electricity, Gas and Water; the Building Trade, Consumer Goods Repairs and Trade; the Hotel and Catering Industry; Transport, Storage and Communication; Financial Institutions; the Lease of and Trade in Movable Property and Real Estate and the Commercial Services Sector; Environmental and Other Services. Businesses and organisations in the public sector were not included (these are not included in the totals either!).

The questions asked in the CIS surveys were quite extensive and included questions on:

- Specific company-related background features;
- Research and development;
- Usage of government programmes;
- Innovation over the past two years;
- Collaboration and knowledge transfer (sale or purchase, type of partner and region);
- Expenditure in connection with product/services innovations;
- Sources of information for the innovation process;
- The objectives and problems of innovation activities.

The survey was held among companies with ten or more employees. A total of 46,932 companies were involved. All companies employing more than 50 workers were surveyed, and a random survey was held among companies employing between 10 and 50 workers. The total response was 73%, i.e. 10,664 companies that completed the questionnaire.

It was a survey that was held in almost every country of the European Union. The CBS survey was slightly more extensive than most of the surveys carried out in other EU countries, both in terms of actual questions (the consequences of innovation for the market position; the introduction of non-technological innovations) and market coverage (the building trade, retail trade and part of the services sector).

It is unfortunate that several limitations are attached to the data source. For instance, the following sectors belonging to the Content sub-cluster are (unfortunately) missing in the CIS survey:

- (Video) film producers (sbi code 92111);
- Supporting activities for the production of (video) films (sbi code 92112);
- The distribution and projection of (video) films (sbi code 9212, 9213);
- Radio and Television (sbi code 9220) and
- Public libraries (sbi code 92511).

This means that nothing can be said about innovation in these sectors. We have consequently underestimated the level of innovation in the Content sub-cluster.

A second problem area is KPN. In 1996 what today is TPG and KPN Telecom then belonged to the same group of companies. There is no separate data available on KPN Telecom for 1996. However, the number of workers in the telecommunication branch has been estimated on the basis of the 1998 annual report. In addition to the R&D data we have no other innovation data at our disposal on this company. This means that we are only able to make a statement as to the level of innovation in the Telecom Services sub-cluster, excluding KPN Telecom. This is a major deficit considering KPN's prominent role in the Telecom services sub-cluster.

Because Philips was taken into consideration in its entirety as a group of companies in the CIS survey we decided to account Philips for 100% to the ICT Hardware sub-cluster. This leads to an overestimation of the level of innovation in this sub-cluster for instance, given that Philips is also active in other sub-clusters, including IT Services (Origin, for instance) as well as in clusters outside the IC cluster.

## ANNEX 2 COMPOSITION INFORMATION AND COMMUNICATION CLUSTER

SBI<sup>11</sup>-codes of the subclusters of the IC cluster

Sub-clusters	SBI'93	Included in CIS II
<b>ICT Hardware</b>		
Manufacture of computers and other information processing equipm.	3002	Yes
Manufacture of insulated wire and cable	3130	Yes
Manufacture of electronic valves and tubes and other electr. comp.	3210	Yes
Manufacture of RTV transmitters & apparatus for line telephony/telegr.	3220	Yes
Manufacture of RTV receivers, sound/video recording or reproducing apparatus and associated goods	3230	Yes
Manufacture of industrial process control equipment	3330	Yes
Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except ind. process contr. Equipm.	3320	Yes
Publishing of sound recordings	2214	Yes
Reproduction of sound recording	2231	Yes
Reproduction of video recording	2232	Yes
Reproduction of computer media	2233	Yes
<b>Telecom services</b>		
Telecommunications	6420	Yes
<b>IT services</b>		
Hardware consultancy	7210	Yes
Software consultancy and supply	7220	Yes
Data processing.	7230	Yes
Database activities	7240	Yes
Maintenance and repair of office, accounting and computing machinery	7250	Yes
Other computer related activities	7260	Yes

<sup>11</sup> Dutch equivalent of NACE.

Tabel A1

Continued: SBI-codes of the subclusters of the IC cluster

	SBI'93	Beschikbaar in CIS II
<b>Content</b>		
Publishing of books	2211	Yes
Publishing of newspapers	2212	Yes
Publishing of magazines	2213	Yes
Other publishing	2215	Yes
Printing of newspapers	2221	Yes
Printing (books)	22221	Yes
Printing (magazines)	22222	Yes
Printing (advertising material)	22223	Yes
Printing (forms)	22226	Yes
Bookbinding and finishing	2223	Yes
Composition and plate-making	2224	Yes
Other activities related to printing	2225	Yes
Video (tape) rental	71401	Yes
Advertsing	744	Yes
Photographic activities	7481	Yes
Motion picture and video production	9211	No
Motion picture and video distribution	9212	No
Motion picture projection	9213	No
Radio and television activities	922	No
Libraries	92511	No
<b>Other</b>		
All other (profit) sectors		Yes