Ministry of Economic Affairs

its

ICT competencies in business

Supply and demand, now and in the future

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Foreword to the ITS research report entitled 'ICT competencies in the business environment'

Nowadays, ICT is an essential feature of every workplace. Modern ICT applications offer companies a wide range of benefits. However, the question is whether employees get the maximum out of the available technology and applications in order to do their work to a standard that meets or exceeds expectations. In other words, it is important to ascertain how ICT competent employees are. An additional issue is whether organisations recruit enough staff with the required ICT competencies. It is also important to establish how companies deal with their need for employees with sufficient ICT competencies. This does not just mean ICT specialists, but also those who apply ICT and, above all, everyday ICT users. The degree to which organisations can find and recruit people with the right ICT competencies is crucial for their capacity to innovate and for the strengthening of their competitive position. This report is the result of broad, quantitative research into the state of affairs with regards to ICT competencies in the business environment in the Netherlands.

The results of this research are to be presented at a conference on 15 November 2006. This is a conference which I am organising together with VNO-NCW [the Confederation of Netherlands Industry and Employers] with a view to enabling parties in the field to engage in mutual discussions. The question is whether the research results will be acknowledged and deemed to be urgent. If that is the case, the next question will relate to the possible solutions and whether there are any inspiring examples.

The leading position that the Netherlands occupies worldwide in the field of ICT can only be maintained if users know how to deal efficiently and effectively with the available infrastructure and services. The policy document entitled *Beleidskader Elektronische Communicatie* [Electronic Communication Policy Framework] which the Cabinet submitted to the Lower House in August 2006 therefore focuses explicitly on the user aspects of ICT. The Cabinet even refers to it as one of the spearheads of future policy. The Strategic ICT Consultative Body, whose participants include a number of key figures from the business community, the government and society, recently referred to e-skills as a breakthrough for the Netherlands. More details can be found in their manifesto entitled *Nederland in Verbinding – de ICT-Ambitie van Nederland* [The Netherlands Connected – the ICT ambitions of the Netherlands] which was published in June 2006.

Lastly, I would like to express a word of thanks to Paul de Graaf (of the *Commissie voor Informatiebeleid* [Information Policy Commission] of the *Raad van de Centrale*

Ondernemingsorgansisaties [Council of the Central Business Organisations], Bernd Taselaar (ICT~Office), Fred Mulder (Open University), Jos Leenhouts (ROC De Mondriaan onderwijsgroep), Ferry de Rijcke (Inspectorate of Education), Tonny Wildvank (Capgemini). As members of the supervisory committee involved in this research, they have supported the Ministry of Economic Affairs with excellent advice.

I hope that this research will contribute to the broad discussion that is currently taking place on the importance and the challenges of ICT competencies in the business environment.

Mark Frequin
Director-General of Energy and Telecom

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1. Introduction

In recent decades, ICT has started to play an increasingly important role in society. The importance of ICT and the ICT sector for the development of the knowledge economy and the image of ICT as innovation axis are generally undisputed phenomena. However, at both international and national level, the focus is increasingly shifting from access to ICT to its actual use and the skills that this demands. ICT infrastructures have been rolled out in most companies and the saturation point seems to have been reached. However, ICT use is still increasing and becoming more and more intensive and advanced. Moreover, the supply of, and demand for, ICT competencies and the balancing thereof is therefore subject to change.
Since the beginning of 2005, more and more references have been made in the media and in research to an imminent qualitative and quantitative shortage of highly qualified ICT specialists. Particularly in the ICT sector there is concern about the link between education and the employment market. However, opinions differ regarding the exact extent and urgency, and the expected development of any problems that might arise, as well as the role of the government in solving them.

In order to acquire greater clarity on the matter, the Minister of Economic Affairs commissioned research at the beginning of 2006 concerning the possible shortages of employees with the required ICT competencies in the Dutch business community. A graded representative sample of more than 1,500 companies and institutions in for-profit and non-profit sectors were asked about their experiences and views relating to ICT competencies and expectations for the future in this field. The main research question was as follows:

What is the state of affairs with regard to the ICT and related competencies of employees in the exercising of their profession, now and in the near future? If there are problems with the balancing of the supply and demand of these competencies, in which sectors and at which types of companies do these problems then occur and what are the (possible) solutions?

Wherever possible, the research drew on past experiences and recent international research. As a consequence of the lack of a clear conceptual framework (both at the national and international level), a decision was made to adopt the definitions used by the CBS [Statistics Netherlands]. This means that shortages of ICT competencies are measured in terms of vacancies for ICT specialists and/or users which are difficult to fill. The emphasis is not only on the extent of any shortages (the number of

vacancies) but also the nature of the problems (quantitative or qualitative). Following on from previous research and policy, the coordination between the employment market and education is a very important point of interest.
For reasons of complexity and ambiguity, competency profiles were not used. Instead, the emphasis was on the filling of various ICT-related job vacancies.
In the research we differentiate between three categories of employees:

1. **ICT specialists:** ICT professionals whose primary task is the computerisation and/or (electronic) facilitating of work processes (including system or network managers, help desk staff, software developers, programmers).
2. **ICT users**: other staff (who are not ICT specialists) who use ICT in their own work.
3. **ICT innovators**: a specific group of ICT users who are responsible for the primary processes in a company but also devise ICT solutions with a view to innovating those processes and/or developing new products.

2. Participating companies and institutions

Because the aim was to draw clear conclusions about the Dutch business community as a whole (for-profit and non-profit) and, if possible, about the individual sectors as well, a very broad sample was taken. In total nearly 8,500 companies were selected. The sample was graded according to company size and sector. As a result, large companies (with more than 100 employees), ICT companies and relatively small sectors (non-ICT) are overrepresented in the final sample. This was compensated for by weighting the analyses according to sector and company size.

In total, 1,511 companies and institutions took part in the research: 353 non-profit institutions and 1,158 companies (for-profit), including 166 ICT companies. This is more than enough to enable representative conclusions to be drawn on Dutch companies as a whole and according to company size. Representative conclusions according to sector can only be drawn in the case of the main questions (which have been completed by all companies). In the case of the subsequent questions, the number of respondents per sector was often insufficient to enable a description of the results per sector. In those cases no additional itemisation was made.
The participating companies are reasonably well spread according to size, although slightly fewer medium-sized companies participated. The 1,511 participating companies employ a total of almost 460,000 people.

Most of the companies participated via Internet. A small number completed the questionnaire by telephone. Small and medium-sized companies were the ones that primarily participated by telephone. When contacted by telephone, companies were also asked whether the fact that the questionnaire initially had to be completed via Internet was the reason for not participating. That turned out not to be the case. Only 3 percent of the companies approached by telephone did not want, or were unable, to participate via Internet. The most common reason for non-participation was a lack of time.

3. The importance of ICT

How important is ICT for Dutch companies? And what role does ICT play within the various organisations? A large majority of companies acknowledge the importance of ICT for their own organisations. Almost two-thirds of non-ICT companies even state that the company would not be able to exist without ICT. Nevertheless, there are also companies (in particular the smaller ones) that regard ICT as being less important. For example, one in three small businesses indicate that ICT costs them more money than it generates.
Non-ICT companies which acknowledge the importance of ICT refer to the following added value aspects:

- ICT permits more efficient operations (93%)
- ICT supports the primary working processes (90%)
- ICT makes it possible to innovate primary work processes (83%)
- ICT enables new services and products to be developed (51%)
- ICT provides a competitive edge (47%)

Companies which lay the emphasis on the importance of ICT in order to be able to innovate and develop new services and products often place ICT high on their policy agendas (ICT is often a policy spearhead).

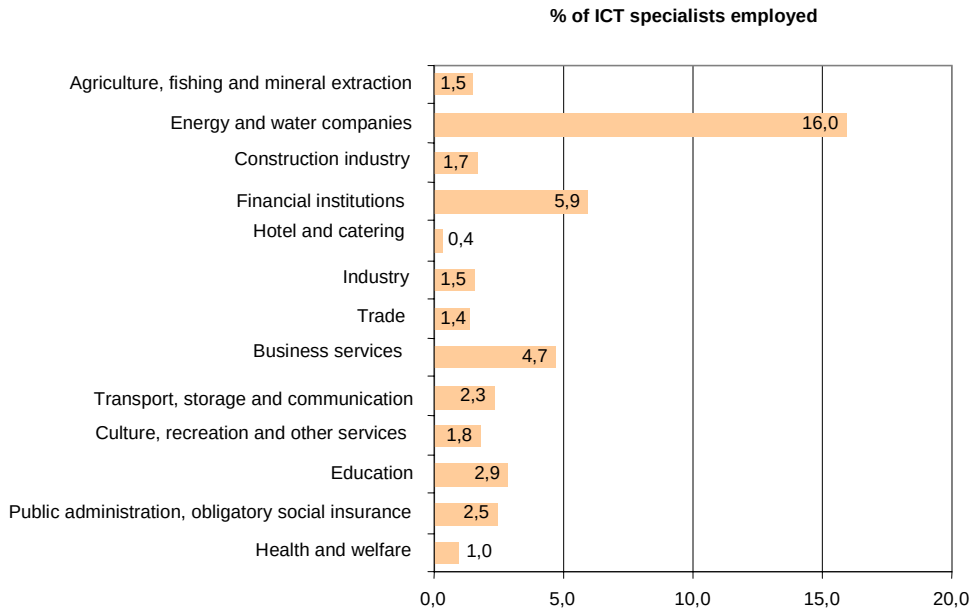
Large companies, non-profit organisations and energy and water companies in particular treat ICT as a priority. ICT appears to play a smaller role for small businesses and companies involved in the agricultural, construction and hotel and catering sectors.
One in five non-ICT companies regard themselves as forerunners in the innovative application of ICT. These are primarily companies which have placed ICT high on their agendas and which recognise the importance of ICT for their own organisations. It is striking that most medium-sized companies are clearly less positive about the role of ICT in their companies than the majority of small and large companies.

Most medium-sized companies feel relatively often that the market is forcing them to keep up with ICT developments. Two-thirds of companies indicate that they are able to keep up quite well but more than half (59%) would prefer to be one of the leaders with regard to innovative ICT use. Small companies are satisfied slightly more frequently than the medium-sized and large companies about their current position as regards ICT, particularly if they think that they are keeping up quite well with developments.

ICT specialists

A clear majority of companies (and, of course, all ICT companies) employ one or more ICT specialists. In the case of the companies that participated in the research, 3.2 percent of the total workforce was employed as ICT specialists (slightly lower than the estimate by the CBS in *De digitale economie 2005* [The Digital Economy in 2005] which put the percentage at 3.9 percent). If this is extrapolated and applied to the total population, it means that businesses employ around 265,000 ICT specialists nationwide. The proportion of ICT specialists is of course highest (sixty percent) in the ICT sector. The percentages differ considerably in the non-ICT sector (see Figure 1).

Figure 1 - Percentage of ICT specialists employed per sector (n=50-122)



In the non-ICT sector, the majority of ICT specialists are employed in management and maintenance, while others work as help desk employees. These are basically jobs which require people with MBO [secondary vocational education] qualifications.

In addition, the ICT companies employ a relatively large number of ICT specialists as consultants, designers, programmers and software developers. In relative terms, these companies also have the largest number of university educated ICT specialists. Non-ICT companies tend to employ more ICT specialists trained to secondary vocational level. This applies primarily to large companies and the non-profit sector.

ICT users

ICT specialists are, of course, not the only users of ICT since the technology is frequently used by many non-specialists as well. According to those who participated in this research, almost half of all employees make structural use of ICT in their primary work processes. The figure is even above sixty percent in the case of supporting work processes. ICT use by non-ICT specialists is highest at companies at which ICT plays a very important role and at which ICT is placed high on the agenda such as businesses in the ICT sector, large companies and non-profit institutions.

ICT innovators

More than half of all non-ICT companies indicated that their group of ICT users includes real ICT innovators, that is to say employees who are specialists in their own (non-ICT) fields but who also devise or use ICT solutions in a creative manner in order to innovate processes and develop new products. Nevertheless, hardly any companies pursue a deliberate policy designed to attract such ICT innovators or to stimulate or facilitate their recruitment. Only large companies and the non-profit sector state that they pay explicit attention to this matter.

It can be concluded that ICT is very important to most companies for the execution of their activities. Many recognise the importance of ICT particularly for being able to work more efficiently, to keep up with the competition and to be able to innovate. The question is whether companies have sufficient ICT-competent employees (ICT specialists and ICT users) now, and whether this will remain so in the future.

In addition, one should not forget that it is not the aim of every company to actually employ ICT specialists themselves. When asked, an average of one in three companies (in non-ICT sectors) indicate that they would prefer not to employ any ICT specialists (particularly very small companies and franchise organisations) and the same percentage opt for a mix between internal and external. The forerunners in the field of ICT and companies that indicated that they were having trouble keeping up with developments opt relatively often for a mix of internal and external solutions. Those who lag behind developments and those who manage to keep up with them in fact choose to employ as few ICT specialists as possible.

Approximately sixty percent of companies indicated that they subcontract (some of their) ICT tasks and activities. These are not only the companies that opt for a mix of internal and external.

Companies which would prefer to employ all of their ICT specialists also subcontract some of the ICT tasks and activities (45% of the companies in question). What is striking is that a majority of those companies which indicated that they do not want to employ any ICT specialists indicated that they do not subcontract any ICT tasks. These are primarily companies at which ICT plays a relatively small role. Companies which place ICT high on the agenda chose more often for a mix of internal and external solutions and are the ones that subcontract some of their ICT tasks most often.

4. Shortages of ICT specialists

A quarter of all companies indicated that they had taken steps to recruit ICT specialists in 2005. In 2005, ICT companies had vacancies more often than non-ICT companies. In the latter group, ICT specialists were recruited primarily by large companies and non-profit institutions. In particular, companies which had ICT high on their agendas tried to recruit ICT specialists in 2005. This applied to forerunners in the field of ICT as well as companies which indicated that they had difficulty keeping up with ICT developments. A striking aspect was the companies which also subcontract ICT tasks were precisely the ones that recruited ICT specialists on a relatively frequent basis. This confirms the image that the subcontracting of ICT activities is a deliberate choice by companies at which ICT plays an important role within the organisation. They are the ones that are searching for a mix of internal and external solutions (i.e. subcontracting specific tasks while continuing to carry out others internally). Companies which do not subcontract any ICT activities generally attach a lot less importance to ICT and therefore also recruit fewer ICT specialists. The subcontracting of ICT tasks and the recruitment of ICT specialists are activities which therefore complement each other rather than cancel each other out.

Number of vacancies for ICT specialists

Based on data from all companies, each company had an average of two vacancies[1] for ICT specialists in 2005. This is equivalent to a vacancy level of 11 percent (or 11 vacancies per 100 ICT jobs). In the ICT sector the figure was 14 percent and an average of 8 percent in the other sectors. In comparison, the national vacancy level

[1] The method of questioning means that some of these vacancies will have been counted twice. If someone leaves company X in 2005 to join company Y and company X wants to fill the resulting vacancy, both companies will have indicated that they had a vacancy in 2005. The same applies to the vacancy count by the CBS.

for all groups of professions is less than 2.5 percent (CBS, Statline, 2005), with peaks in the hotel and catering and business services sectors (4.1% and 3.7% respectively for all groups of professions in those sectors).

One in three vacancies for ICT specialists include a request for candidates with university education. Half of the vacancies were for candidates trained to HBO [higher professional education] level and 18 percent were for candidates trained to MBO [secondary vocational education] level. The demand for ICT specialists with university education was highest in the ICT sector (42 percent of the vacancies). As regards non-ICT companies, ICT specialists with university or HBO training were sought most by companies in the for-profit sector. Non-profit institutions and large companies predominantly had vacancies for ICT specialists educated to MBO level.

If this is extrapolated and applied to the total population (assuming 265,000 ICT specialists), this represents around 29,000 vacancies in the Dutch business community as a whole. If the data is divided up according to level of education, the estimated figures are:

- approximately 8,200 vacancies for ICT specialists with university education
- approximately 14,600 vacancies for ICT specialists with education at HBO level
- approximately 5,300 vacancies for ICT specialists with education at MBO level

Companies clearly prefer candidates with work experience elsewhere to those who have just graduated or who are already employed at the company. More than 80 percent of companies filled their vacancies with candidates with work experience elsewhere. Approximately one in five companies indicated that they had also recruited recent graduates.

Vacancies which are difficult to fill

Three-quarters of the companies with vacancies for ICT specialists had problems filling them. This was the case for around 16 percent of all companies (including those without vacancies). One in three vacancies for ICT specialists turned out to be difficult to fill (i.e. were not filled within three months). This figure is high in comparison to national data for all groups of professions. That data shows that almost one in five vacancies for all groups of professions in all sectors were difficult to fill (CBS, Statline, 2004).

The extent of the problem depends very much on the desired level of training (see Table 1). In 2005, vacancies for highly-qualified ICT specialists were particularly difficult to fill: 42 percent of all vacancies for candidates with university education and 38 percent of vacancies for candidates educated at HBO level had not been filled

after a period of three months. In the case of candidates trained to MBO level, the figure was considerably lower (11 percent of vacancies).
Nationally, this would correspond to almost 3,500 vacancies which were difficult to fill for ICT specialists with university education, well over 5,500 vacancies which were difficult to fill for ICT specialists educated to HBO level and around 600 vacancies which were difficult to fill for ICT specialists educated to MBO level.

Table 1 – Vacancy level for ICT specialists and the percentages of vacancies which were difficult to fill for ICT specialists according to level of education for a total sample survey and according to ICT/non-ICT sector (n=951)

total	vacancy level for ICT specialists (%)	% of vacancies which are difficult to fill
total		
mbo	8	11
hbo	12	38
university education	16	42
ICT		
mbo	5	72
hbo	13	46
university education	25	36
non-ICT		
mbo	9	6
hbo	11	32
university education	10	51

The problems were therefore greatest for those sectors in which more highly educated ICT specialists were sought: namely the ICT sector and small companies. Large companies and non-profit institutions, which actually looked for ICT specialists with MBO education more frequently, experienced fewer problems.
Companies which subcontract (some of their) ICT activities did not experience any fewer problems as regards filling vacancies than companies which did not subcontract.

Nature of the shortage
According to the participating companies, the shortages were primarily of a qualitative nature. Most companies indicated that the problem as regards filling vacancies was that the available candidates did not meet the set requirements. The requirement most frequently referred to was the lack of relevant ICT or work experience.

In addition, some of the companies also experienced problems relating to the following requested competencies/qualifications:

- connected to specific jobs, particularly those of project manager, adviser, consultant and information manager
- in the field of specialist ICT knowledge, such as SAP, Unix, ASP.NET
- related competencies (besides the requested ICT skills), for example strategic and operational knowledge, language skills, knowledge of specific disciplines and knowledge of and a feeling for ICT practice

Companies that need ICT specialists with university education often have difficulty finding enough personnel. According to them, there are simply not enough candidates. The companies stated that, at the level of HBO and university education, excessively high salaries also play a role as regards not being able to fill vacancies.

Future expectations

Almost a quarter of companies expect to have vacancies for ICT specialists in the next two years. It therefore seems to be scarcely any change in the percentage of companies with vacancies for ICT specialists (was also 25% in 2005). Most companies expect to have vacancies for candidates educated to HBO level (28%). The demand for ICT specialists with MBO and university education is slightly lower, as was the case in 2005 (11 and 17 percent of all companies respectively). Almost 2 percent of the participating companies expect to have vacancies for candidates with educational backgrounds at all levels (this concerns primarily large companies). The ICT sector, in particular, expects to recruit ICT specialists in the coming two years. Almost three-quarters of companies in the ICT sector expect to have vacancies in the next few years for candidates trained to HBO level and a further 45 percent expect to have vacancies for ICT specialists educated to university level. In the non-ICT sector, a quarter of companies expect to have vacancies for candidates educated to HBO level and almost ten percent expect vacancies for candidates with university education.

Organisations from the non-profit sector expect to have vacancies relatively frequently for candidates educated to MBO level. These will be vacancies in primarily the education sector (33 percent expect vacancies for candidates educated to MBO level).

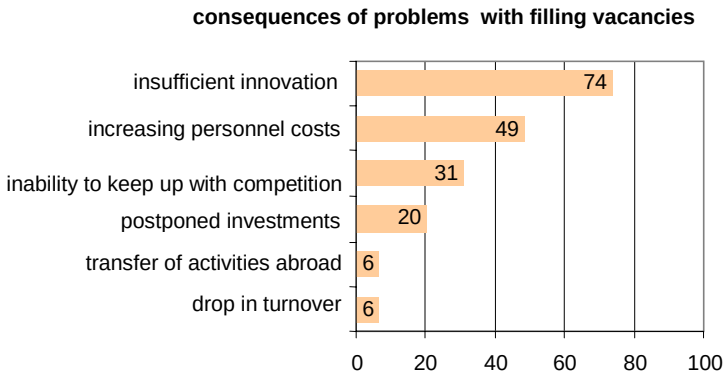
In the for-profit sector the energy and water companies expect to have the majority of vacancies for ICT specialists, particularly at university level.

Almost half of the companies that expect to have vacancies assume that they will recruit about as many ICT specialists in the coming two years as in 2005. A third of companies with vacancies even expect to recruit more ICT specialists educated to HBO and university level. The demand for MBO candidates is actually expected to decrease.

A large majority of companies that expect to have vacancies think that they will have difficulties finding candidates during the next two years. This was the case for less than 15 percent of all companies (including those without vacancies). In particular, companies with vacancies for candidates educated to university and HBO level expect problems (respectively 85% and 68% of the companies which have vacancies at the level of education involved).
Companies predict more qualitative than quantitative shortages as regards filling vacancies in the future. The primary concern has to do with the ICT competencies of those joining the employment market. Companies primarily expect a quantitative shortage as regards vacancies for candidates with university education. Moreover, excessive salary demands are expected to create a problem as regards recruiting candidates educated to MBO and HBO level.

Consequences of shortages of ICT specialists
Companies which fail to fill existing and expected vacancies will face serious consequences. The problem most frequently referred to is the inability to innovate. Almost three-quarters of the companies that expect to have vacancies indicated that the result will be a weakening of their innovative capacity. Figure 2 shows the consequences referred to by the companies of shortages of ICT specialists.

Figure 2 – Consequences of not being able to fill vacancies for ICT specialists, or of difficulties filling such vacancies, based on the total sample survey (n=203)



Other consequences which companies referred to include increasing pressure of work suffered by current employees, the hiring of staff from outside the company, not being able to anticipate clients' wishes and the missing of orders due to a lack of capacity. The consequence of being less able to innovate was referred to as a problem primarily by companies that expect/are experiencing quantitative shortages.

These are predominantly companies that need ICT specialists with a university education. Companies that label the shortages as qualitative expect slightly less frequent negative consequences for their innovative capacity. They expect to have to subcontract ICT tasks and activities slightly more often in the future than companies with quantitative shortages.

5. Shortages of ICT users

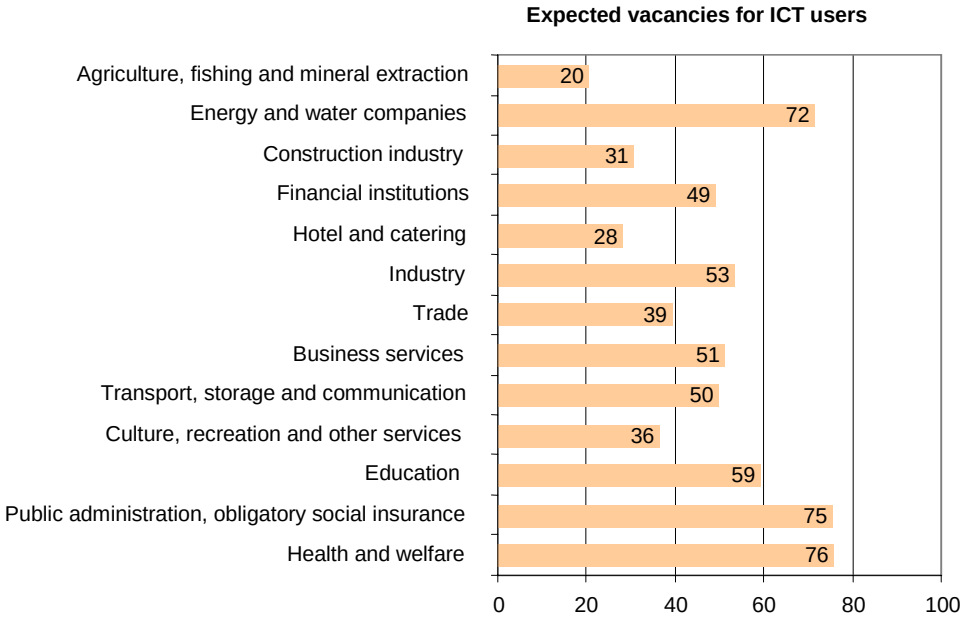
A large number of non-ICT specialists also use ICT in primary and supporting work processes (ICT users). The question now is whether and to what extent companies formulate explicit demands when recruiting ICT users with regard to the desired ICT competencies and to what extent they can then fill these vacancies.

Vacancies for ICT users
Almost half of the companies had vacancies for ICT users in 2005 (that is vacancies for which there was a specific demand for ICT competencies). Most of these are the energy water companies and organisations in the education sector. Small companies recruit hardly any ICT users. In 2005, approximately 5 percent of small companies had a vacancy for which specific ICT competencies were required. The same applied to well over half of the medium-sized/large companies.

Most companies filled the vacancies for ICT users without too many problems. Only fifteen percent of companies had vacancies in that field open for longer than three months (for the sake of complete clarity: this was equivalent to 7.5 percent of all companies). In the ICT sector this percentage is slightly higher (33%).
According to the participating companies, the problems were primarily of a qualitative nature. Candidates usually lacked general computer/instrument skills. Particularly in the non-profit sector, a number of companies expressed concern at the large number of employees with insufficient computer know-how.

Future expectations
The companies expect the number of vacancies for ICT users to increase. Approximately half the companies expect to have vacancies in the next two years. Primarily the non-profit sector, in particular the healthcare and welfare and public administration segments, expects to have vacancies for ICT users on a fairly frequent basis. Slightly fewer vacancies are expected in education.

Figure 3 - Percentage of companies that expect vacancies for ICT users in the next two years, according to sector (n=49-115)



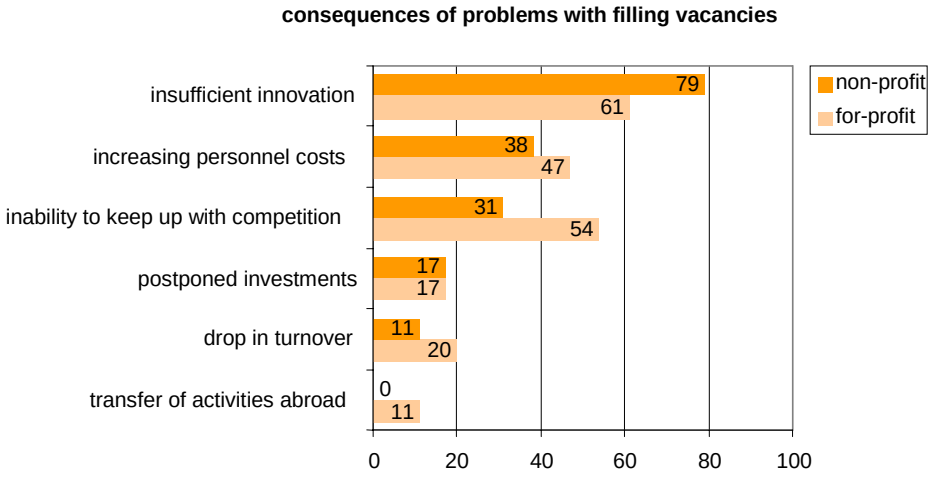
In the for-profit sector, the majority of vacancies are expected in the ICT sector, at large companies and at the energy and water companies.

Almost four in ten companies that expect to have vacancies also predict problems with filling them. This figure is substantially higher than in 2005 when just fifteen percent of companies had problems filling vacancies for ICT users. Problems are anticipated particularly by companies which place ICT high on their agendas (the ICT sector, large companies and the non-profit sector). According to the participating companies, the shortages are of both a qualitative and quantitative nature. As regards the quality of the candidates, the companies expressed concern particularly about practical and innovative skills.

Consequences of shortages of ICT users

The (expected) shortages have negative consequences for the companies. The companies refer, in particular, to the inability to innovate, to falling behind the competition and to increasing personnel costs. The for-profit companies also expect more frequent decreases in the turnover and expect they will have to relocate (some of their) activities abroad.

Figure 4 – Consequences of not being able to fill vacancies for ICT users, or of difficulties filling such vacancies, according to type of organisation, n for-profit=124; n non-profit=83



According to the companies, other consequences are an increase in the pressure of work on current staff, the loss of quality (of products and services) and inefficiency as regards operational management.

6. Types of solutions

As might be expected, companies prefer to fill vacancies for ICT specialists and ICT users with candidates who have suitable training and relevant work experience. If such is not possible, companies tend to opt to hire temporary staff from elsewhere or, in the worst case scenario, tend not to fill the vacancy at all. The latter applies particularly in the event of vacancies for candidates with university education. Companies that have already subcontracted some of their ICT activities indicate more frequently that they opt to hire external expertise than companies that have not (yet) subcontracted any ICT tasks.

In the case of ICT users, vacancies are hardly ever left unfilled. Companies indicated that, in such instances, they prefer to lower their demands. This was the most frequently adopted solution in 2005 as regards ICT users. It is striking, however, that companies are less prepared to use this as a long-term solution. They then prefer approaches which involve additional training, internal reorganisations, refresher courses, or outsourcing. It seems as if companies will soon start giving more priority

to the requested ICT competencies and will be less prepared to make concessions in the future. The question is, of course, whether companies that are confronted with vacancies will indeed choose for different solutions or will instead once again lower their ICT demands.

Maintaining ICT competencies at the required level

Creating vacancies for ICT specialists and ICT users is not the only, nor the most important, measure that companies take in order to maintain/raise ICT competencies at the company at/to the required level. However, this is referred to as one of the top five policy measures, although competency development and training of the company's own staff are more favoured methods.

*Top five policy measures for keeping ICT competencies at the required level**	for ICT specialists:	for ICT users:
investing in competency development and training of one's own staff	59	66
temporary recruitment via software firms and/or temporary employment agencies	58	33
buying in specific expertise from outside	42	-
recruiting experienced personnel from other companies/organisations	40	50
working with trainees/students	35	33
distributing work differently among staff	-	30

* percentage of the companies that refer to the measure as being in their top five

Only a few referred to other measures such as outsourcing abroad or attracting new target groups (less than 5 percent).

Companies hardly ever take explicit policy measures for recruiting or keeping *ICT innovators* (less than 20 percent of companies). Even companies that express a need for more ICT innovators (non-profit sector and large companies) also confess to rarely pursuing a specific policy.

Training

The companies indicated that they attach a great deal of importance to ICT competency development and training. However, this is rarely reflected in concrete policy. The majority of companies have no ICT training plan and/or budget. Exceptions are the industrial sector, public administration and, particularly, the education sector.

Approximately half the companies provide training for ICT specialists and users. The forerunners in this respect are the ICT sector, non-profit institutions (and within that category education in particular) and the energy and water companies. Companies which regard themselves as forerunners in the field of ICT innovation provide training more frequently than companies that are less up-to-date or indeed lag behind.

Most companies arrange for external training for their ICT specialists (provided by commercial or private organisations). Only ICT companies tend to provide internal training. ICT users receive a combination of internal and external training.
What is striking is that almost half of the companies indicated that they had insufficient insight into the existing training provision for ICT specialists and ICT users on the market. Those companies that provide training are, in general, reasonably happy about the available training provision for their own staff.

Satisfaction with recent graduates
Companies were also asked about their satisfaction with the ICT competencies of their graduate employees. A significant majority (90%) are satisfied. Within the ICT sector, there is slightly more criticism of the competencies of recently graduated ICT specialists (almost 20 percent are dissatisfied). The assessment of the ICT competences of ICT students and graduates from non-ICT courses is comparable.

Companies which place ICT high on their agendas (the ICT sector, large companies and the non-profit sector) are in general less satisfied with the ICT competencies of recent graduates. This primarily concerns MBO graduates (ICT specialists and non-ICT specialists).

The companies which are (very) dissatisfied complained primarily about the complementary competencies of recent graduates. This pertains to:
- a lack of practical skills (knowledge of and a feeling for practical matters)
- insufficient client-orientation (university graduates)
- too little insight and creative reasoning power (HBO and university graduates)
- insufficient level of knowledge and outdated know-how (MBO graduates)

Solutions for the shortages
In order to prevent future shortages of ICT specialists and users, the companies believe that a joint effort is required for all the parties concerned (education, the companies themselves and the government). The proposed solutions focus on the following three points:
- ICT as a profession should be encouraged and made attractive at the earliest possible stage (starting in secondary education). Companies regard this to be a task primarily for the government and the education sector.
- (Additional) training and more flexibility needs to be provided so that ICT jobs become more attractive for more and other target groups. This is a matter for the companies themselves and is an issue endorsed primarily by companies in the ICT sector.

- There needs to be more consultation and coordination between and within sectors and with those in education and government about the required competencies of ICT specialists and users and the link between theory and practice.

The role of government in this is primarily a facilitating one involving, for example, the issuing of subsidies for training and the provision of work placement and work experience opportunities as well as the provision of incentives for adequate and up-to-date training by the educational institutions.

7. Summary and conclusions

Do these results allow a satisfactory answer to be provided to the research questions? Which questions and points still require attention? In this final paragraph we answer the individual research questions and determine which questions remain and/or which new points for attention can be derived from the research.

1. *To what extent does the supply of ICT specialists and users match the demand from the business community? Are there any (imminent) shortages and if so in what form (qualitative or quantitative)? Are there any differences per sector, company size and degree of ICT innovation within the company and, if so, what are they?*

Is there currently a shortage of employees with the required ICT competencies in the Dutch business sector? The research data indeed reveals a shortage of ICT specialists and users but it also shows that these shortages affect specific sectors and company types.

Nationally, sixteen percent of all companies experienced problems in the past year with regard to filling vacancies for *ICT specialists.* This figure may, at first sight, seem insignificant. However, when expressed as the total number of vacancies in relation to the total number of ICT specialists (the vacancy level), the shortage comes across as considerable. There are eleven vacancies for every hundred ICT specialists, of which a third are difficult to fill. This is considerably higher than in other professional groups. Across all professional groups and sectors there are 2 to 3 vacancies fewer per 100 employees and less than one in five of those vacancies are difficult to fill (CBS, Statline, 2004/2005).

When extrapolated and applied to the total population, this produces the following figures (estimates):

total population estimate of the Netherlands	number of vacancies for ICT specialists	number difficult to fill
mbo	5.300	585
hbo	14.600	5.550
university education	8.200	3.450
*total**	*29.150*	*9.700*

* including vacancies for which the requested level of education is not known or has not been specified

Problems were encountered particularly by companies looking for ICT specialists educated to university level. This primarily concerned the ICT sector and smaller companies.
The expectation is that the total demand for ICT specialists will remain approximately the same over the next two years (the percentage of companies that expect to have vacancies is equal to that recorded in 2005). However, there were differences with regard to the requested level of education: Companies expect more vacancies for ICT specialists educated to HBO and university level than in 2005. A majority of companies stated that they expected a drop in the number of vacancies for candidates educated to MBO level. Most companies that expect vacancies for more highly educated ICT specialists also expect to have problems filling them. This primarily concerns the above-mentioned ICT sector and small companies, although the energy and water companies also believe they will experience more problems than in the past.

According to the companies, the problem will not be as great for *ICT users*. Less than 10 percent of all companies found it difficult to fill vacancies for ICT users in 2005. However, the expectation is that larger shortages will arise in the next two years. The percentage of companies that expect vacancies will remain the same (namely 50 percent), but a lot more companies expect to have major problems filling the vacancies. A possible explanation for this is that, in the future, companies will be less prepared to lower their demands as regards ICT competencies if there are too few candidates for a vacancy. This indicates that companies (will) attach more value to the ICT competencies of future employees.
Particularly companies that have ICT high on their policy agendas expect to be confronted with an increasing number of problems. These are mainly companies in the ICT sector, large companies, non-profit organisations and energy and water companies.

Nature of the shortages

The shortages are primarily of a qualitative nature. According to companies that have identified shortages, when it comes to recruiting *ICT specialists*, candidates tend to have insufficient work experience and insufficient specific knowledge and skills in some areas. This concerns very specialist ICT knowledge, as well as ICT knowledge in combination with related knowledge and skills (such as strategic and operational competencies, client orientation, creative intellect). *ICT users* primarily lack practical and innovative skills.

A quantitative shortage is only expected in the case of ICT specialists with university education. In particular, ICT companies and energy and water companies are afraid that they will be unable to recruit sufficient academics in the coming two years.

The numbers are too small to allow an additional breakdown according to size and sector and according to the links with other company characteristics. As a result, it is not possible to draw conclusions about which specific problems are current in certain sectors or ascertain whether companies that attach a lot of importance to ICT experience different problems than companies which place ICT lower down the agenda.

On the basis of the results, we can only say in general terms whether the shortages are primarily of a qualitative or quantitative nature. It is not possible to infer more detailed information on the specific ICT competencies which are lacking, sector specific or company specific problems and the relation with the type of ICT applications used. This is partly the consequence of the chosen definition of shortages (in terms of vacancies) and partly of the chosen structure of the research (large-scale, with little space for sector-specific questions).

Consequences for companies

The consequences of not having enough ICT specialists and users are considerable.

The companies with vacancies that are difficult to fill indicate that their capacity to innovate is limited and that they are also confronted by rising personnel costs, the postponement of investments and a less favourable competitive position.

2. *Which measures do employers use to invest – perhaps temporarily – in the recruitment of people with ICT competencies? Which solutions/initiatives do companies use to resolve any mismatch between supply and demand (internal or external training of employees, the external recruitment of new employees, temporary hiring, outsourcing, etc.)? What role can the government fulfil in this?*

Companies that are directly confronted by vacancies which are difficult to fill generally opt for short-term solutions: the temporary hiring of external employees, leaving the vacancy unfilled, or lowering their demands. As regards the future,

companies are aiming for more constructive long-term solutions (supplementary training, structural subcontracting of specific ICT tasks).
The recruitment of new personnel is just one of the options companies have at their disposal to ensure that ICT competencies within the company are maintained at (or brought to) the required level. When asked about the most important measures, the following top five are referred to for ICT specialists and users.

*Top five policy measures for keeping ICT competencies at the required level**	for ICT specialists:	for ICT users:
investing in competency development and training of one's own staff	1	1
temporary recruitment via software firms and/or temporary employment agencies	2	3
buying in specific expertise from outside	3	-
recruiting experienced personnel from other companies/organisations	4	2
working with trainees/students	5	4
distributing work differently among staff	-	5

Companies continue to make little use of other measures. Only a few companies outsource abroad or recruit staff from outside the Netherlands and only a couple reported that they have started focusing on new target groups (such as immigrants and women).

Although competency development and training are referred to most frequently as the policy measure used to keep ICT competencies at companies at the required level, it should be noted that this is hardly ever translated into definitive policy. Exceptions are the industrial, public administration and education sectors where competency development in the field of ICT is laid down relatively frequently in ICT training plans and budgets.
Another striking factor is that specific policies to recruit and/or retain ICT innovators are only pursued rarely. This is despite the fact that a relatively large number of companies actually do recognise the innovation possibilities that using ICT offers and that, moreover, making concessions on innovative capacity is one of the most important consequences of not being able to fill vacancies for personnel with sufficient ICT competencies. Because so few companies focus explicitly on this group, it is impossible to draw any conclusions on the added value for companies of ICT innovators or refer to any good and relevant examples. This could certainly be the focus of follow-up research.

Solutions
The measures which companies themselves undertake to deal with (imminent) shortages have been examined above. When asked about broader, cross-company and

even cross-sector solutions, companies indicate that they believe that such things should be based first and foremost on a joint effort. The companies themselves, the education sector and the government can and must all contribute. The proposed solutions focus on three points:

1. ICT training needs to be supported and made more attractive. The companies believe that this is primarily a task for the government and the education field.
2. The image of ICT as a profession needs to be improved by offering (extra) training possibilities and greater flexibility. This is seen as primarily a task for the companies themselves.
3. There needs to be consultation and coordination between and within sectors and with those in education and government about the required competencies of ICT specialists and users and the link between theory and practice.

As regards image improvement (both of the training courses and the profession), we would like to point out that the 'pork cycle' image does not make this easy. The fact that the employment market has appeared to be largely unstable and fickle has, very probably, not done the image of the ICT sector any good. In order to improve this situation, more will have to be done than the provision of extra training and more flexible terms and conditions of employment. In our view, the emphasis will have to be on more long-term policy.
Companies have indicated that they want to reach new target groups by making ICT professions more attractive. For us, however, the question is whether they mean the target groups from the previous government policy, given that the companies themselves rarely see the recruitment of more women and/or immigrants as a possible solution for shortages. Before this solution can be interpreted in any greater detail, an assessment will first have to take place to establish which new groups those involved want to and can focus on.

The points for attention described above are, in our opinion, very similar to the conclusions which the Risseeuw Taskforce formulated six years ago. Back then, they concluded that changes needed to be made to education, that interest in ICT had to be aroused among new target groups (women, immigrants, refugees) and that the image of ICT had to be improved in order to prevent shortages. At that time, these conclusions resulted in a number of initiatives being taken which have since run out of steam, partly due to a collapsing economy. We can conclude, as a result, that it would perhaps be better to make the continuity of future initiatives less dependent on a 'pork cycle'.

The number of companies that referred to possible solutions was too small to provide an insight into existing and desirable solutions per sector, or according to company

size, or on the basis of any other company characteristics. It is therefore impossible to give a description of sector-specific measures on the basis of the present results. The solutions proposed by the companies are generally vague and offer too little basis to allow an overview to be given of good or bad practical examples.
The third research question as to which *best* and *worst practices* can be identified in and across the sectors therefore remained unanswered. For this, more detailed and specific research would be required. The available research results only permit an exploratory and general overview of the possible problems according to company size and to sector.

Points which require special attention
While the results do allow the main research question to be answered, no conclusions can be drawn with regard to sector-specific problems and solutions. More attention should, in any event, be paid to the following points:

- More detailed information on the specific ICT competencies (or related competencies) which are lacking and the companies that this affects.
- The role of ICT innovators in companies. At the moment, it seems that insufficient attention is being paid to this matter. It may be the case that there are no good and relevant examples.
- The link with the degree to which ICT is applied innovatively. The trends which are expected in the field of ICT applications and the consequences this has for the requested ICT competencies. This not only means the developments within the sectors which are leading the way, but also in those which have been lagging behind to date, such as the agricultural and hotel and catering sectors. The question is whether those latter sectors will catch up in the years ahead and whether they will also be affected by the ICT shortages which are currently in evidence at the front-running companies.
- Attention for the specific problems facing small companies. It has become clear that small companies have a relatively frequent need for ICT specialists with university education. The question is which measures they must/can take if the shortages of this specific group of ICT specialists increases as expected. In the case of larger companies it is clear that they also recruit people straight from college or provide additional training for their existing staff. Smaller companies have fewer opportunities to take such steps. The question is which solutions are possible and desirable.
- An overview of national and/or international best and worst practices which provides guidelines for companies on how to meet the requirement for ICT specialists and users.

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