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Information and Communication Technologies (ICT) in Switzerland

From economic activity to occupations in various sectors

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Table of contents

1	Introduction	5	Tables		
2	The Information and Communication Technologies sector	6	T1	Share, in %, of the ICT sector's GVA in GDP	7
2.1	Definition and classification of ICT sector	6	T2	Contributions, in percentage points, of the ICT sector to GDP growth	8
2.2	Salient gross value added trends ...	7	T3	Contributions, in percentage points, of ICT sector labour productivity to productivity growth in the market economy	11
2.3	... reactive labour demand ...	9	T4	Share of ICT occupations in the main branches of economic activity	16
2.4	... and dynamic labour productivity	10	T5	Evolution of ranks of the main branches of economic activity	16
3	Employed population and their occupations	13	T6	Share of computer specialists in the main branches of economic activity	17
3.1	From the national economy...	13	Charts		
3.2	... to the Information and Communication Technologies sector ...	15	G1	Rates of change, in %, at prices of preceding year, of ICT sector GVA and GDP	7
3.3	... to occupations in the computer field	17	G2	Rates of change, in %, of FTE jobs in the ICT sector and in the national economy	8
4	Conclusions	19	G3	Rates of change, in %, of FTE jobs in the ICT sector, of ICT investments (GFCF) and of the economic cycle	9
5	Bibliography	20	G4	Rates of change, in %, of labour productivity in the ICT sector and in the market economy	11
List of abbreviations		20	G5	Decomposition of contributions, in percentage points, of ICT sector labour productivity	12
			G6	Relative shares of occupations in the national economy, by qualification level	14
			G7	Relative shares of occupations by economic sector (national economy)	14
			G8	Index (1991=100) of ICT occupations and of the total of occupations in the national economy	15
			G9	Indexed change (1991=100) of computer-related occupations	17
			G10	Rates of change, in %, of computer-related occupations	18

Appendixes

1	Classification of ICT goods and services activities	21
2	Classification of occupation type and associated skills	22
3	Classification of ICT-related occupations	22
4	Classification of occupations in the computer field	23

1 Introduction

It is generally acknowledged that since the 1990s, the Information and Communication Technologies (ICT) producing sector (goods and services) has contributed to the development of the member countries of the Organisation for Economic Cooperation and Development (OECD). Numerous studies have been undertaken to better understand and measure the national and international impact of this phenomenon. Since then, a large body of literature has emerged on the impact of the ICT sector on gross domestic product (GDP). All studies agree that the ICT sector has become a key factor in economic growth. However, the technological modifications brought about by this sector have also wrought significant changes in the composition of labour demand. In fact, the emergence of ever more powerful machines and the automation of production lines has resulted in the decrease of certain jobs (manual workers, etc.), but have also contributed to the development of certain specialised jobs (computer specialists, technicians, etc.).

This study has a twofold aim. **Chapter 2** presents a definition of the ICT sector. Next, it focuses on an examination of gross value added (GVA), its evolution and its contribution to GDP growth. Two other themes discussed are the current situation in the labour market and labour productivity. Particular emphasis is put on the prominent role of ICT-productive activities in industry and the service sector. **Chapter 3** presents a broad outline of the structure of the occupations practised by the employed population according to level of qualification (high, medium and low) in the national economy. The aim is to examine both the evolution of the composition of occupations and the dynamics of the change in the levels of qualifications. Particular emphasis is placed on analysing occupations related to the ICT sector and particularly to the computing field. **Chapter 4** presents the main results and conclusions of this study.

It is important to note that all the analyses presented in this paper were made with data available within the Federal Statistical Office (FSO). Consequently, no additional survey was carried out among enterprises or households.

Lastly, it should be noted that this study **does not contain an international comparison section**. Before tackling this aspect, it is important to begin by making full use of existing domestic data. This theme can be explored at a later date.

2 The Information and Communication Technologies sector

After defining the ICT goods and services sector (**chapter 2.1**), this section proposes an analysis of its GVA (**chapter 2.2**), the labour market (**chapter 2.3**) and its labour productivity (**chapter 2.4**). The aim is to determine the extent of the ICT sector's contribution to economic growth and the economy's labour productivity.

2.1 Definition and classification of the ICT sector

In recent years, various studies of the ICT goods and services sector have been undertaken at the international level, particularly within the OECD. These studies enable us to take a measure of the sector within each country and ensure the comparability of data at the international level.

The **ICT-producing sector** is defined as "all economic activities that produce goods and services facilitating the digitisation of the economy¹, which means converting information that is used or provided in electronic form that is easier to handle, communicate, store, recover, etc."²

The classification of the ICT-producing branches of economic activity (see Appendix 1) employed in this paper is based on the General Classification of Economic Activities (NOGA).³

Two aspects of this classification are worth mentioning:

1. It is **compatible with international recommendations**. It differs slightly from work undertaken within the OECD,⁴ in that it excludes the "Manufacture of office machinery" (NOGA 30.01A) branch. Thus, international recommendations were adjusted only at the margins to provide a more appropriate image of the ICT sector's economic reality in Switzerland.
2. It only contains **enterprises that have as their principal activity** the production of ICT goods or services. Consequently, it excludes all activities within enterprises that are not, by definition, carried out in an ICT branch. But many enterprises (e.g. big banks) manage numerous ITC activities themselves (e.g. they write their own data processing software). However, insofar as these activities are not outsourced to enterprises included in the classification in Appendix 1, they cannot be taken into account in the method used for this study of the ICT sector. Therefore, **the results based on the principal activity criterion represent only an approximation** that would ideally be complemented by an analysis based on ICT products. But the lack of complete and coherent statistics on "ICT products" in Switzerland makes this kind of analyses impossible.

¹ Digitisation of the economy refers to the transformation into digital information of the stocks and flows of information that are present and circulate through our economies.

² Source: Organisation for Economic Cooperation and Development (OECD), *Towards a List of Information Economy Products and Activities*, Stockholm 2002.

³ Federal Statistical Office (FSO), *Nomenclature générale des activités économiques* (General Classification of Economic Activities), Neuchâtel, 2002.

⁴ Following a revision of the classification of economic activities of the European Community (NACE Rev. 2), a new classification of ICT-producing economic activities is available. Because Swiss data are still not available for the new NOGA, these analyses are based on NOGA 2002.

2.2 Salient gross value added trends ...

Estimates of the ICT sector's GVA⁵ are based on an analysis of the Value Added Statistics⁶ (WS) produced by the FSO. Given that the first estimates of the WS refer to the year 1997, no data are available prior to that year.

On an annual average basis (over the 1997–2006 period), the share of GDP accounted for by the ICT sector's GVA reached 5.5%, at prices of preceding year (Table T1).

T1 Share, in %, of the ICT sector's GVA in GDP

Year	Share
1997	5.2%
1998	5.3%
1999	5.5%
2000	5.8%
2001	5.5%
2002	5.6%
2003	5.5%
2004	5.4%
2005	5.5%
2006	5.5%
1997–2006	5.5%

Source: FSO

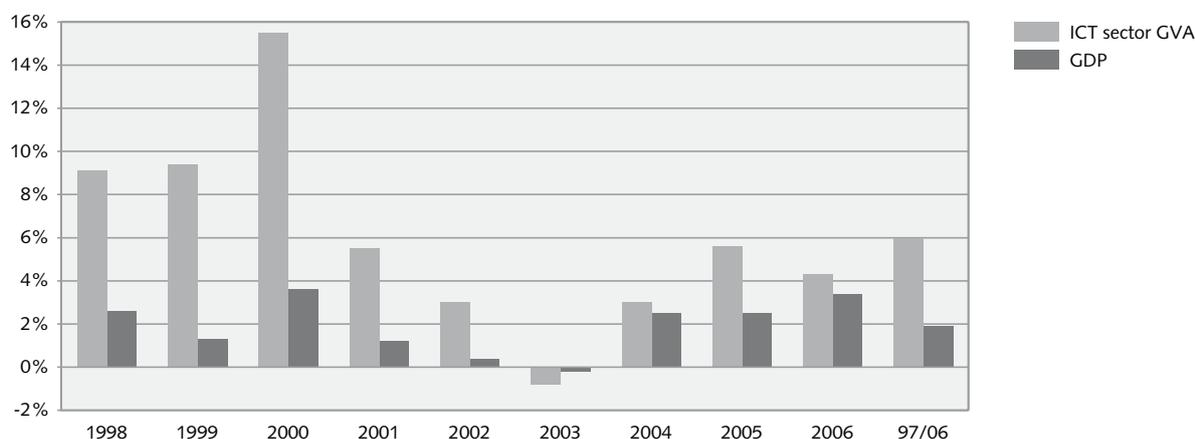
Chart G1 below shows that the ICT sector presented greater dynamism than the GDP (ICT sector's GVA annual average growth rate of 6.0%, compared to 1.9% for the GDP).

The second half of the 1990s was characterised by particularly strong GVA growth in the ICT sector. The ICT sector profited not only from rapid advances in technologies and the rapid expansion of the Internet as of 1996 but also from measures taken by enterprises to prepare themselves for the passage to the year 2000. As of 2002, the sector began to show signs that it was running out of steam and it even registered negative growth in 2003 (see chart G1 above). Nevertheless, this decline was an exception in the period under review.

Data adjusted to reflect the price effect allow us to show the change in volume (or quantity).⁷ Thus, the average annual GVA growth for the whole period was 3.3% at current prices. Taking account of an average annual price decline of 2.6%, the change in volume of GVA was +6.0%.

The ICT sector in Switzerland is **essentially based on service activities** (telecommunications and computer-related activities), which account for nearly 75% of the ICT sector. Telecommunications services exert a particu-

Rates of change, in %, at prices of preceding year, of ICT sector GVA and GDP G 1



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⁵ Unless otherwise indicated, the data are expressed at prices of preceding year, base year = 2000.

⁶ The Value Added Statistics is an annual survey conducted since 1997 which is based on a sample of 12,000 enterprises established in Switzerland (excluding the primary sector, banks, insurance firms and public authorities). For further details on the method for estimating the ICT sector's GVA, see Federal Statistical Office, *Rapport de méthodes, Technologies de l'information et de la communication, Estimations sur la base de la statistique de la valeur ajoutée*, Neuchâtel, 2008.

larly strong influence on the whole of the ICT sector in Switzerland. The **liberalisation of the telecommunications market** in 1998, which contributed to the emergence of new enterprises, paved the way for greater

⁷ NB: the value corresponds to volumes (quantities) multiplied by the prices.

market competition. From 2000 onwards, new operators, which quickly established roots in the domestic market, waged a price war (sporadic special offers, price reductions, customised subscriptions) in an attempt to win the greatest market share. As a result, prices in the telecommunications sector dropped by 20.6% in 2000. This price effect generated a GVA rise of +27.2% in the telecommunications sector. This strong volume growth was mainly attributable to the rise of new fields, such as access to internet services and mobile telephony, which had a knock-on growth effect on computer-related activities which, in turn, led to a significant expansion of services in the ICT sector.

In 2003, we saw **negative GVA growth** in the ICT sector. This was attributable to a decline in the GVA of computer-related activities (-10.5%), which was partly due to a rise in prices of +1.3%.

An analysis of the ICT sector's GVA rates of change by itself does not allow us to determine whether this sector has been an engine of economic growth in Switzerland. Consequently, we need to examine this sector's **contributions**⁸ to GDP growth (see table T2 below).

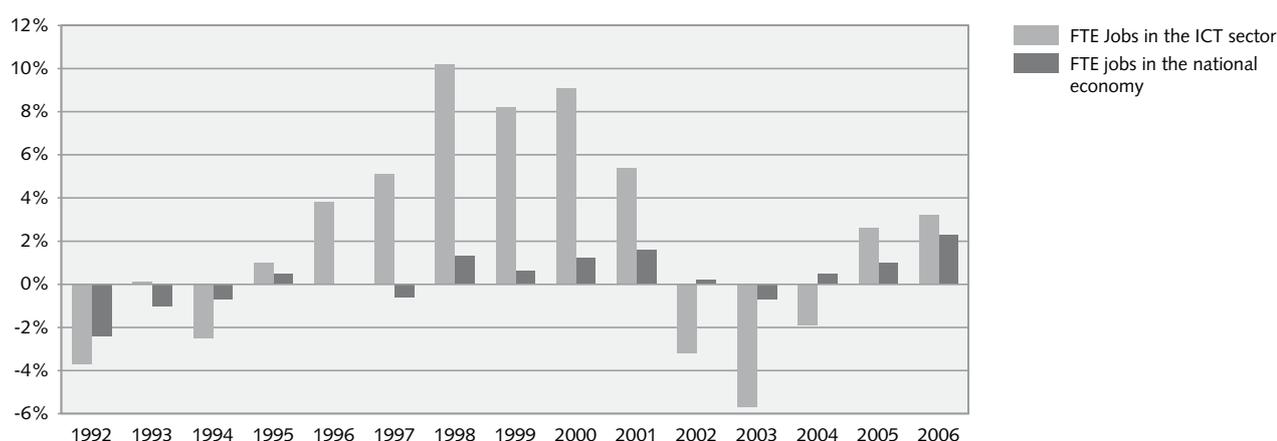
T2 Contributions, in percentage points, of the ICT sector to GDP growth

Year	ICT sector contributions	GDP trend	Relative share
1998	0.5%	2.6%	19.2%
1999	0.5%	1.3%	38.5%
2000	0.8%	3.6%	22.2%
2001	0.3%	1.2%	25.0%
2002	0.2%	0.4%	50.0%
2003	0.0%	-0.2%	-
2004	0.2%	2.5%	8.0%
2005	0.3%	2.5%	12.0%
2006	0.2%	3.4%	5.9%

Source: FSO

The results in this table are presented as **percentage points of GDP** at prices of preceding year. For example, in 2002 the ICT sector's GVA growth represented 0.2 percentage points of the growth of GDP (+0.4%). In other words, the growth of the ICT sector accounted for 50% of GDP growth in 2002. Considering its relatively small share of GDP, this result is mainly attributable to the dynamic growth of the ICT sector. However, to put this result into perspective it is worth noting that certain sectors that have a significant weight in the economy, such as the hotels and restaurants sector, banking, insurance and other business services, registered a negative contribution in 2002, *de facto* reinforcing the significant contribution by the ICT sector to the growth of the economy.

Rates of change, in %, of FTE jobs in the ICT sector and in the national economy G 2



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⁸ For more in-depth information on the concept of contributions, see FSO, *L'économie suisse des années 90 à nos jours. Faits marquants et analyses conjoncturelles*, Neuchâtel, 2005, pp. 35-37.

Between 1998 and 2006, the ICT sector's **contributions to GDP growth were positive without exception**. It is beyond dispute that despite its relatively small size, this sector made a significant contribution to the growth of the Swiss economy. However, from 2003 onwards, there was a noticeable decline in the relative share of the ICT sector's contributions to GDP growth. Evidently, after the sector's strong growth around the year 2000, it grew at a more stable pace. This phenomenon is connected to the end of the series of restructuring waves which the economy experienced.

2.3 ... reactive labour demand ...

As shown in chapter 2.2, the **ICT sector's GVA displays significant dynamism**. Next, we need to broaden our analysis and consider the situation in the labour market. To this end, this chapter analyses full-time equivalent (FTE) ⁹ jobs.

Chart G2 below shows the rates of change of FTE jobs in the ICT sector and in the national economy from 1992 to 2006.

During the period under review, the rate of change of FTE jobs in the ICT sector followed the FTE employment rate in the national economy, but was even more pronounced. In other words, labour demand was higher in the ICT sector than in the national economy (the ICT sector's annual average FTE job growth rate was +2.0%, compared to +0.2% for the national economy).

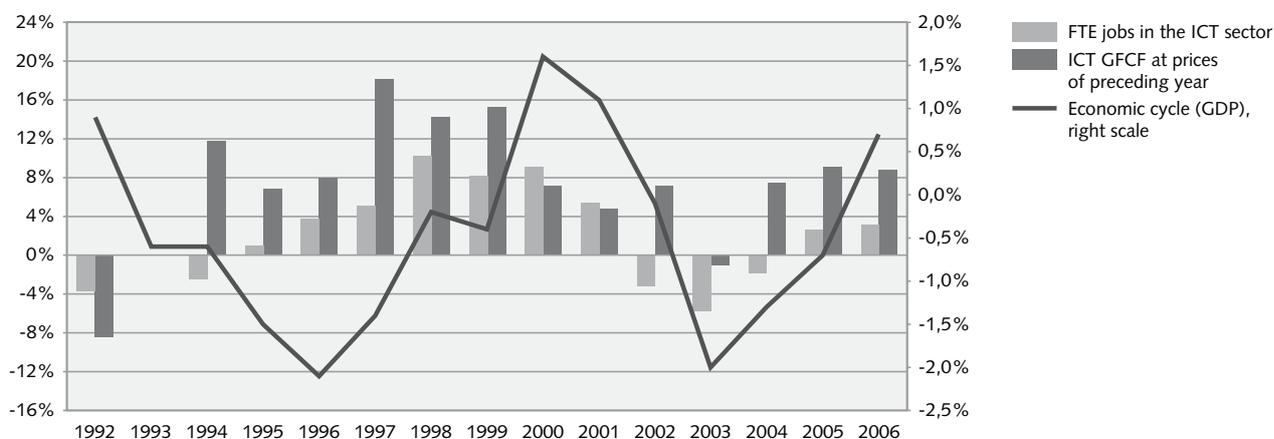
During the 1997–2001 period, FTE employment in the ICT sector grew, on annual average, by 8.2%, to subsequently decline by -0.5% between 2002 and 2006.

The rapid expansion of ICT enterprises had a clear impact on the labour market and particularly on the computer-related activities sector, which experienced an average annual FTE job growth rate of +6.6% over the whole of the period under review. Between 1997 and 2001, the average annual growth rate even reached 15.9%.

This analysis becomes even more pertinent if we correlate the rate of change of FTE jobs in the ICT sector with investment in ICT goods (GFCF) and the economic cycle¹⁰ (see chart G3 below).

Rates of change, in %, of FTE jobs in the ICT sector, of ICT investments (GFCF) and of the economic cycle

G 3



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⁹ Full-time equivalent jobs convert jobs held by persons who work part time into full-time jobs. Because the series goes back to 1991, it is possible to undertake a longer-term analysis than for the GVA.

¹⁰ For further details on the concept of the economic cycle, see FSO, *L'économie suisse des années 90 à nos jours. Faits marquants et analyses conjoncturelles*, Neuchâtel, 2005, pp. 6–16.

An analysis of the labour market in relation to the economic cycle shows four periods:

1991–1996:

The FTE employment for the ICT sector as a whole declined by 0.3% on annual average. The ICT industry¹¹ alone registered a fall of 3.8%. This poor performance was essentially a reflection of an unfavourable economic climate (annual GDP growth rate of 0.4% at prices of preceding year) during this period, which was marked by a series of political and economic events (the disappearance of the Soviet Union, the invasion of Kuwait, an oil price explosion, restrictive monetary policies, high inflation, etc.). Investment in ICT goods grew by 3.4% on annual average at the previous year's prices. This positive trend proved unable to quickly shore up FTE employment in the ICT sector. Nonetheless, the strong increase in investment had a noticeable effect on the labour market from 1995 onwards (FTE growth rate for the ICT sector of +3.8% between 1995 and 1996).

1996–2000:

This period was characterised by a notable improvement in the economic climate (average annual GDP growth of 2.4%). There was noticeably strong FTE job growth in the ICT sector (+8.1%), as well as sustained growth in investment in ICT goods (+13.6%) – for the most part computers, measuring instruments and software. The rapid expansion of new technologies led to the creation of many small and specialised companies (start-ups), notably in the field of computer consulting services. This period was a real golden age for ICT enterprises and jobs.

2000–2003:

In 2003, the ICT sector's labour market began to show signs that it was running out of steam. That year, the economy entered a recessionary phase that led to the disappearance of numerous start-ups. Moreover, the weak economic climate prompted big ICT sector enterprises, which were already well established in the economy, to implement restructuring and rationalisation programmes that inevitably hurt employment (a 1.3% decline on annual average). Investments in ICT goods continued to grow but at a slower pace than previously (+3.6% on annual average) and therefore did not contribute to job growth.

2003–2006:

The economic situation began to improve in 2004 (average annual GDP growth of 2.9%), easing pressure on the ICT labour market. Despite negative job growth in 2003 and 2004, ICT-sector employment grew by +1.3% on annual average. Investments in ICT goods were again more dynamic than in the previous period (average annual growth of +8.5%), which had positive repercussions on labour demand.

The main conclusions to be drawn from the analysis of the ICT sector's labour market are that investments in ICT goods did not have an immediate impact on employment and that what effects they did have took some time to manifest themselves. Furthermore, ICT sector employment followed a pro-cyclical behaviour pattern.

2.4 ...and dynamic labour productivity

In this paper, the analyses of labour productivity¹² by branches of economic activity do not refer to GDP but rather to the **market economy**¹³. This approach was chosen due to certain characteristics of the definition of the GDP. The GDP comprises the GVA of all economic agents active in a country's economic territory. Consequently, it encompasses economic agents, such as the public administration, which do not pursue the logic of profitability but rather objectives defined by society. However, referring to GDP can be problematic when the focus of analysis is on the structure or dynamic of a **part of the economy that is driven by the logic of profitability**, as is the case for the ICT sector. It therefore makes more sense to **exclude the non-market part** of the GDP and to include only the market sector as a referent.¹⁴

Chart G4 below shows the rates of change of labour productivity in the ICT goods and services sector as well as in the market economy.

¹¹ Appendix 1 presents the branches that comprise the ICT industry.

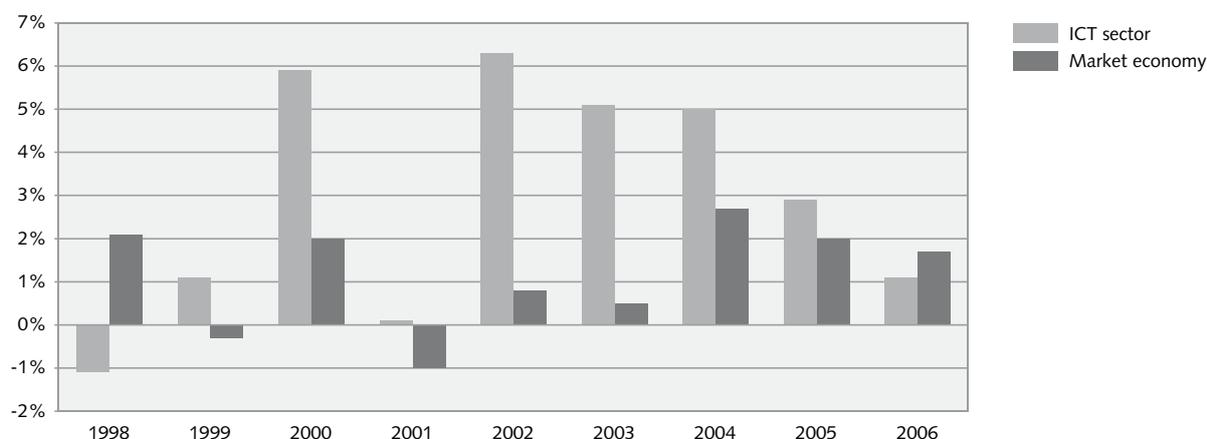
¹² Labour productivity is a ratio that correlates GVA (numerator) with FTE jobs (denominator). It measures the efficiency with which human resources are employed in the production process. For more details, see FSO, *Productivité du travail, Comparaisons internationales: Le rôle des données dans l'interprétation des résultats*, Neuchâtel, 2004, pp. 7–8.

¹³ For further detail on the market economy, see FSO, *Analyse structurelle de l'économie suisse: Evolution du secteur manufacturier de 1991 à 2005, Vers une concentration sur les branches à forte valeur ajoutée*, Neuchâtel, 2008, p. 5.

¹⁴ In short, the "non-market economy" refers to all economic agents who sell what they produce at a price that covers less than 50% of production costs.

Rates of change, in %, of labour productivity in the ICT sector and in the market economy

G 4



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Labour productivity in the ICT sector showed more dynamic growth than in the market economy. On annual average over the 1997–2006 period, the ICT sector's labour productivity grew by +2.9%, compared to +1.2% for the market economy.

The years 2000, 2001 and 2002 merit particular analysis because although they showed positive growth, in 2001 in particular it was distinctly less dynamic.

In 2000, the price drop experienced by the ICT sector (see chapter 2.2) provoked a significant increase in GVA (+15.5%). However, strong FTE job growth (+9.1%) limited the effect this had on productivity (+5.9%).

The ICT sector's weak productivity growth in 2001 (+0.1%) was a reflection of strong growth in FTE employment (+5.4%). The positive growth of ICT sector GVA (+5.5%) barely compensated for the growth in employment.

The steep growth registered in 2002 was a reflection of a drop in FTE employment (-3.2%) and excellent ICT GVA growth (+3.0). As a consequence, labour productivity registered its widest variation (+6.3%).

Having established these trends, we can now deepen our analysis by determining whether the ICT sector was, in fact, an engine for labour productivity growth in the market economy. To this end, we will analyse the **contributions** made by ICT sector labour productivity to the growth of productivity of the market economy (see table T3 below).

T3 Contributions, in percentage points, of ICT sector labour productivity to productivity growth in the market economy

Year	ICT sector contributions	Market economy evolution	Relative share
1998	0.5%	2.1%	23.8%
1999	0.6%	-0.3%	-
2000	0.9%	2.0%	45.0%
2001	0.3%	-1.0%	-
2002	0.2%	0.8%	25.0%
2003	0.0%	0.5%	0.0%
2004	0.2%	2.7%	7.4%
2005	0.3%	2.0%	15.0%
2006	0.1%	1.7%	5.9%

Source: FSO

The year **1998** reveals an interesting phenomenon. Although labour productivity in the ICT sector declined (see chart G4 above), it made a positive contribution (+0.5 of a percentage point) to the market economy's labour productivity. A more refined analysis of the contribution made by ICT sector labour productivity can help explain this seemingly paradoxical situation.

The decomposition of contributions shows **three effects**:

1. Direct effect:

This effect reflects the evolution of the contribution due to the evolution of the ICT sector's contribution itself.

2. Reallocation effect:

This effect captures the impact of the reallocation of the labour production factor in the ICT sector to the productivity of the market economy. A positive value indicates that the reallocation of the labour factor to the ICT sector has a positive effect on the market economy's labour productivity.

3. Interaction effect:

This is a residual effect that captures the simultaneous effects of changes affecting productivity and employment.

Chart G5 below shows the decomposition of the contributions of ICT sector labour productivity.

Let us go back to the example of **1998**. The ICT sector's labour productivity registered negative growth (-1.1%, see chart G5 above) but nonetheless made a positive contribution (+0.5%, see table T3) to labour productivity in the market economy. This result is attributable to a positive **reallocation effect** (+0.6 of a percentage point) which amply offsets the negative **direct effect** (-0.1 of a percentage point). In other words, the reallocation of jobs towards the ICT sector (ICT FTE job growth of +10.2%) had a very positive effect on labour

productivity in the market economy but not in the ICT sector. In fact, this sharp employment rise did not have the same impact on the ICT sector's GVA, which grew by +9.0%. Consequently, because the denominator (employment) rose at a faster rate than the numerator (GVA), labour productivity in the ICT sector sank by -1.1% (see chart G5), producing the direct negative effect noted above. It should also be noted that 1998 was an exception in that the direct effect was systematically positive in the years that followed.

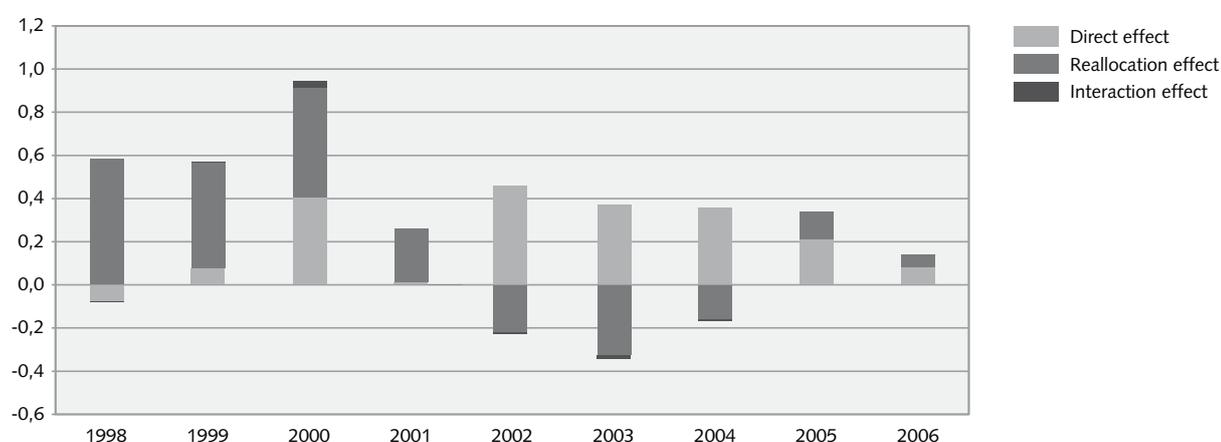
We also note that the **reallocation effect** was negative in the years 2002, 2003 and 2004. This result was a reflection of a decline in the sector's FTE employment during these years (2002:

-3.2%, 2003: -5.7% and 2004: -1.9%). This reallocation of employment from the ICT sector to the rest of the economy curbed the growth of the economy's labour productivity. This finding is particularly true for the years 2002 and 2003. The direct effect remained positive because the rate of the decline in employment was higher than that of the ICT sector's GVA. Therefore, labour productivity grew but at a slower rate.

The ICT sector provided significant support to the growth of labour productivity in the market sector. Our analysis of the decomposition of the contribution shows that a reallocation of employment from the economy to the **ICT sector resulted in a positive contribution to the growth** of labour productivity in the market economy.

Decomposition of contributions, in percentage points, of ICT sector labour productivity

G 5



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3 Employed population and their occupations

Chapter 2 looked at the ICT sector from an essentially monetary perspective (GVA, investments, labour market and labour productivity). However, an increase in investments in ICT goods alone is not sufficient to have a substantial effect on the economy if such investments are not accompanied by the recruitment of qualified personnel. Therefore, this section proposes to discuss the composition and dynamism of the **occupations practised by employed persons**.

The term “employed persons”¹⁵ refers to persons who were aged 15 or older and met one of the following criteria during the reference week:

- worked in gainful employment for at least one hour per week
- had a job as an employee or self-employed worker although they were temporarily absent from work (due to illness, maternity leave, holiday, military service, etc.)
- worked without pay in the family business

Chapter 3.1 presents an analysis of the situation at the level of the national economy. The aim is to see how these occupations, broken down by qualification level, are distributed across the Swiss economy. The **other chapters** focus on an analysis, by branch, of ICT-related occupations (chapter 3.2) and occupations in the computer field (chapter 3.3).

The analysis of occupations practised by the employed population is based on the International Standard Classification of Occupations (ISCO, 1988 version),¹⁶ which was developed by the International Labour Organisation (ILO). Based on this classification and on work done by the OECD,¹⁷ it is possible to regroup the different categories of occupations according to qualification levels (see Appendix 2).

¹⁵ For a more detailed definition of employed active persons, see FSO, *Indicateurs du marché du travail*, Neuchâtel, 2007, p. 31.

¹⁶ A revised version of this classification is planned for 2008.

¹⁷ For further details, see OECD, *Skills by Industry Database (ANSKILL): Contents, Majors Trends and Issues for Further Investigation*, Working Party on Industry Analysis, Paris, 2007.

In Switzerland, data on the employed population broken down by occupations come from the Swiss Labour Force Survey¹⁸ (SLFS) conducted by the FSO.

3.1 From the national economy ...

Chart G6 below shows the relative shares of the different qualification level categories in the employed population.

On annual average, the relative share of employed persons with medium-skilled occupations was 47.9%, compared to 42.1% for persons with high-skilled occupations and 10.9% for persons with low-skilled occupations. It is worth noting, however, that from 1991 to 2006, the share of persons with high-skilled occupations presented a rising profile while the share of persons with medium-skilled occupations declined. The two curves crossed in 2005. This result is attributable to opposing dynamics in the employed population with high-skilled occupations (+2.5% on annual average) and the employed population with medium-skilled occupations (-0.2% on annual average).

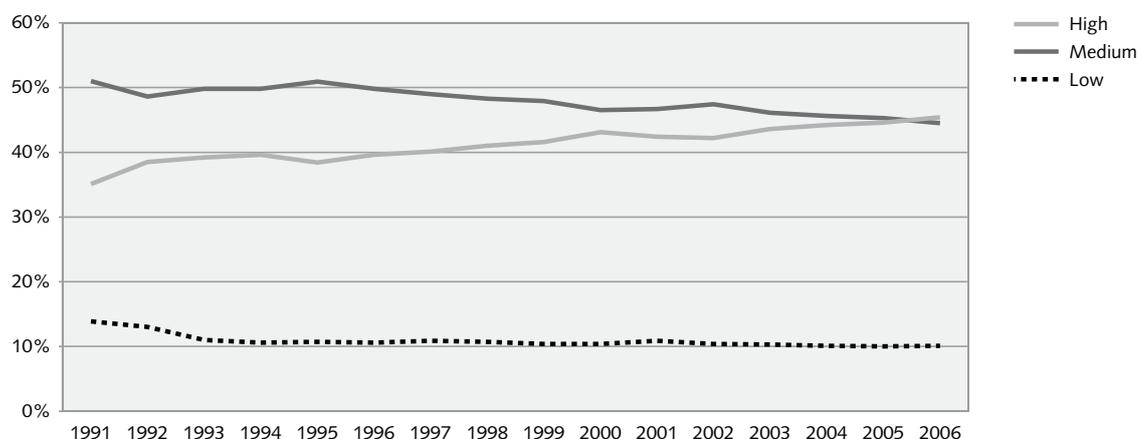
Chart G7 shows that the Swiss economy **has tended to specialise in service activities**. Thus, the tertiary sector's relative share went from 67% in 1991 to 73% in 2006 and did not stop growing throughout the period (except in 1995). This result is corroborated by a recent FSO analysis of the manufacturing sector.¹⁹ This study concludes that Switzerland has gone through a series of successive restructuring waves, both in the labour market and in production activities, which have led to a decline of the manufacturing sector to the benefit of the service sector. However, not all branches of economic

¹⁸ The SLFS is an annual household survey whose principal aim is to obtain and provide data about the Swiss labour force and its occupational behaviour. For further details, see FSO, *Indicateurs du marché du travail*, Neuchâtel, 2007, pp. 49–50.

¹⁹ For further detail on the tertiarisation of the Swiss economy, see FSO, *Analyse structurelle de l'économie suisse, Evolution du secteur manufacturier de 1991 à 2005, Vers une concentration sur les branches à forte valeur ajoutée*, Neuchâtel, 2007.

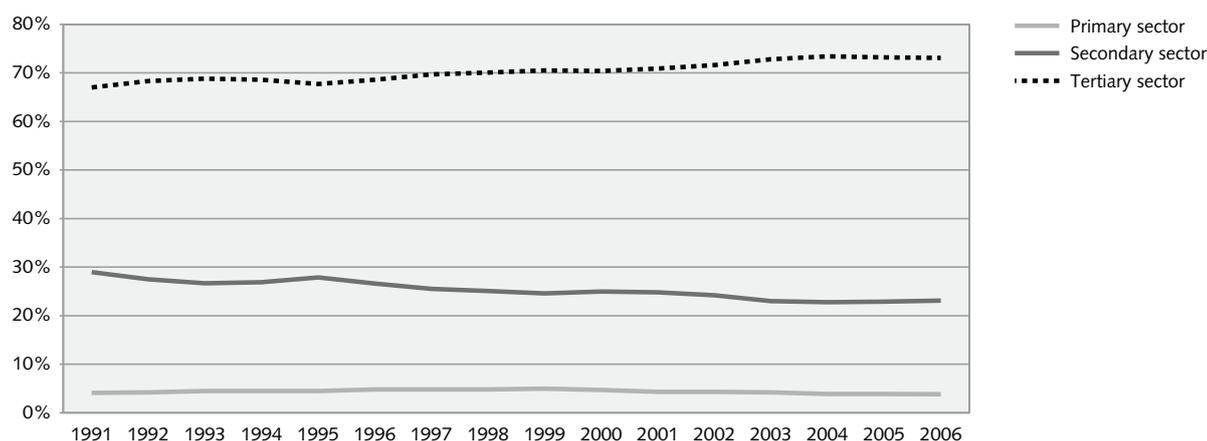
Relative shares of employed population in the national economy, by qualification level

G 6



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Relative shares of employed population by economic sector (national economy) G 7



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activity have been affected in the same way. Thus, we observe a **restructuring phenomenon** that has led to a **concentration of resources** (both human and financial) in branches of economic activity with high value added (tobacco, chemical, medical, optical instruments and watchmaking industries).

The tertiarisation of the economy is as much a reflection of technological advances as of the rapid expansion of ICT services, which facilitate the unbundling of production processes, geographic localisation and the outsourcing of certain production activities, such as low-tech handling work, to emerging countries.

3.2 ... to the information and communication technologies sector ...

Chapter 3.1 presented a global overview of the employed population by level of qualification. Since this paper aims to analyse the ICT sector, this section focuses on an examination of the development of ICT-related occupations during the 1991–2006 period.

By focusing on occupations we are able to identify the distribution of employed persons with ICT-related occupations across all branches of economic activity (NOGA 1) and not just within one selected segment of them. This analysis allows us to highlight any potential structural dynamic.

Before proceeding to an analysis of the results, we need to define **ICT-related occupations**. The OECD distinguishes three categories of ICT competencies:²⁰

Specialists:

Persons who have the ability to develop, operate and maintain ICT systems. In other words, ICTs constitute the main part of these persons' job.

Advanced users:

Competent users of advanced software tools. ICTs are not the main job but a tool.

Basic users:

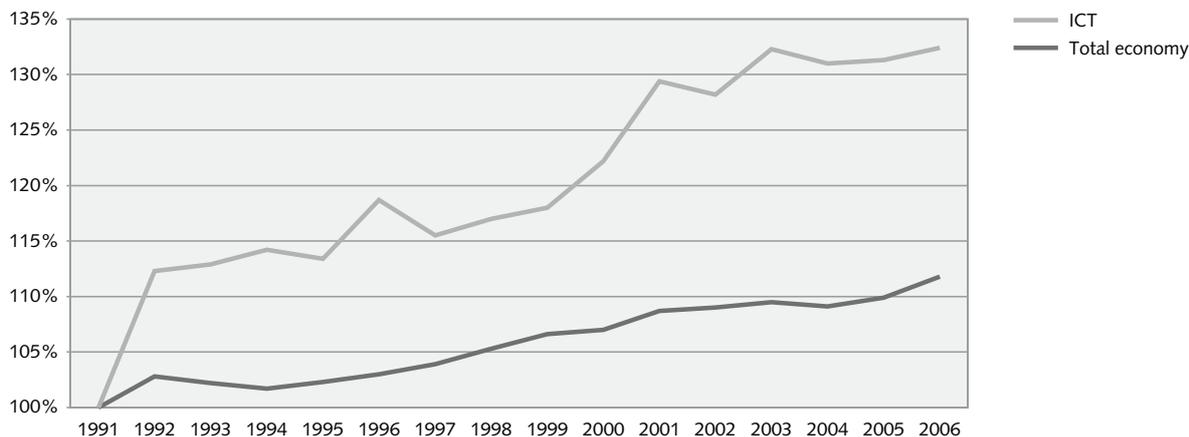
Competent users of generic ICT tools (e.g. word-processing software). ICTs are not the main job.

These three categories are employed in the classification of ICT-related occupations used for this analysis (see Appendix 3). This choice aims to offer a broader perspective on the use of ICTs in various occupations.

Chart G8 below presents the indexed change (1991=100) of employed population with ICT-related occupations and of the total employed population in the national economy.

With an average annual growth rate of +1.9%, the employed population with ICT-related occupations registered more dynamic growth than the total employed population in the national economy (+0.7% on annual average).

Index (1991=100) of employed population with ICT occupations and of the total employed population in the national economy **G 8**



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²⁰ OECD, *New Perspectives on ICT Skills and Employment*, Working Party on the Information Economy, Paris, 2005.

We observe particularly marked growth during the 1997-2001 period (average annual growth of +2.9%). This growth is consistent with that observed in chapter 3.2 for FTE employment and investments in ICT goods.

This analysis becomes considerably more pertinent if we look at the distribution of employed persons with ICT occupations by NOGA 1 branches. Table T4 below shows the branches of economic activity with the highest proportion of employed persons who practise an ICT-related occupation.

T4 Share of employed persons with ICT occupations in the main branches of economic activity

Year	Manufacturing sector	Retail trade and repair	Banking and insurance	Real estate, rental, computing, R&D
1991	20%	18%	14%	17%
1992	18%	18%	16%	17%
1993	18%	18%	15%	18%
1994	18%	17%	16%	18%
1995	18%	16%	15%	19%
1996	18%	17%	16%	20%
1997	17%	17%	15%	22%
1998	17%	16%	14%	23%
1999	17%	16%	15%	22%
2000	17%	15%	15%	22%
2001	17%	15%	16%	23%
2002	16%	14%	17%	23%
2003	14%	13%	17%	24%
2004	14%	12%	17%	25%
2005	15%	12%	16%	25%
2006	15%	11%	17%	25%

Source: FSO

The results of this table are read across the rows. Thus, in 1991, 20% of ICT occupations were in the manufacturing sector.

Over the whole period, the share of employed persons with ICT occupations grew in the banking and insurance branches, as well as in real estate, computing and research and development (R&D). This result is not surprising in view of the fact that these branches are **knowledge-intensive²¹ and present high labour productivity levels.**

The evolution of ranks of the various NOGA 1 branches (table T5 below) shows that until 1993, the manufacturing, retail trade and repair sector branches presented the highest proportions of employed persons with ICT-related occupations. Starting in 1994, the real estate, computing and R&D branch climbed from the third to the first position. From 2001 to 2006, the real estate, IT, R&D and banking and insurance branches occupied the first two places.

T5 Evolution of ranks of the main branches of economic activity

Year	Manufacturing sector	Retail trade and repair	Banking and insurance	Real estate, rental, computing, R&D
1991	1	2	4	3
1992	1	2	4	3
1993	1	2	4	3
1994	2	3	4	1
1995	2	3	4	1
1996	2	3	4	1
1997	2	3	4	1
1998	2	3	4	1
1999	2	3	4	1
2000	2	3	4	1
2001	2	4	3	1
2002	3	4	2	1
2003	3	4	2	1
2004	3	4	2	1
2005	3	4	2	1
2006	3	4	2	1

Source: FSO

Several elements can explain this phenomenon. The reorientation of economies towards **more knowledge-intensive activities** played a role in this trend in that it stimulated growth in branches such as R&D and business consulting, as did the growing trend by enterprises to **outsource certain service activities**. In fact, for a variety of reasons (cost, expertise, etc.), enterprises increasingly outsourced service activities, such as computer-related activities, which were previously handled in-house. Outsourcing was also seen as a solution to the problem of hiring specialised personnel. In addition, there was also **apprehension about the passage to the year 2000**, which generated strong demand in those branches which had invested heavily in computer equipment (banks, insurance firms, etc.).

²¹ For more detail, see FSO, *L'économie suisse des années 90 à nos jours, Faits marquants et analyses conjoncturelles*, Neuchâtel, 2005.

3.3 ... to occupations in the computer field

The previous chapter highlighted a concentration of persons employed with ICT-related occupations in certain branches of economic activity. Because the ICT sector is mainly centred on service activities (telecommunication and computer-related activities), it is worth broadening our analysis to include occupations in the computer field. Appendix 4 presents the classification applied here.

T6 Share of computer specialists in the main branches of economic activity

Year	Manufacturing sector	Retail trade and repair	Banking and insurance	Real estate, rental, computing, R&D
1991	21%	16%	22%	20%
1992	22%	18%	19%	19%
1993	22%	20%	15%	22%
1994	19%	17%	17%	22%
1995	18%	16%	19%	26%
1996	17%	13%	16%	38%
1997	16%	13%	11%	42%
1998	13%	12%	9%	41%
1999	14%	17%	13%	34%
2000	14%	14%	17%	33%
2001	14%	10%	15%	38%
2002	16%	10%	14%	40%
2003	14%	10%	15%	39%
2004	14%	10%	15%	42%
2005	14%	8%	16%	43%
2006	15%	7%	15%	42%

Source: FSO

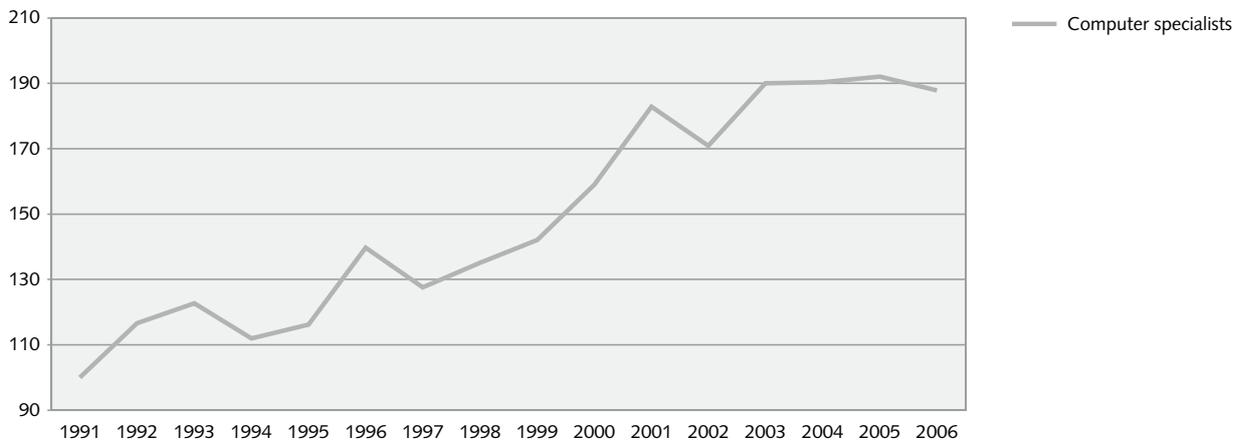
The results of this table are also read across the rows. Thus, in 1991, 21% of employed persons with occupations in the computer field were in the manufacturing sector.

Our analysis of the relative share of persons practising an occupation in a computer-related field (see table T6 above) shows that computer specialists were again mainly concentrated in the real estate, computing and R&D branches, as well as in banking and insurance.

Computer-related occupations seem to have evolved independently of the economic cycle. In fact, the average annual growth rate in the number of computer specialists was positive regardless of whether the economy was in recession or expanding (see chart G9 below). In other words, this occupational category responds more to a structural need in the economy than to fluctuations in the economic cycle. But this statement needs to be put into perspective. In fact, during recessionary periods (such as 1991–1996), companies tended to postpone investment in computer-related projects – a fact that affected the computer-specialist labour market. Strong growth in some years (+16.6% in 1992, +20.0% in 1996 and +15.0% in 2001) masks the effect attributable to the economic situation.

Indexed change (1991=100) of employed population with computer-related occupations

G 9

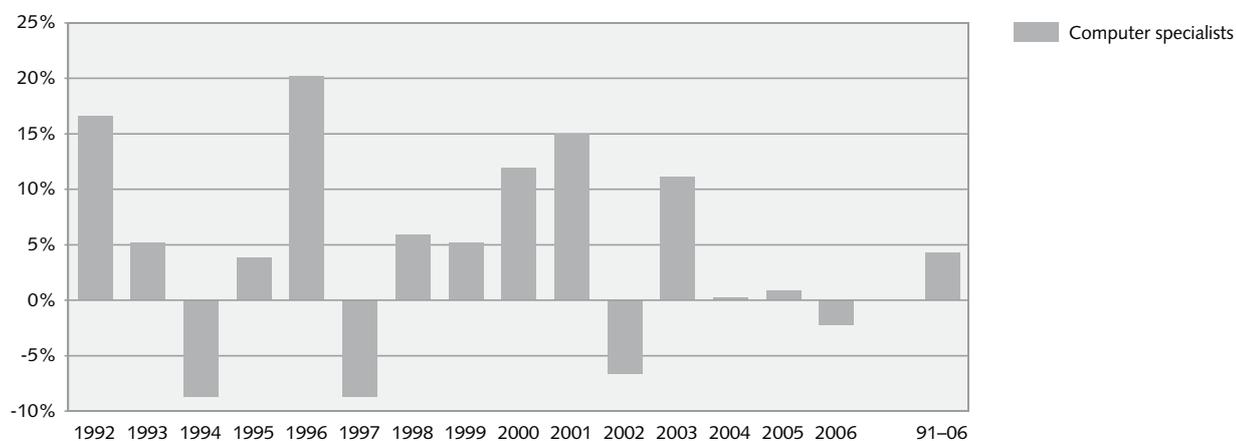


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As is clear from chart G10 below, the number of employed persons with occupations in the computer field exhibit highly volatile rates of change. But this volatility is not incompatible with the structural needs mentioned above. In fact, over the whole period, demand for computer specialists rose by +4.3% on annual average (chart G10). There was thus a definite upward trend. Consequently, the **volatility** was not only a reflection of **ad hoc needs** related to structural changes in the branches of economic activity but also to **needs arising from the economic situation**.

Banks, insurance companies and the real estate, computing and R&D branches alone represented 60% of the employed persons with computer-related occupations. Apprehension about the passage to the year 2000 and the introduction of the euro resulted in a sharp rise in the number of employed persons with computer-related occupations in banks and insurance companies. On the other hand, restructurings and mergers had a downward effect on the number of computer specialists.

Rates of change, in %, of computer-related occupations **G 10**



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4 Conclusions

The preceding analysis has highlighted a number of facts that have determined the development of the ICT sector within the Swiss economy:

- ICT goods and services activities registered dynamic growth. Despite its relatively modest size (the proportion of GDP accounted for by GVA was 5.5% on annual average), the ICT sector made an **important contribution to Swiss economic growth**, particularly thanks to the dynamic growth of service activities.
- The evolution of the labour market led to a **pro-cyclical behaviour pattern in ICT-sector employment**.
- The rapid expansion of ICT enterprises was accompanied by a rise in FTE employment (+2.0% on annual average from 1991 to 2006). This phenomenon was particularly pronounced in the computer-related activities branch, which experienced FTE job growth of +15.9% between 1997 and 2001.
- The decomposition into three effects of the **contributions made by ICT sector labour productivity** to the labour productivity of the market economy underscores the positive effect of a reallocation of human resources towards the ICT sector.
- Our analysis of the **occupations practised by the employed population**, broken down by level of qualification (high, medium and low), shows that the Swiss economy is based on high qualifications. The outsourcing of certain activities, the restructuring of the manufacturing sector, the concentration of resources in branches of economic activity with a high value added and the rapid expansion of ICT services fostered the tertiarisation of the Swiss economy.
- **Employed persons with ICT-related occupations** were increasingly concentrated in high-productivity branches such as banking, insurance, real estate, computing and R&D. This phenomenon is partly attributable to the reorientation of economies towards more knowledge-intensive activities and the increased trend by companies to outsource certain service activities.

The evolution of the **employed population with occupations in the computer field** was very volatile. This phenomenon was not only a reflection of **ad hoc needs** related to structural changes in the branches of economic activity but also to **needs arising from the economic situation**. Banks, insurance companies and the real estate, computing and R&D branches alone represented 60% of the employed persons with computer-related occupations. Apprehension about the passage to the year 2000 and the introduction of the euro resulted in a sharp rise in the number of employed persons with computer-related occupations in banks and insurance companies. On the other hand, restructurings and mergers had a downward effect on the number of computer specialists.

This study is based on **data available** within the Federal Statistical Office. In other words, no additional survey was conducted.

The findings of this analysis **shed new light** on the subject of information technologies and communications in our economy. They are, therefore, an additional statistical contribution to future analyses of our economic environment.

5 Bibliography

Federal Statistical Office (FSO), *Analyse structurelle de l'économie suisse, Evolution du secteur manufacturier de 1991 à 2005, Vers une concentration sur les branches à forte valeur ajoutée*, Neuchâtel, 2008.

FSO, *Indicateurs du marché du travail*, Neuchâtel, 2007.

FSO, *L'économie suisse des années 90 à nos jours, faits marquants et analyses conjoncturelles*, Neuchâtel, 2005.

FSO, *Nomenclature générale des activités économiques*, Neuchâtel, 2002.

FSO, *Productivité du travail, Comparaisons internationales: Le rôle des données dans l'interprétation des résultats*, Neuchâtel, 2004.

FSO, *Technologies de l'information et de la communication, Estimations sur la base de la statistique de la valeur ajoutée*, Rapport de méthodes, Neuchâtel, 2008.

Organisation for Economic Cooperation and Development (OECD), *New Perspectives on ICT Skills and Employment*, Working Party on the Information Economy, Paris, 2005.

OECD, *Skills by Industry Database (ANSKILL): Contents, Majors Trends and Issues for Further Investigation*, Working Party on Industry Analysis, Paris 2007.

OECD, *Towards a List of Information Economy Products and Activities*, Stockholm 2002.

Abbreviations

FSO	Federal Statistical Office
FTE	Full-time equivalent
GDP	Gross domestic product
GFCF	Gross fixed capital formation
GVA	Gross value added
ICT	Information and Communication Technologies
ISCO	International Standard Classification of Occupations
NOGA	General Classification of Economic Activities
OECD	Organisation for Economic Cooperation and Development
R&D	Research and Development
SLFS	Swiss Labour Force Survey
WS	Value Added Statistics

Appendixes

Appendix 1: Classification of ICT goods and services activities

NOGA 2002	Classification	Economic Sector
3002A	Manufacture of computers and other information processing equipment	Manufacturing
3130A	Manufacture of insulated wire and cable	Manufacturing
3210A	Manufacture of electronic components	Manufacturing
3220A	Manufacture of telecommunication apparatus	Manufacturing
3230A	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods	Manufacturing
3320A	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes	Manufacturing
3330A	Manufacture of industrial process control equipment	Manufacturing
5184A	Wholesale of computers, computer peripheral equipment and software	Services
5184B	Wholesale of software	Services
5186A	Wholesale of electronic parts and equipment	Services
6420A	Telecommunications except transmission of radio and TV broadcasting	Services
6420B	Transmission of radio and TV broadcasting	Services
6420C	Internetprovider	Services
7133A	Renting of office machinery and equipment, including computers	Services
7210A	Hardware consultancy	Services
7221A	Publishing of software	Services
7222A	Software consultancy and development	Services
7230A	Data processing	Services
7240A	Database activities	Services
7250A	Maintenance and repair of office, accounting and computing machinery	Services
7260A	Other computer related activities	Services

Source: OECD

Appendix 2: Classification of occupation type and associated skills

Occupation type	Associated Skills
Legislators, senior officials, managers	High skilled
Professionals	High skilled
Technicians and associate professionals	High skilled
Clerks	Medium skilled
Service workers and shop and market sale workers	Medium skilled
Skilled agricultural and fishery workers	Medium skilled
Craft and related trade workers	Medium skilled
Plant and machine operators and assemblers	Low skilled
Elementary occupations	Low skilled
Armed forces	Not included in the analysis

Source: OECD

Appendix 3: Classification of ICT-related occupations

Occupation type
Directors and chief executives
Production and operation managers
Other specialist managers
Physicists, chemists, and related professionals
Mathematicians, statisticians and related professionals
Computing professionals
Architects, engineers, and related professionals
Business professionals
Legal professionals
Archivists, librarians, and related information professionals
Computer associated professionals
Optical and electronic equipment operators
Finance and sales associate professionals
Business services agents and trade brokers
Administrative associate professionals
Secretaries and keyboard-operating clerks
Numerical clerks
Electrical and electronic equipment mechanics filter

Source: OECD



Appendix 4: Classification of occupations in the computer field

Occupation type

Computer systems designers, analysts and programmers

Computing professionals not elsewhere classified

Computer assistants

Computer equipment operators

Source: OECD

