Transversal Analysis on the Evolution of Skills Needs in 19 Economic Sectors

Report prepared by Oxford Research for DG Employment, Social Affairs and Equal Opportunities

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- monitoring and reporting on the implementation of EU legislation and policies in PROGRESS policy areas;
- promoting policy transfer, learning and support among Member States on EU objectives and priorities; and
- relaying the views of the stakeholders and society at large

For more information see: http://ec.europa.eu/employment_social/progress/index_en.html

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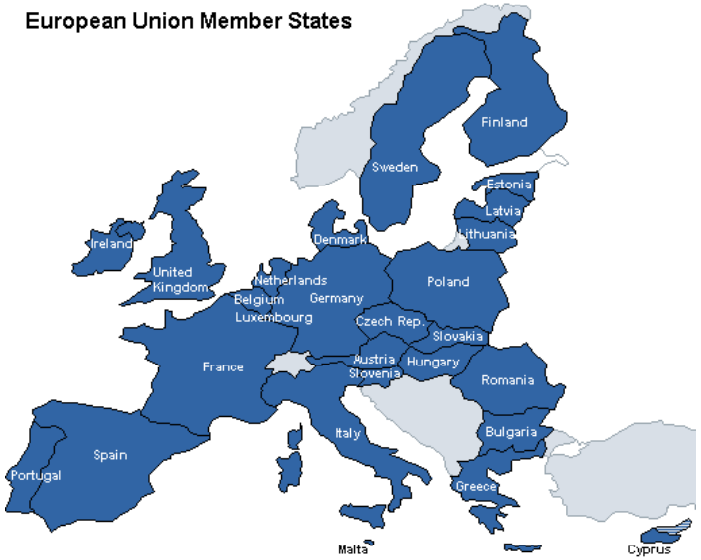


1. Introduction

In its new **Social Agenda** for modernising Europe, the European Union engages in providing jobs and equal opportunities for all, thus ensuring that benefits of growth reach everyone in society. The goal is to modernize labour markets helping people to seize the opportunities created by international competition, technological advances and changing population patterns while protecting the most vulnerable in society. The overall aim is to be seen in the light of the Lisbon Agenda promoting **a socially fair and competitive Europe.**

In order to enhance strategic human resource management, and thereby improve European competitiveness in the global economy, the European Commission has pointed to the importance of developing better **methods and tools to anticipate trends and changes** in the European labour market. On this background, the Commission carried out a number of comprehensive sector studies during 2008 and 2009 (studies available at http://ec.europa.eu/restructuringandjobs).The main aim of the sector studies was to map and analyse the evolution of **innovation**, **skills and jobs** within each of the selected sectors, taking into account the sector's global, national and regional contexts, in order to anticipate possible changes in jobs and skills need until 2020. The studies were carried out by the following contractors: TNO Netherlands Organisation for Applied Scientific Research, SEOR Erasmus University Rotterdam, ZSI Centre for Social Innovation , Oxford Research A/S, Alphametrics Ltd, Ismeri Europa , Economix Research and Consulting, Danish Technological Institute, DKRC Research and Consulting, IKEI Research and Consulting, Eurostrategies sprl, and Alpha Group.

The present report is a transversal analysis of these sector studies. Where the sector studies focused on sector specific developments and characteristics, this study aims at identifying common patterns of change across the different sectors and to group the sectors according to common historical and anticipated developments in jobs and skills. The study is structured following the European Foresight Methodology, the same methodology that was applied to carry out 18 of the 19 sector studies, included in the transversal analysis.

Sector analysis has been performed for decades. It appears, however, that for the first time comprehensive, in-depth sector analysis applying the same methodology has been performed for a large number of sectors at the same time, covering around a majority of total employment in Europe. The amount of comparable data, both qualitative and quantitative, has provided **a unique opportunity for developing a coherent view** on the ongoing restructuring process in Europe, indentifying strategies to secure and improve EU's competitiveness redeploying the economy to new activities providing more value added as well as new and better jobs. As part of the study process, the main results of the report were also presented at the **Restructuring Forum: Sector's New Skills for New Jobs** in Brussels December the 7th and 8th 2009.

2. Methodology

The study is mainly based on the results of 19 individual sector studies (listed in the table below) together covering around 60% of total EU Employment. For the ease of presentation, the denomination of sectors will be shortened in the rest of the study (e.g. Electricity, gas, water and waste = Electricity) but the whole sector is covered in the analysis.

Sectors included in the transversal study	
Automotive	Furniture
Building of ships and boats	Health and social work
Chemicals, pharmaceuticals, rubber and plastics	Hotels, restaurants and catering (Horeca)
Computer, electronic and optical devices	Non-metallic materials
Construction	Other services, maintenance and cleaning
Defence industry	Post and telecommunications
Distribution and trade	Printing and publishing
Electricity, gas, water and waste	Textiles, apparel and leather products
Electromechanical engineering	Transport and logistics
Financial services	

The study process consisted of the four following main steps:

1. **Compilation:** collecting all data from the sector studies (see annex 9). Where needed extra data were added from Eurostat or other relevant sources
2. **Validation:** checking latest available sector reports and forecasts to asses if the current economic crisis are properly reflected in the sector studies
3. **Multi correlation:** analyzing patterns of similar attributes across sectors providing overviews of main economic and employment trends
4. **Path finding and paradigms**: grouping sectors with similar paths of evolution and identifying a number of evolutionary paradigms'

2.1 The European Foresight Methodology

The structure of the report follows The European Foresight Methodology (EFM) developed by Prof. Maria João Rodrigues with support from the European Commission. The methodology has been developed in order to perform comprehensive sectoral analyses and foresights on emerging skills and competencies in the EU, and was also applied as the ground methodological approach in all of the individual sector studies (a similar but slightly different methodology was applied in the construction study). The EFM contains 10 steps. 8 of these steps were used in the sector studies:

- **Step 3:** Present and analyse the **main economic and employment trends** and structures of the sector
- **Step 4:** Identify the sector's **main drivers of change** (economy, technology, organisation etc.)
- **Step 5:** Identify emerging or **changing sector job profiles, skills, and competencies**
- **Step 6:** Build possible **sector scenarios** and identify their implications for employment trends
- **Step 7:** Analyse **scenario's implications** for competencies and occupational profiles
- **Step 8:** Identify **strategic choices** to be taken by companies in order meet skills needs
- **Step 9:** Identify the **implications for education and training**
- **Step 10:** Present the main recommendations

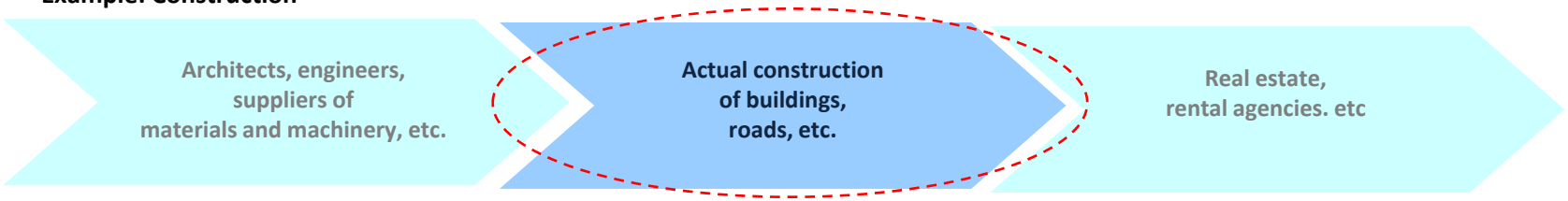
Data for the sector reports were collected through varying sources:

- **Reviews** of existing reports, analyses, statistical publications, policy papers, and communications from social partners, the EU and others
- **Sectoral meetings and consultations** with social partners and other EU level stakeholders
- **Expert interviews** including representatives from universities, companies, social partners and relevant international organisations
- **Statistics from Eurostat**, European Labour Force Survey (LFS) and CEDEFOP
- Finally, the results of the sector studies have been presented for and discussed by a **panel of leading European experts** within the relevant sector representing educational institutions, R&D actors, companies and social partners.

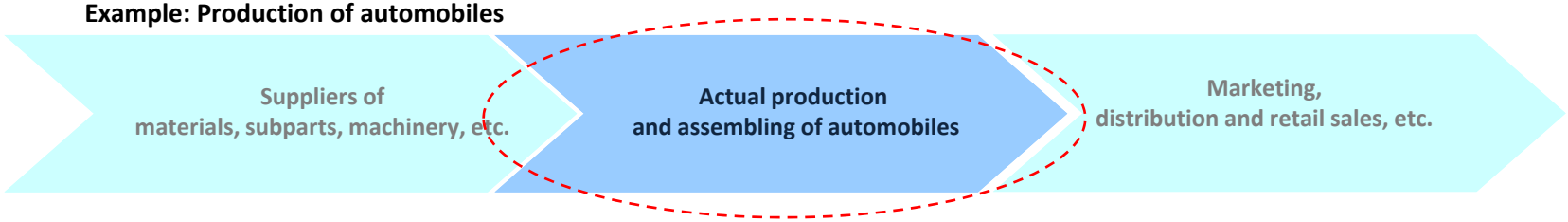
2.2 Focus on Direct Employment

Lastly it is important to underline that the sector studies, and thus also the transversal study, only covers trends and developments within direct sectoral employment. As illustrated in the supply chains below many of the studied sectors also creates many indirect jobs in both ends of the value and supply chains. This especially seems to be the case within production, where services seem to imply shorter supply chains. The importance of some sectors for the European economy are therefore often bigger than indicated by their share of EU employment.

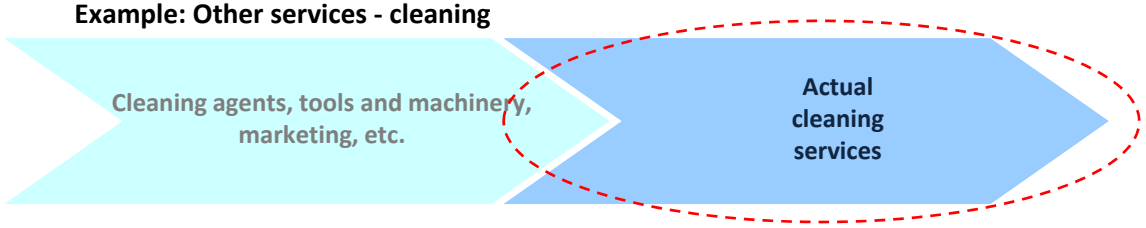
Example: Construction



Example: Production of automobiles



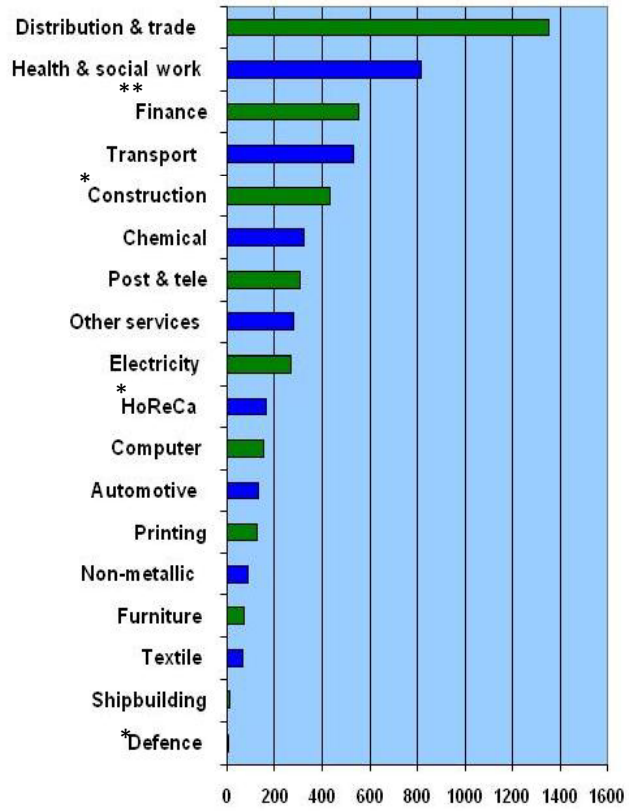
Example: Other services - cleaning



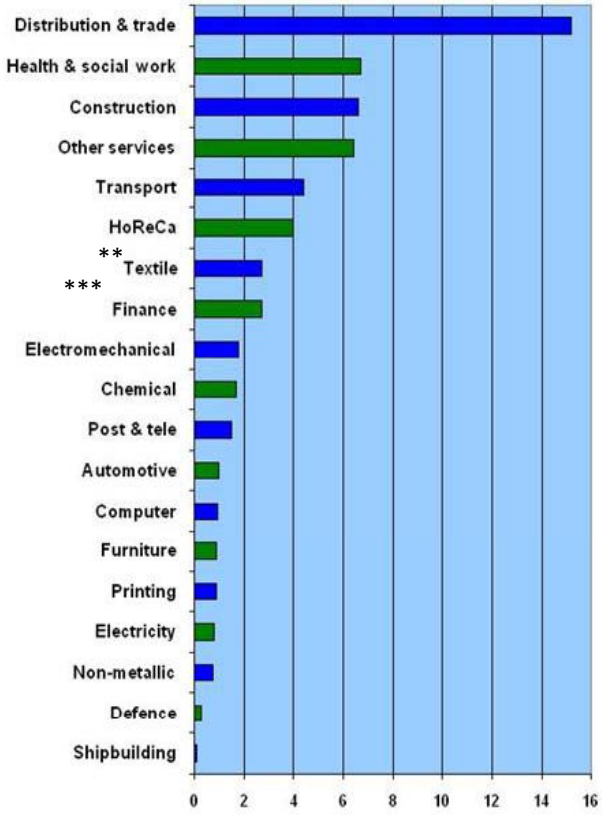
3. Main Economic and employment Trends

The importance of the different sectors vary according to employment and added value. The far biggest of the 19 studied sectors, both concerning added value and share of EU employment, is, however, Distribution and trade followed by Health & social work. Some service sectors like Horeca, Construction and especially Textile are far more important in terms of employment than added value, indicating their labour intensive nature, while others, typically more knowledge intensive sectors, like Finance and Chemical, are much more important in terms of added value than employment.

Total added value (in billion EUR) 2006



Share of EU employment (%) 2006



Sources: Sector studies and Eurostat 2009 . See annex 4 & 9

* **2004**

** **2005**

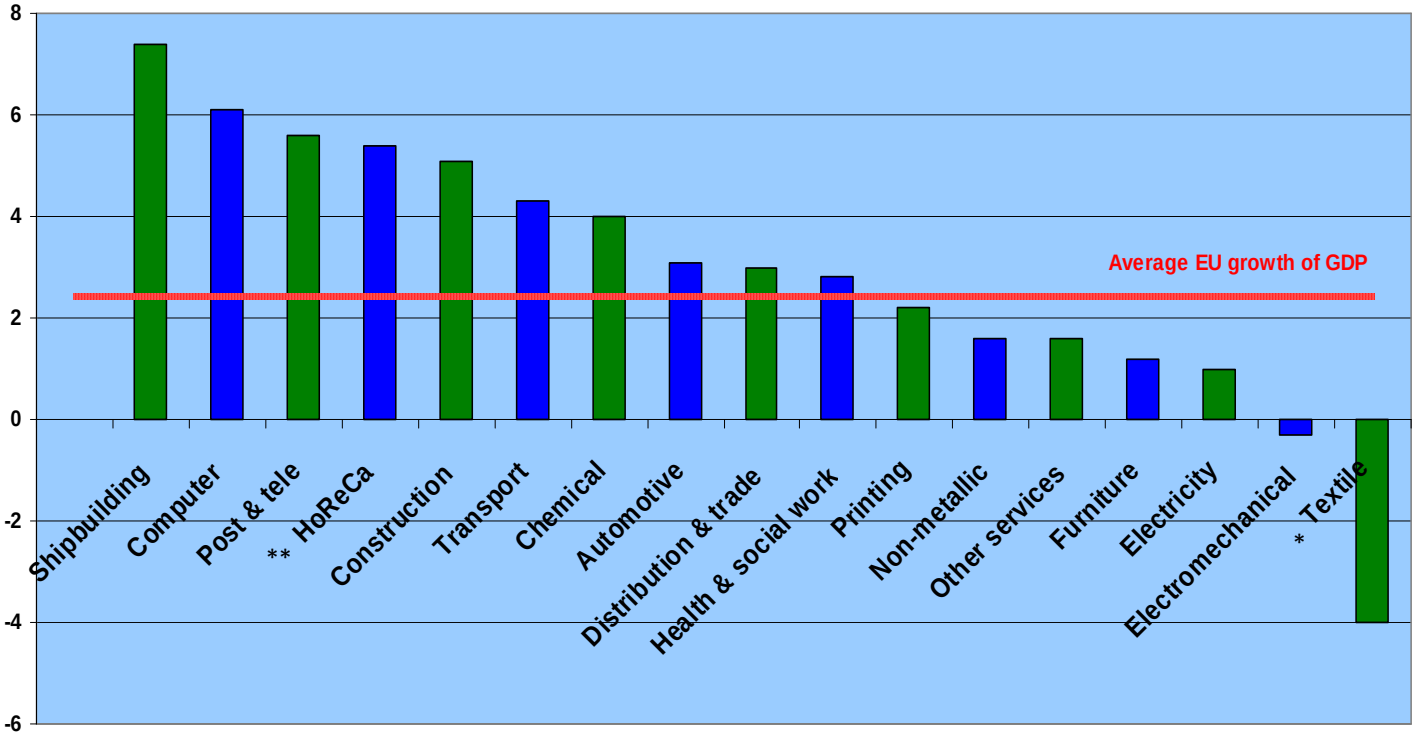
*** **2007**

Total added value for Electromechanical: n/a

Where employment and total added value indicates the size and importance of a given sector the growth rate in added value can indicate to which degree the sector succeeds in enhancing efficiency, competitiveness, introducing new and more value adding products or services or if the sector is loosing competitiveness resulting in reduced activity, which has happened within Electromechanical and Textile.

When looking at growth in added value from 1995 to 2006 it is evident that more than half of the sectors experienced growth rates that were higher than the average growth of GDP in the EU in the same period. Seven sectors however had lower growth rates that the average GDP growth and two sectors, Electromechanical Engineering and Textile, even experienced a fall in added value.

Annual growth in added value 1995-2006 (%)



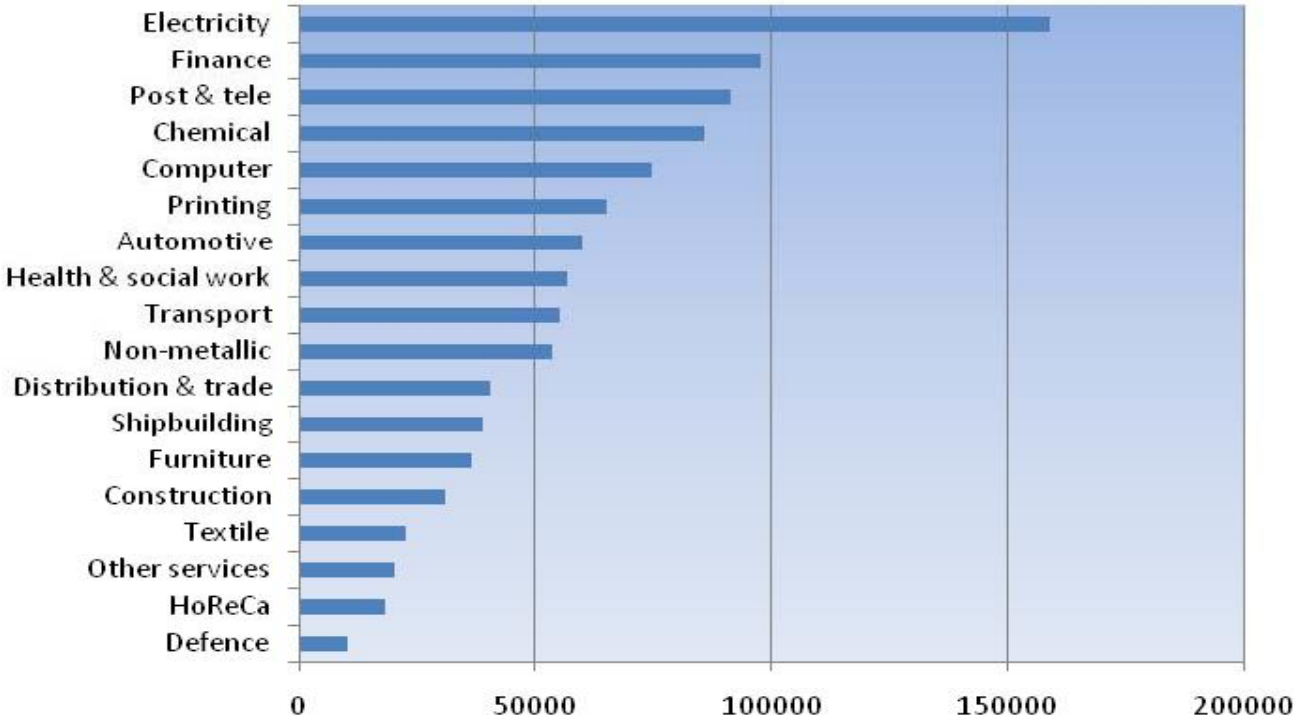
Sources: Sector studies and Eurostat 2009. See annex 4 & 9.

* **2000-2006**

** **1999-2004**

The figure, this page, shows the size of added value pr. employee in the different sectors. Average added value pr. employee can be seen as a proxy for productivity within a given sector. Most often, high knowledge intensive sectors have a higher productivity than low knowledge intensive sectors. A fact which is also partly mirrored in the figure below. The sector with the far largest added value pr. employee is electricity followed by Finance, Post & tele, Chemical and Computer. Among the sectors with the lowest added value pr. Employee are Horeca, Other services and Textile.

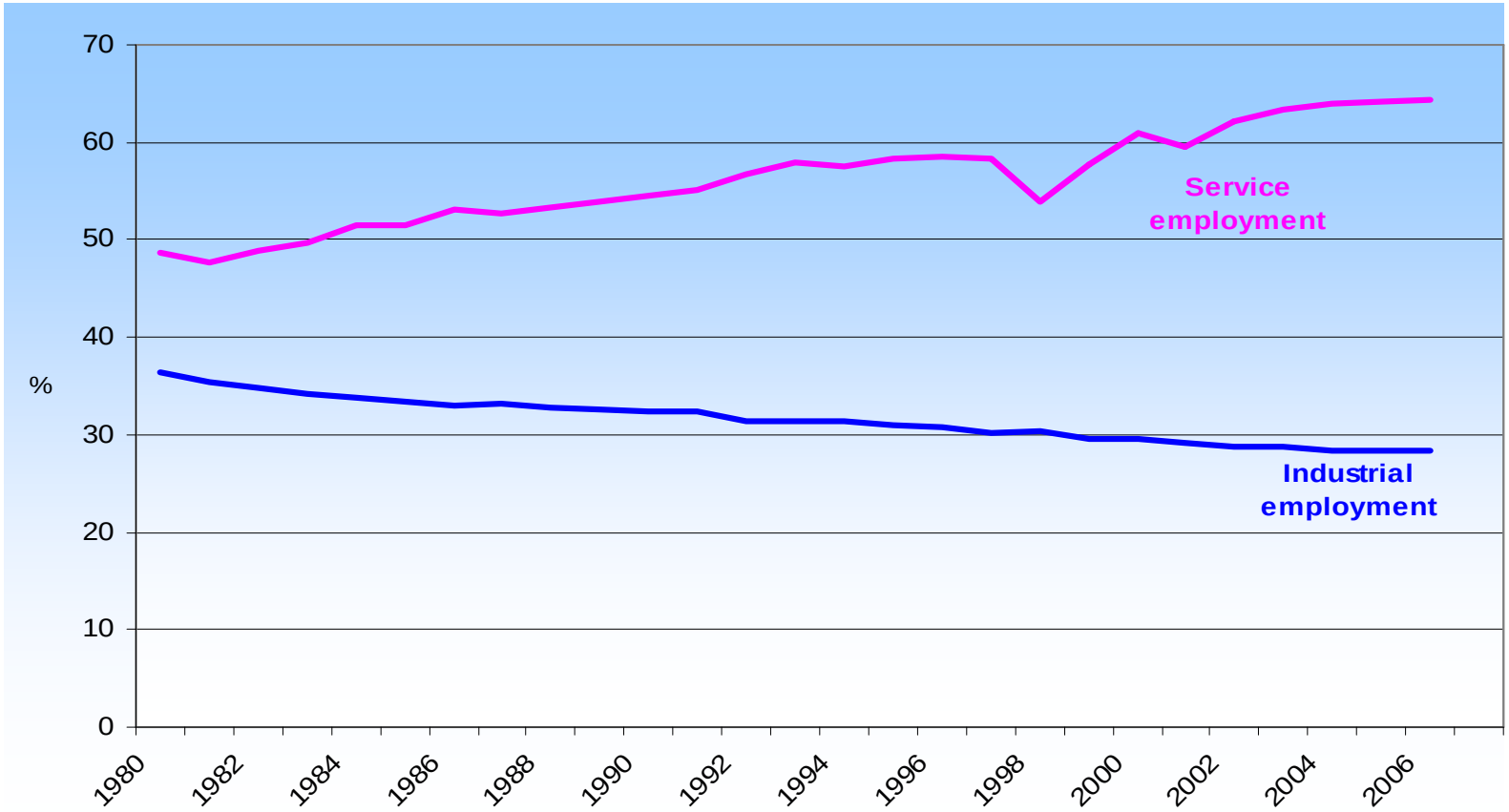
Productivity: Added value in Euros pr. employee 2006



Sources: Sector studies and Eurostat 2009. See annex 3 & 9. No comparable data available for Electromechanical

The following table shows the historical development in the share of employment between (all) services sectors and (all) industrial/production sectors in the EU. As clearly evident, service sectors' share of total employment in the EU have increased steadily since the early 1980's on behalf of a diminishing industrial labour force indicating the growing importance of services in the European economy.

Historical employment trends (EU-27)

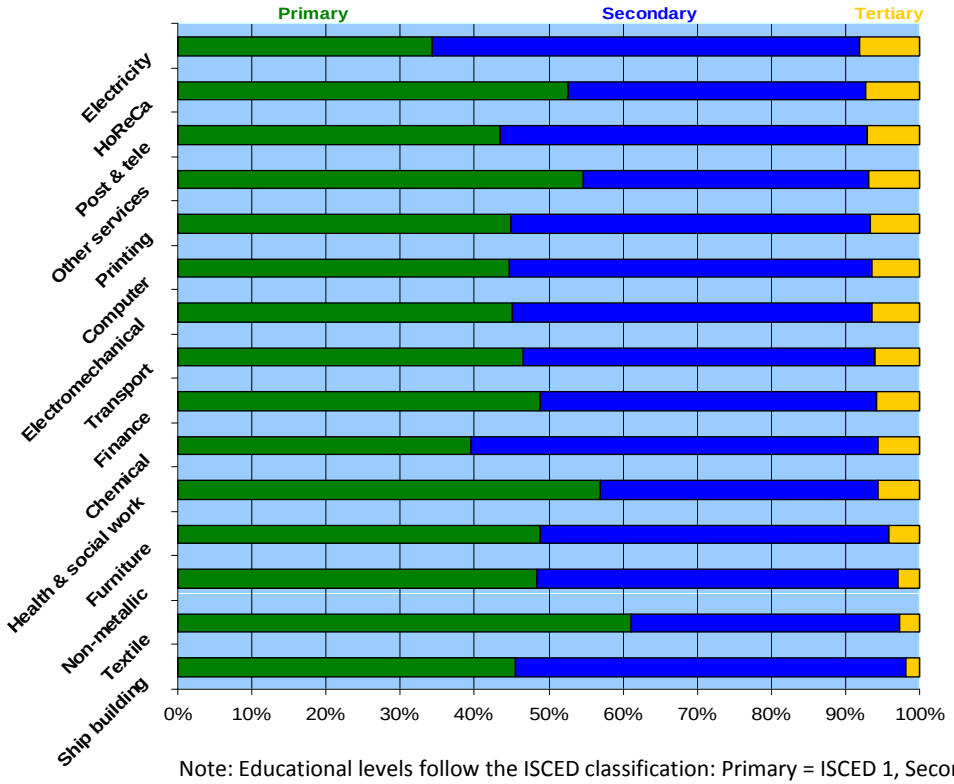


Source: Gapminder 2009. See annex 5

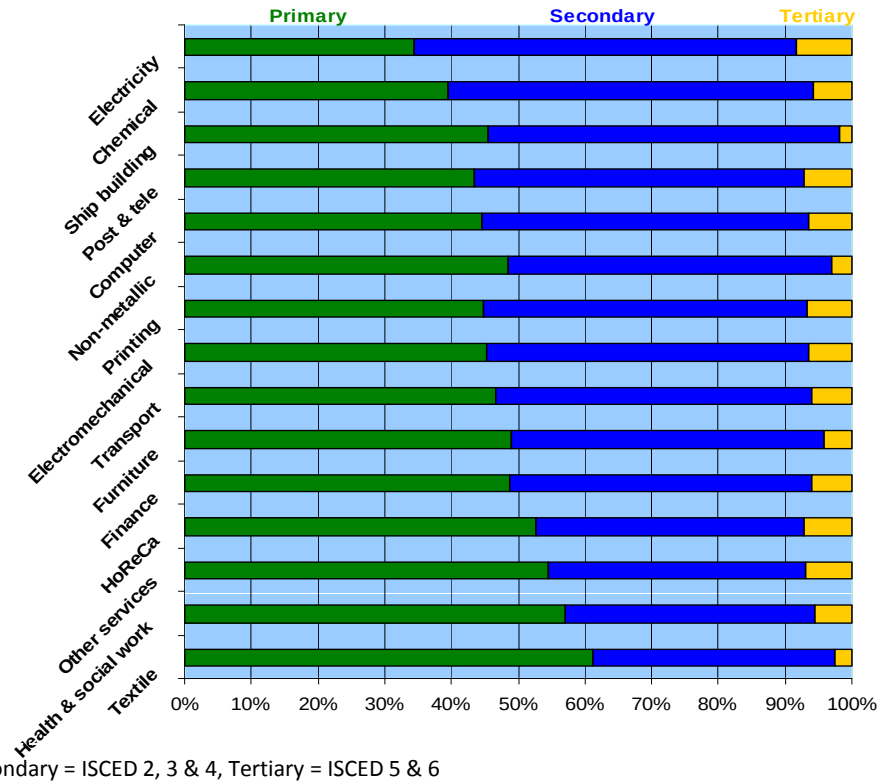
3.1 Educational levels

The share of employees with either primary, secondary or tertiary level education differs a lot from sector to sector. There seems to be tendency, though, towards service sectors having a very high share of employees only having primary level education together with a comparatively high share of employees with tertiary education. Production sectors, on the other side, are mostly dominated by employees with secondary education. This is most probably connected to the fact that European production sectors traditionally have employed many craftsmen and skilled workers, often having attained secondary level education, where service sectors (included in this study) especially have been in need of low skilled manual labour with limited educational attainment.

Educational level 2007: sorted by tertiary level



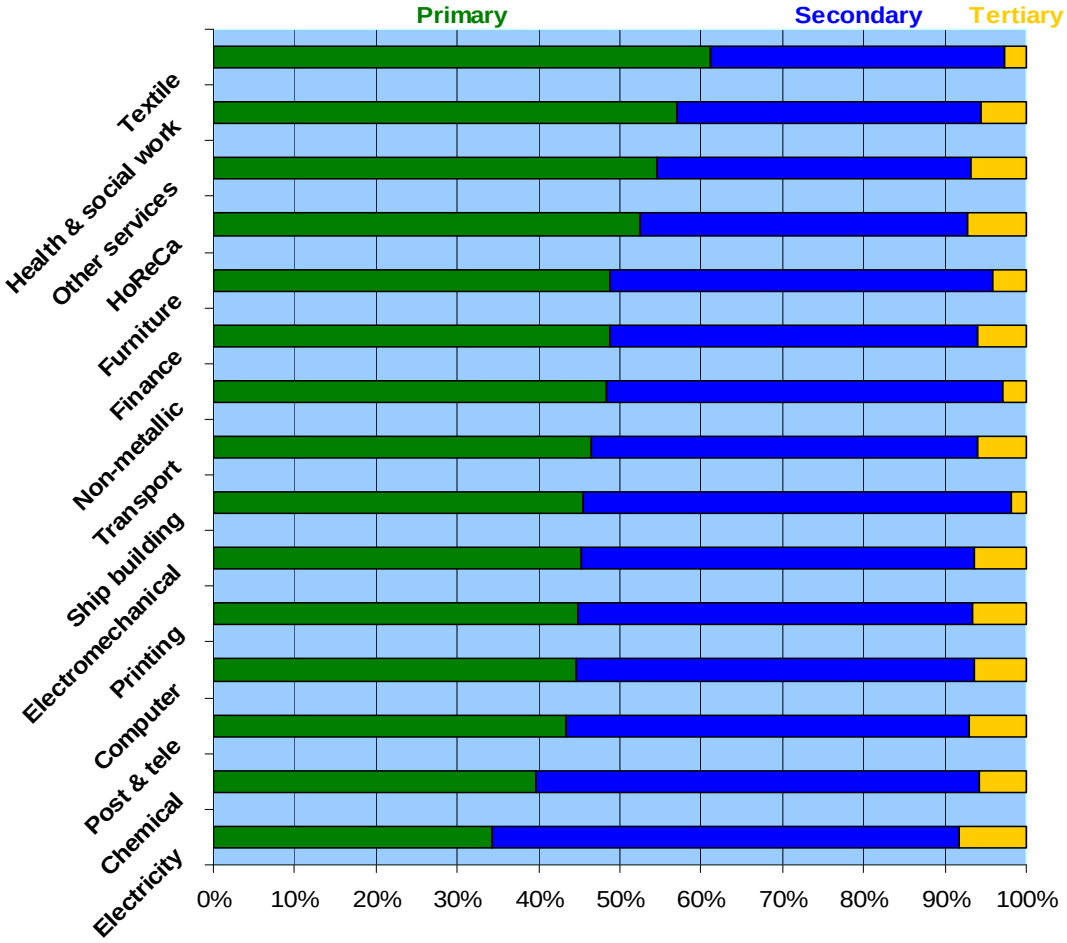
Educational level 2007: sorted by secondary level



Note: Educational levels follow the ISCED classification: Primary = ISCED 1, Secondary = ISCED 2, 3 & 4, Tertiary = ISCED 5 & 6
(see http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm for detailed definition of ISCED levels)

Source: Eurostat LFS 2008. See annex 6. Comparable data not available for Distribution & trade, Construction, Automotive, and Defence

As evident from the next table, the sectors with the highest share of employees with primary level education are the labour intensive service sectors like Textile, Health & social work, Other services and Furniture.



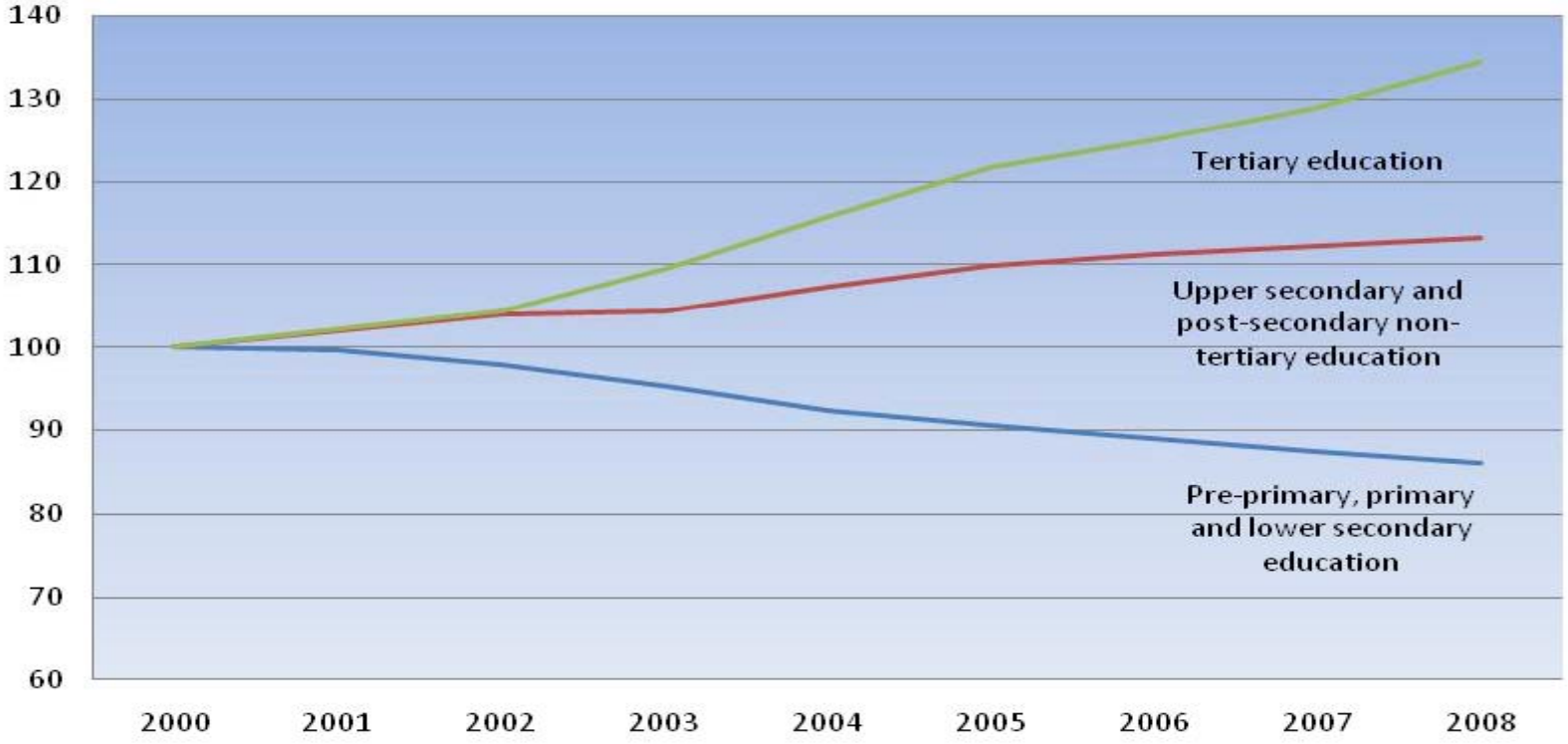
Educational level 2007:
Sorted by primary level

Source: Eurostat LFS 2008. See annex 6.
Comparable data not available for Distribution & trade, Construction, Automotive, and Defence

All the sector studies (except Ship building) report on increasing educational levels of employees. This tendency is also reflected when looking at the general development in educational levels of the European population (see the figure this page). Since 2001 there has been a high increase in the share of people with tertiary level education together with significant decrease in people with primary level and lower secondary education.

Index of general educational level of population in EU 27

Highest attained educational level in the age group 24-65



Note: Educational levels follow the ISCED classification: Primary = ISCED 1 & 2. Secondary = ISCED 3 & 4. Tertiary = ISCED 5 & 6 (see http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm for detailed definition of ISCED levels)

Source: Eurostat 2009. See annex 6.

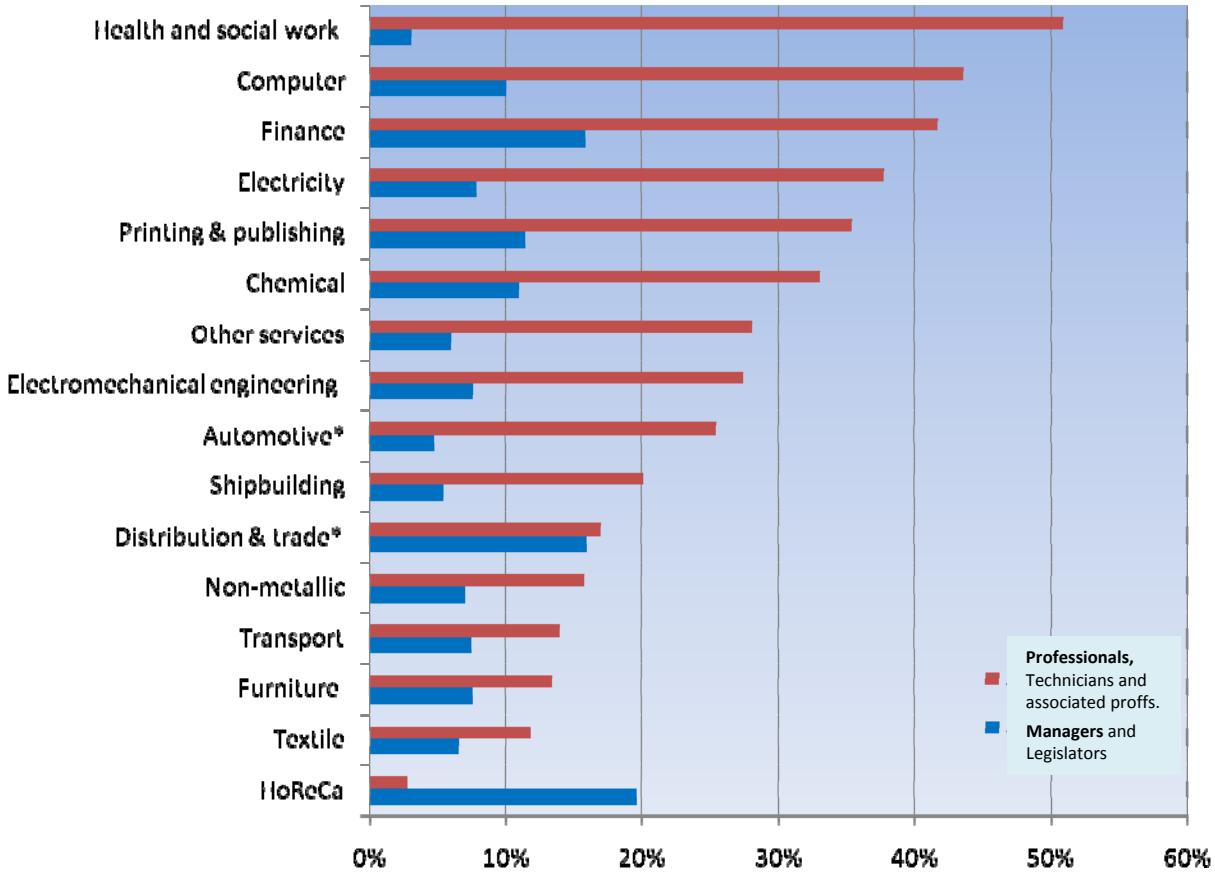
3.2 Occupations

To understand the employment structure of sectors and be able to anticipate changes in skills and jobs it also important to look at the occupational structures of the sectors concerned. The next table gives an overview of the share of high skilled, skilled and low skilled (low skilled and elementary occupations) within the selected sectors in 2007. Circles with dotted red line indicate sectors with high share of employees within the relevant occupation. In the following tables the occupational groupings will be presented and explained in more detail.

Sector \ Occupation	High skilled (non-manual)	Low skilled non-manual	Skilled manual	Elementary occupations
Automotive*	30,3	9,1	55,4	5,2
Chemical	44,0	12,7	34,2	9,1
Computer	53,6	10,6	31,6	4,2
Distribution & trade*	33	46	14	6
Electricity	45,7	17,7	32,3	4,3
Electromechanical engineering	34,9	10,4	49,7	5
Finance	57,6	40,2	0,5	1,7
Furniture	21,0	11,7	58,9	8,4
Health and social work	54,0	36,8	2,2	1,8
HoReCa	22,3	62,2	2,8	12,7
Non-metallic	22,8	9,4	59,1	8,7
Other services	34,1	30,8	9,2	25,9
Post & tele	34,4	41,3	11,9	12,4
Printing & publishing	46,9	13,2	27,7	12,2
Shipbuilding	25,5	7,0	62,6	5
Textile	18,4	11,2	62,9	7,5
Transport	21,5	21,2	48,2	9,1

Source: Eurostat LFS 2008. Comparable data not available for Construction and Defence. * Data from 2006
Note: The breakdown of employed persons by occupation is based on the classification ISCO 88-COM. High Skilled = 1. Legislators & managers, 2. Professionals and 3. Technicians & associate professionals. Low skilled non manual = 4. Clerks and 5. Service, shop & market sales workers. Skilled manual = 6. Craft & related trade workers, 7. Skilled agricultural, forestry and fishery workers and 8. Plant & machine operators. Elementary occupations = 9 . Elementary occupations. For detailed description of the ISCO classifications see: http://www.ilo.org/public/english/bureau/stat/isco/isco88/major.htm .

Share of High skilled ** in sectors 2007



* Data from 2006

** High Skilled = 1. Legislators & managers, 2. Professionals and 3. Technicians & associate professionals. For detailed description of the ISCO classifications see: http://www.ilo.org/public/english/bureau/stat/isco/isco88/major.htm .

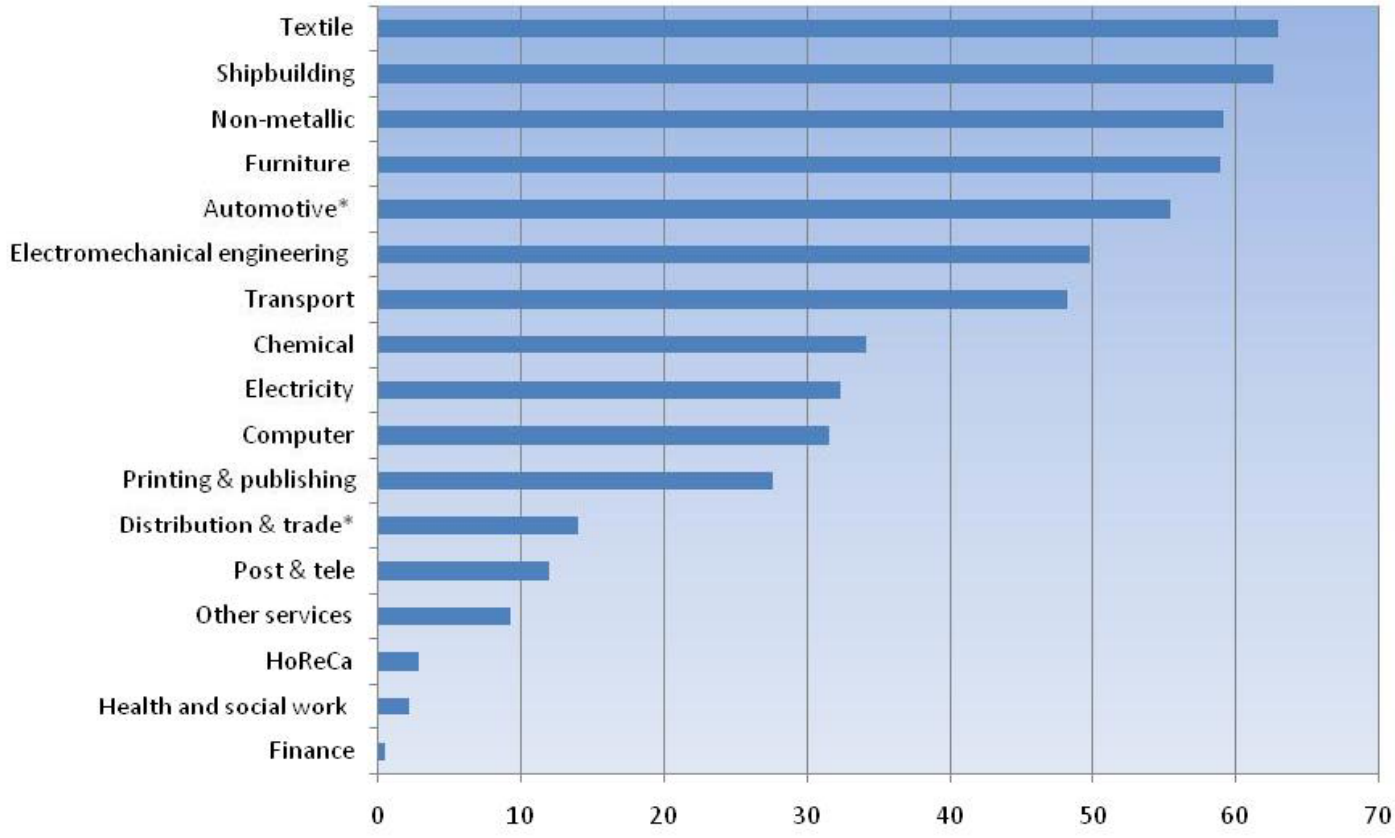
Source: Eurostat LFS 2008 and sector studies. See annex 1. Comparable data not available for Construction and Defence

High skilled workers among others include managers and professionals, that will say workers typically with relatively long educational backgrounds and/or specialist knowledge within a certain field. A high share of high skilled workers within a sector indicate a relatively high knowledge intensity. The sectors with the highest share of professionals are Health & social work, Computer, Finance, Printing & publishing, Electricity, and Chemical.

The sectors with the lowest share of high skilled d are not surprisingly, the labour intensive but relatively low knowledge intensive sectors such as Furniture, Textile, transport and Horeca.

When looking at the share of managers, it is Horeca and Distribution & trade that have the highest shares. This is most probably connected to the characteristics of the two sectors as 'do it your self sectors' with many start ups, SME's and micro enterprises.

Share of skilled workers in sectors 2007**



Skilled workers among others include craftsmen and skilled trade workers. Hence, sectors with high share of skilled workers would typically be sectors including some kind of craft related production.

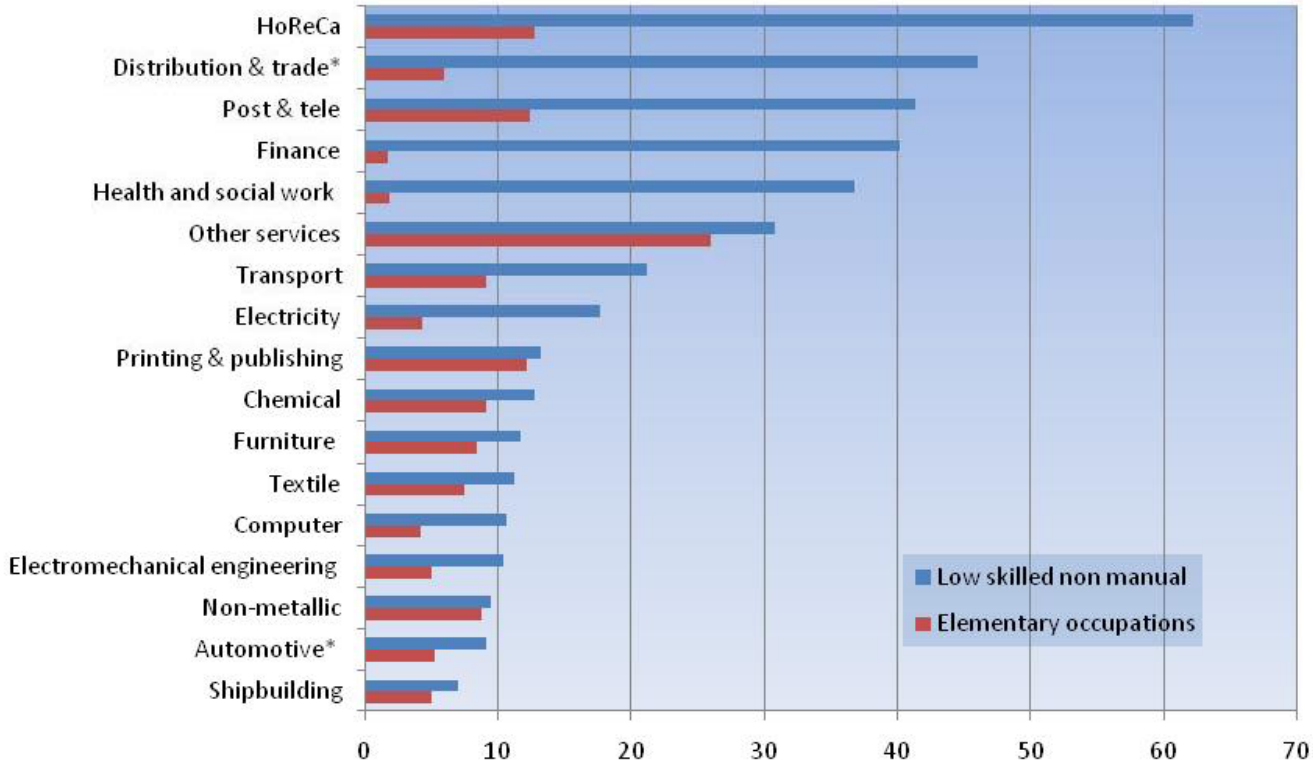
When looking at the table, it is also evident that the sectors with the highest share of skilled workers are the traditional European production sectors such as Automotive, Shipbuilding, Furniture and Textile, which traditionally have been in high need of skilled craftsmen and women.

* Data from 2006

****** Skilled manual = 6. Craft & related trade workers, 7. Skilled agricultural, forestry and fishery workers and 8. Plant & machine operators. For detailed description of the ISCO classifications see: http://www.ilo.org/public/english/bureau/stat/isco/isco88/major.htm .

Source: Eurostat LFS 2008 and sector studies. See annex 1 . Comparable data not available for Construction and Defence

Share of low skilled workers in sectors 2007**



* Data from 2006

Low skilled non manual = 4. Clerks and 5. Service, shop & market sales workers.** Elementary occupations = 9 . Elementary occupations. For detailed description of the ISCO classifications see: http://www.ilo.org/public/english/bureau/stat/isco/isco88/major.htm.

Source: Eurostat LFS 2008 and sector studies. See annex 1. Comparable data not available for Construction and Defence

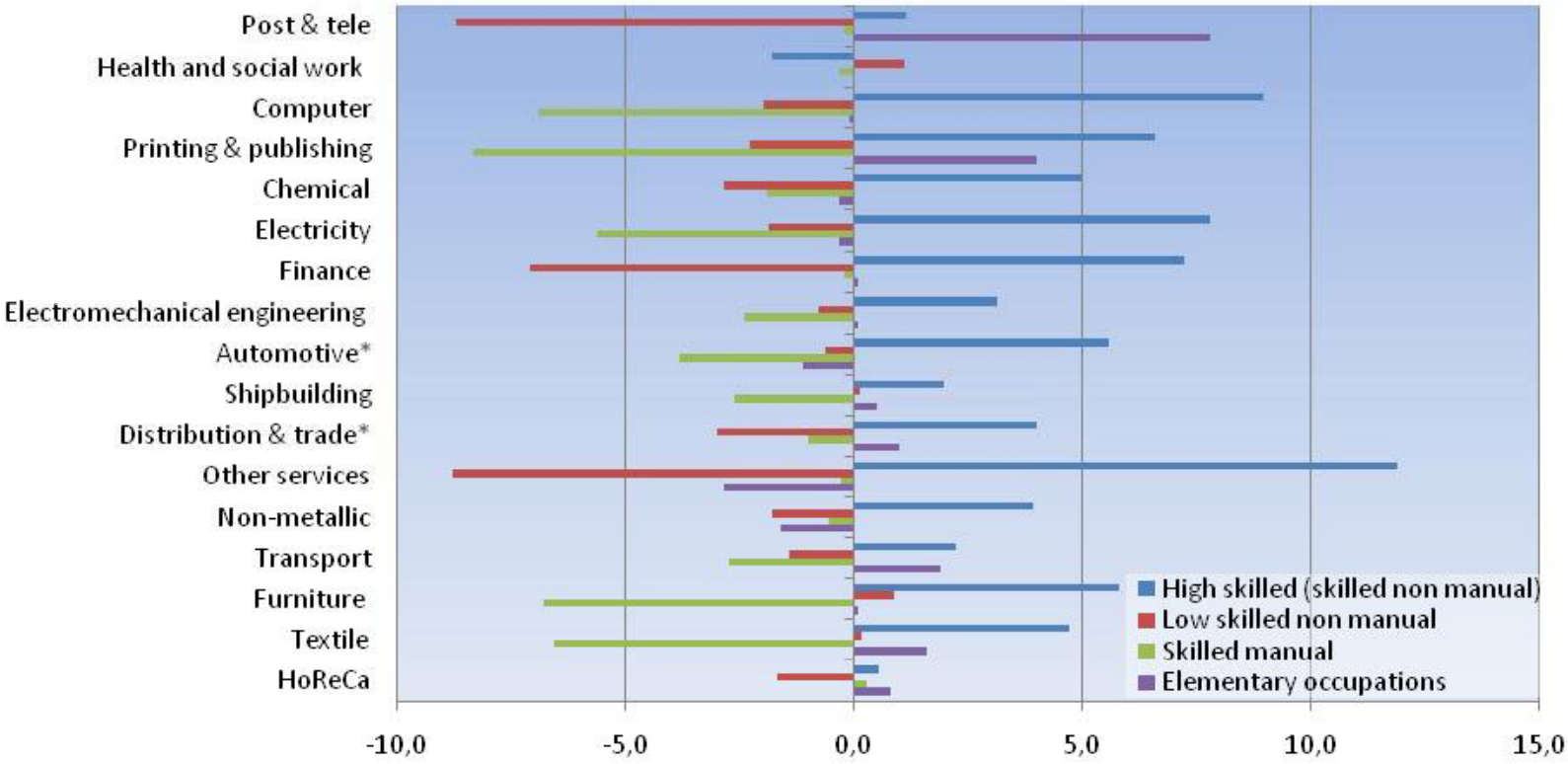
Low skilled workers covers two occupational categories: low skilled non-manual and elementary occupations.

Non-manual occupations includes occupations such as secretaries, cashiers and accountants, bookkeepers, protective service workers, waiters and housekeepers. Elementary occupations are typically characterised by very simple manual labour task such as for example cleaning, dish washing, street vending, basic caretaking of buildings and gardens ,etc.

A high share of low skilled and/or elementary occupations therefore normally indicates high labour intensity and a relatively low knowledge intensity. The sectors with the highest share of low skilled are workers are Distribution & trade, Horeca and Post & tele and Other services.

The figure below shows changes in the shares of main occupations within the selected sectors from 2000 to 2007. As it can be observed, most sectors have experienced quite significant occupational changes taking the relatively short time span into account. Furthermore, there seems to be a general tendency towards an increasing share of high skilled workers and a diminishing share of skilled workers. In some sectors as for example Post & Tele, Textile and Horeca there has also been an increase in the share of elementary occupations.

Estimated changes in shares of occupations 2000 - 2007



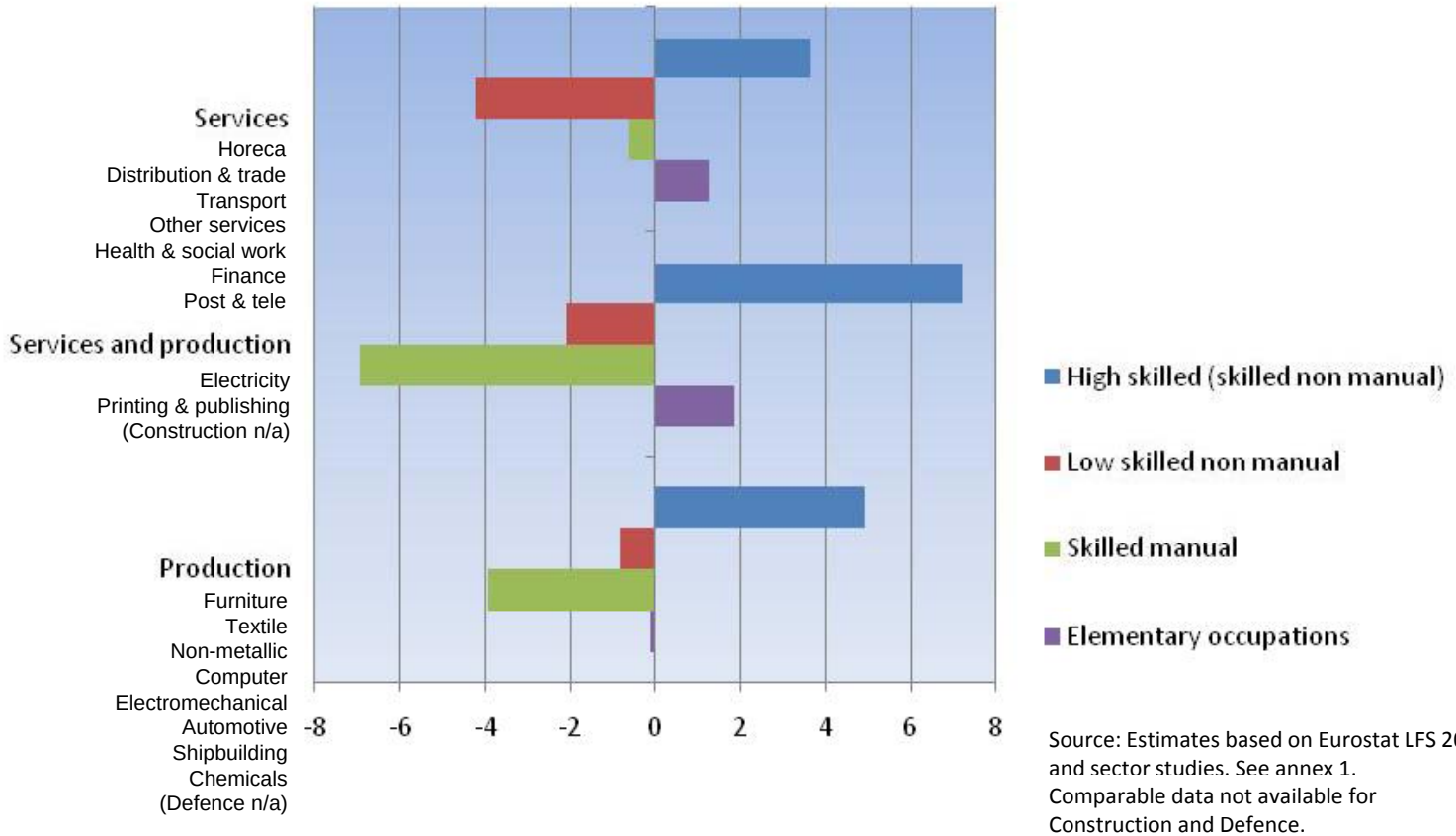
* Data from 2006

Source: Eurostat LFS 2008 and sector studies. See annex 1. Comparable data not available for Construction and Defence

In the next figure, the sectors have been grouped into three main groups being 1) Services, 2) Production and 3) combined Services & production. In all of the three sector groups, the share of high skilled workers have increased from 2000 to 2007. Also common to the three groups is a slight increase in the share of elementary, i.e. very basic and low skilled, occupations.

When looking at share of skilled workers there has been a quite significant fall within production and combined services and moderate fall within services. Low skilled non-manual occupations also seems to be decreasing in share, far most significant however, within services.

Estimated changes in shares of occupations 2000 - 2007



Source: Estimates based on Eurostat LFS 2008 and sector studies. See annex 1.
Comparable data not available for Construction and Defence.

Up skilling vs. deskilling

Level of up skilling	Sectors
High	Chemical, Computer, Finance, Printing
Medium	Automotive, Defence, Electricity, Electromechanical, Furniture, Health & social work, Post & tele, Other services.
Low	Shipbuilding, Construction, Distribution & trade, Horeca, Non-metallic, Textiles, Transport.
Static	None
Deskilling	None

Up skilling defined as prominent growth in High skilled and/or skilled occupations

Deskilling defined as prominent growth trends among Low skilled occupations and/or elementary occupations

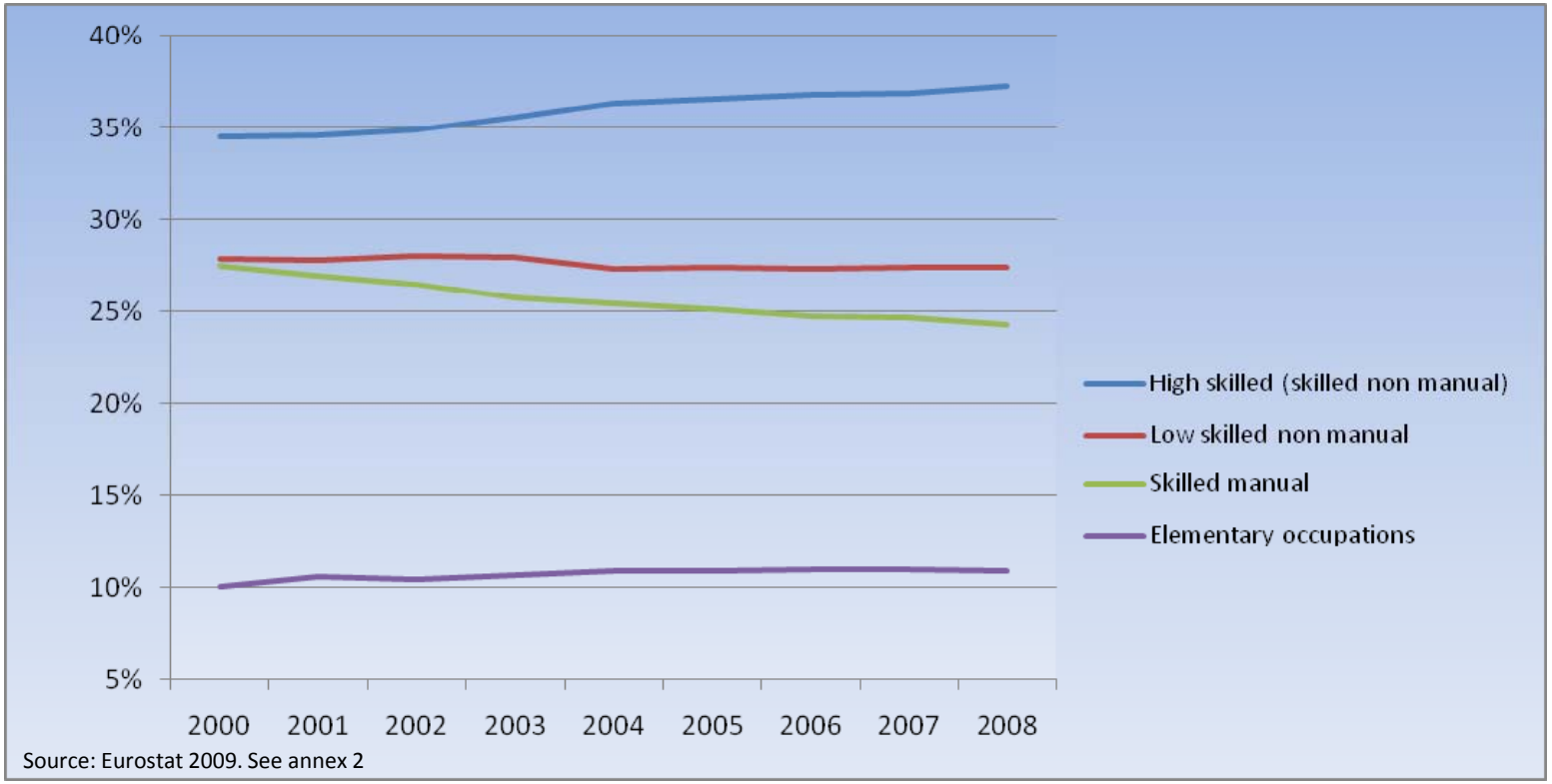
Source: Assessments based on Eurostat LFS data and on qualitative reporting from sector studies.

All sector studies report on tendencies towards up skilling. To group sectors according to up skilling, it is therefore necessary to take a closer look at the level and pace of up skilling within each of the sectors concerned.

For example: within Chemical, Computer , Finance and printing the level of both ongoing and anticipated up skilling seems to be rather high, where the level of up skilling in the labour intensive service sectors such as Horeca, and Distribution & trade seems to be quite low.

When looking at the general development in occupations in the European labour force from 2002 to 2008, there has been a clear tendency of polarisation. The number of high skilled jobs is clearly on the increase while the number of skilled manual jobs have experienced a decrease. At the same time, the number of very low skilled jobs (elementary occupations) have remained more or less the same, even with a slight increase. As discussed earlier, the decrease in the number of skilled jobs seems to be closely connected to the development within Europe's traditional production sectors that has normally relied on craftsmen and other skilled workers. Many of theses sectors are under heavy pressure due to fierce international competition and many production activities have been out sourced and off shored during the last 10-15 years.

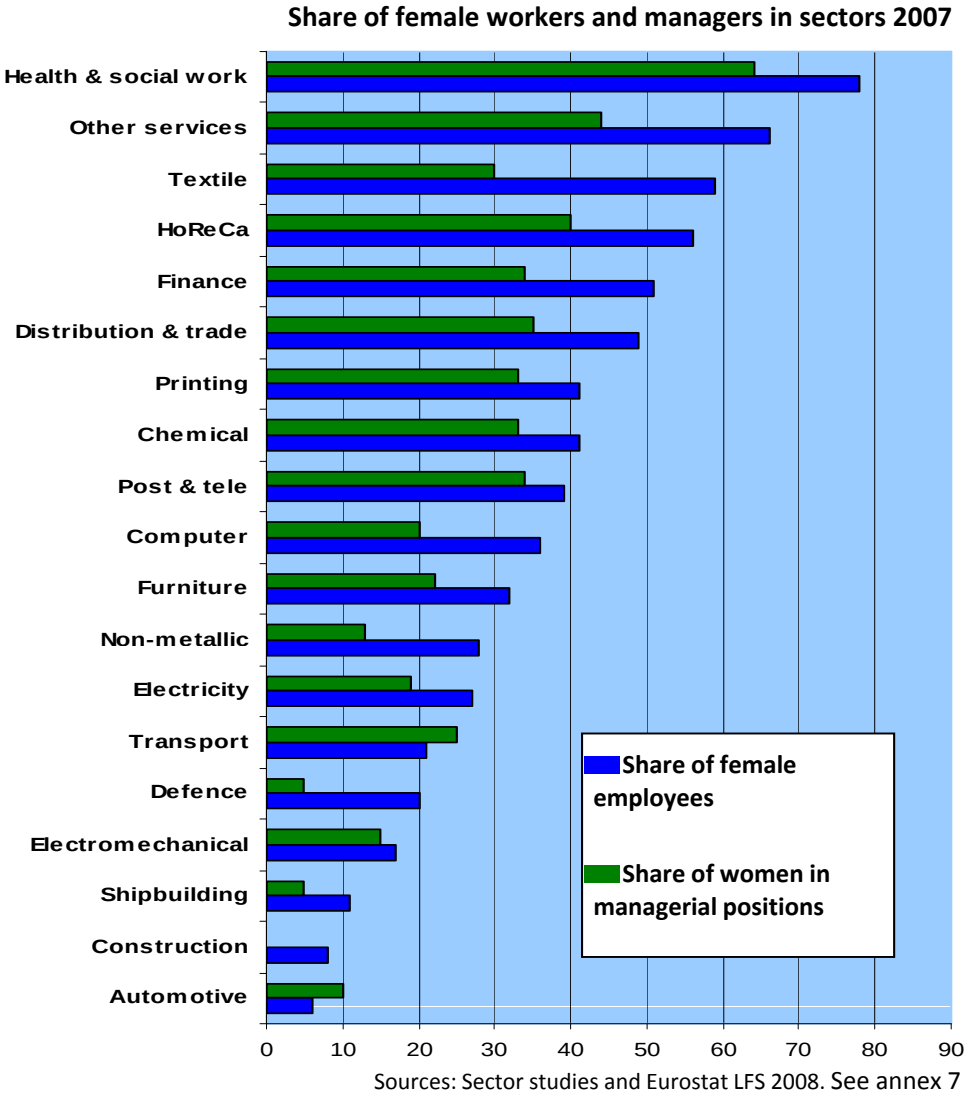
Change in the share of occupations in EU(27)



Source: Eurostat 2009. See annex 2

Note: The breakdown of employed persons by occupation is based on the classification ISCO 88-COM. High Skilled = 1. Legislators & managers, 2. Professionals and 3. Technicians & associate professionals, Low skilled non manual = 4. Clerks and 5. Service, shop & market sales workers**,** Skilled manual = 6. Craft & related trade workers, 7. Skilled agricultural, forestry and fishery workers and 8. Plant & machine operators, Elementary occupations = 9 . Elementary occupations. For detailed description of the ISCO classifications see: http://www.ilo.org/public/english/bureau/stat/isco/isco88/major.htm .

3.3 Share of female employees and managers



Sources: Sector studies and Eurostat LFS 2008. See annex 7

Many of the sector studies point towards the importance of improving the ability to recruit more women (or men according to the current female/male ratio) in order to meet future skills and recruitment challenges.

The current share of female and male workers also clearly reveals that many sectors struggle with unequal ratios between men and women. The clearly male dominated sectors include Automotive, Construction and Shipbuilding where sectors like Health & social work have a clear majority of female employees.

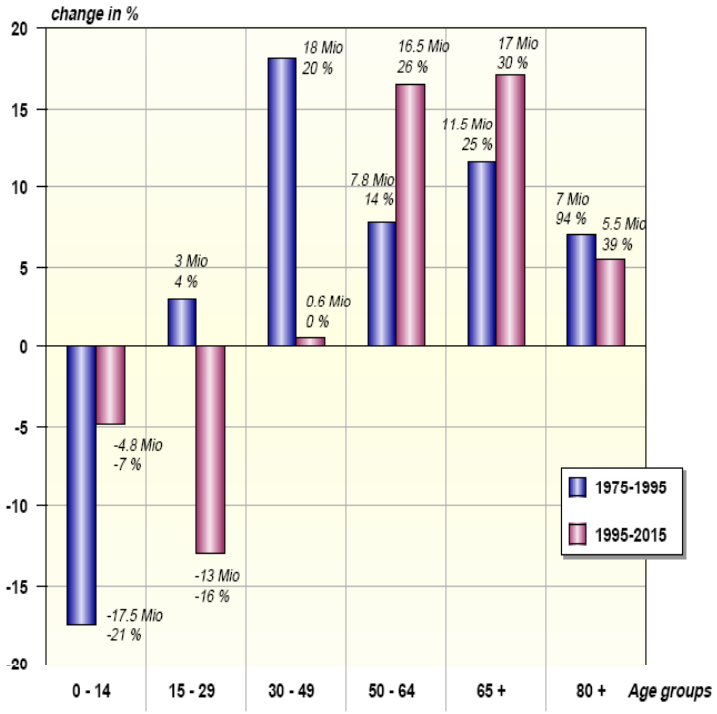
Common to most of the sectors is a relatively low share of female managers when compared to the share of female employees.

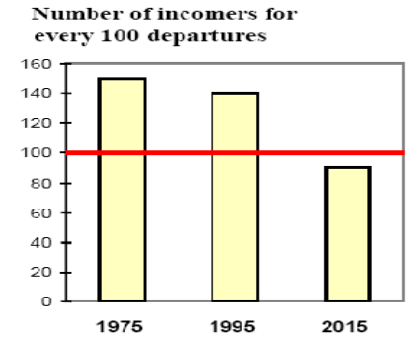
3.4 An ageing workforce

The ageing workforce and the need for replacement is a common problem in many sectors. As shown in the figures, the share of persons in the EU aged 50 or more will increase dramatically until 2015 resulting in general replacement challenges. Looking at the forecasted number of incomers to the EU compared to the number of persons leaving, the labour challenge seems to be even more evident. In 2015 more persons will leave than immigrate to the EU.

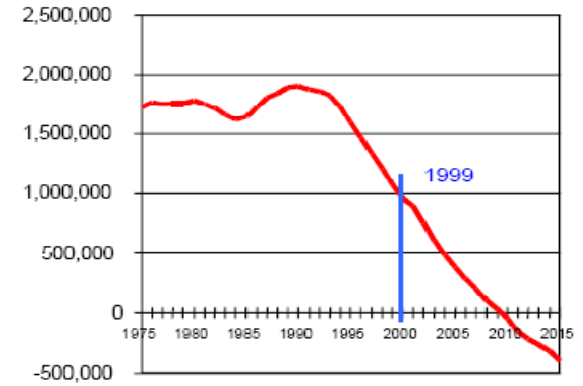
In many sectors, the huge need for replacement also generates challenges in terms of securing transfer of skills and knowledge from experienced retiring workers to the new generations.

Demographic changes in main age groups in the EU





Balance between 20-29 and 50-64 age cohorts



Source: The European Commission 1999*: Towards a Europe for All Ages.*

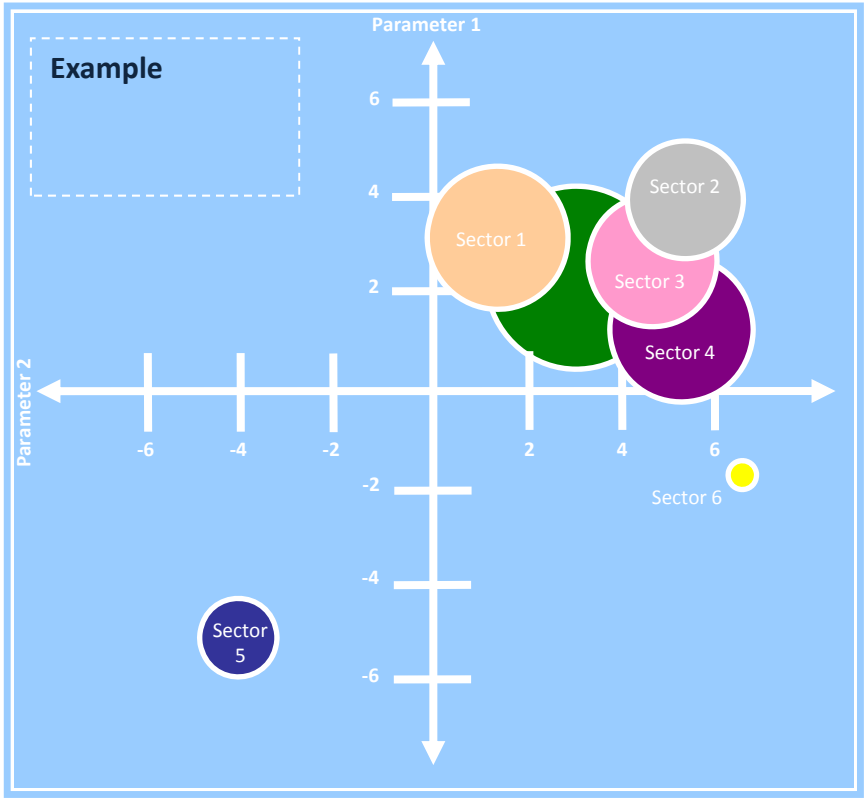
3.5 Common paths of sectoral evolution

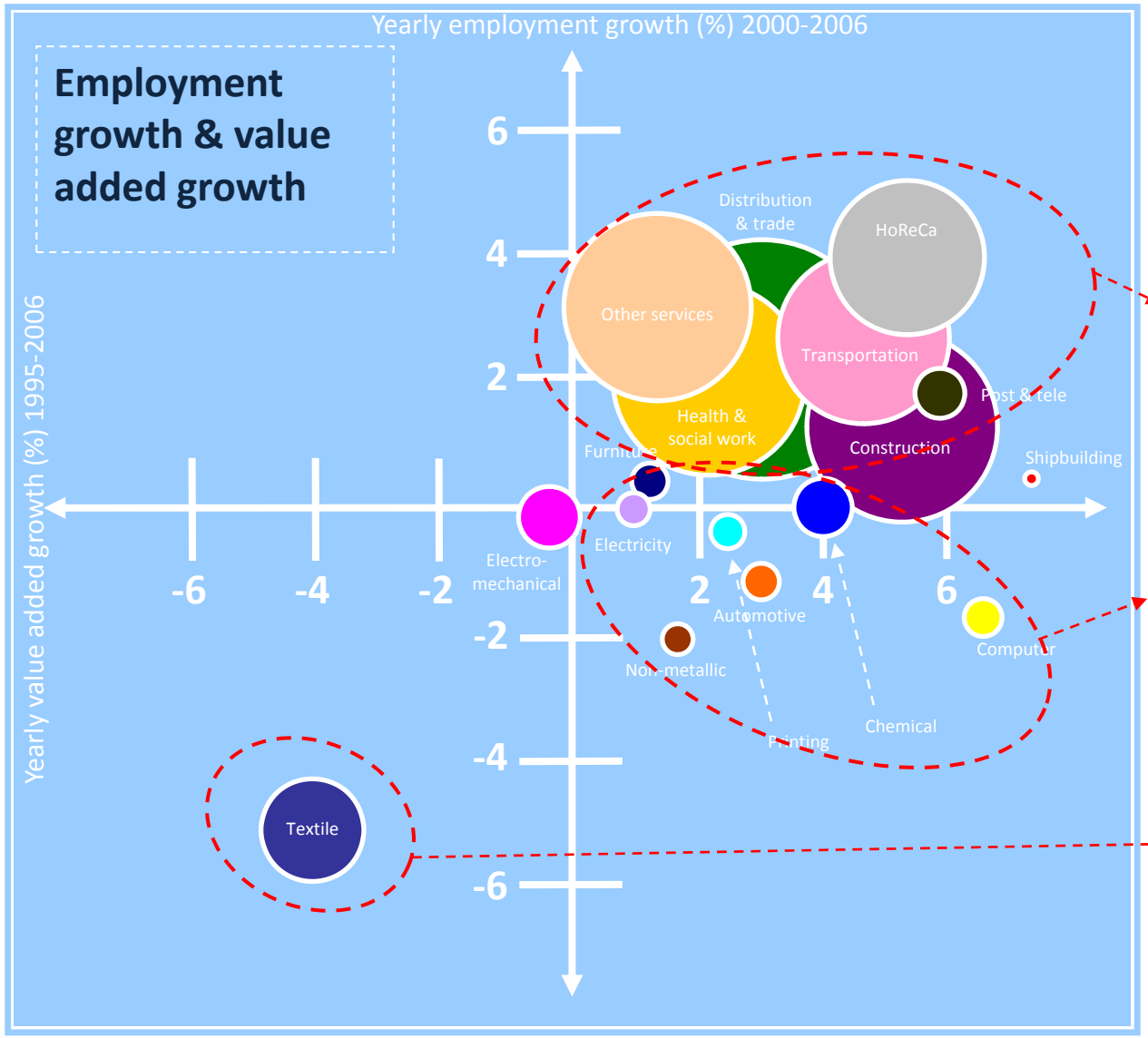
To sum up on the main economic and employment trends, a number of coordinates, grouping the sectors according to different economic and employment parameters, will be presented on the following pages. This facilitate a better understanding of how different groupings of sectors share common paths of evolution. As will be evident, the most important division of sectors, according to their evolution, seems to be between services and production.

The figure on this page illustrates how the graphically groupings of sectors is done. The size of circles refer to the sectors' share of EU employment (2006) Hence the bigger the circle, the bigger the share of total EU employment.

Data for the figures stem from Eurostat and from the sector studies (as presented previously in the study. See also annex 9). The axes without precise values (numbers), indicate that data is of qualitative character. This means that it is Oxford Research's own evaluation of the development of the parameter concerned based on the qualitative revision of the sector reports.

The coordinates, thus, serve to illustrate the overall direction of development within different groupings of sectors and should not be seen as exact numerical pictures of the individual sectors.





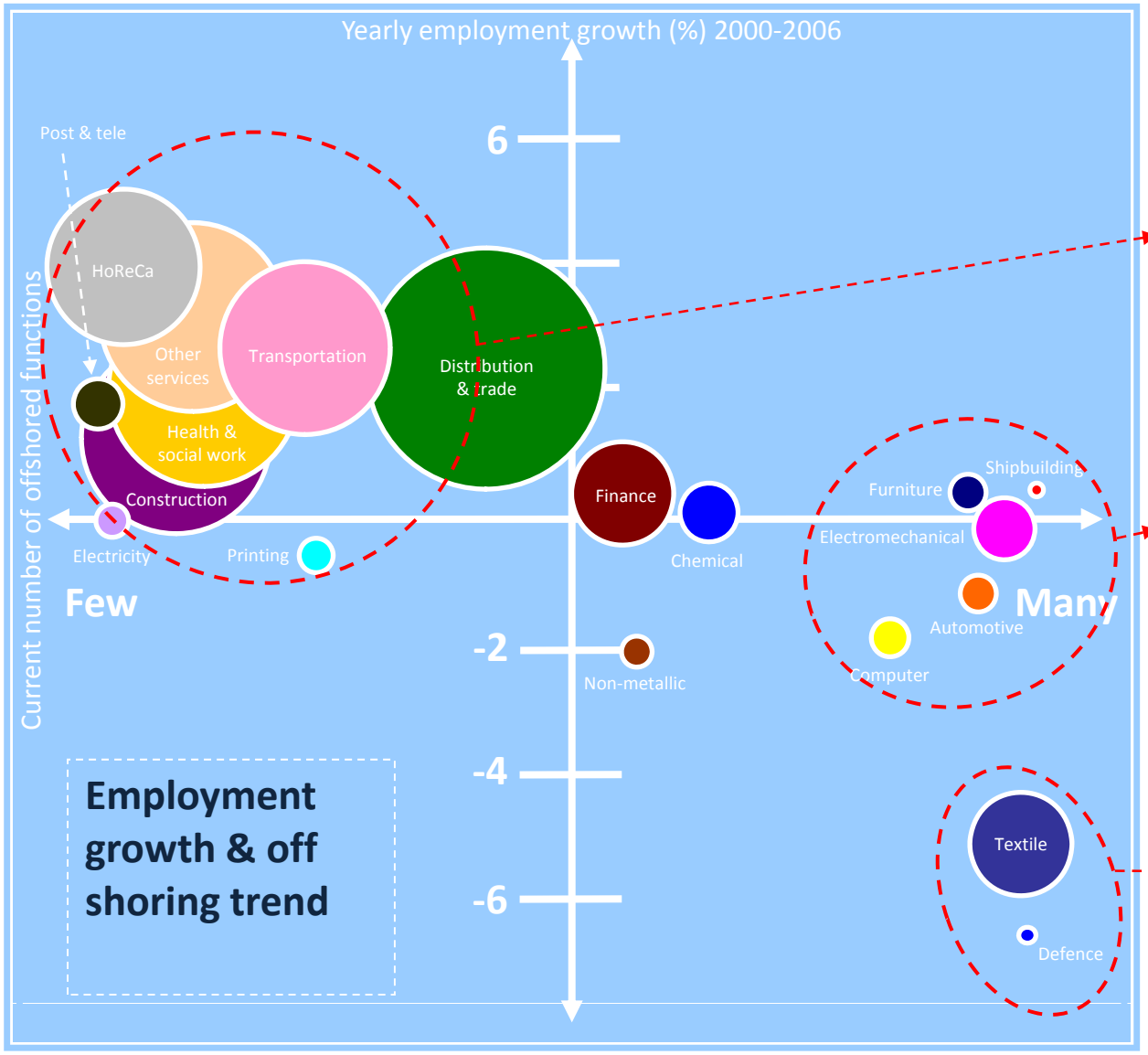
When crossing **employment and added value growth** it becomes clear that growth mostly has been within service sectors.

Services: High growth sectors with significant employment growth combined with growth in added value

Production: European Excellence. In most production sectors there has been an employment decline combined with high to medium growth in value added. This suggest a higher focus on excellence and value adding activities in these sectors, while simple production activities has been out sourced and off-shored.

The European Textile & leather sector seems to be one of the sectors being most severely hit by the increased global competition and the much lower production costs in developing economies. Much production has been off-shored during the last 10-20 years resulting in job losses and decreased activities in Europe. This development is also reflected in several of the following graphs.

NB! Comparable data on added value growth not available for Defence and Finance.



On this page, employment growth has been crossed with sectors' current **number of off shored functions.**

'Staying sectors' (services): These sectors will increase in importance due to:

- High employment growth
- Low level of off shoring
- Increase in high skilled jobs
- Still need for both skilled and low skilled labour

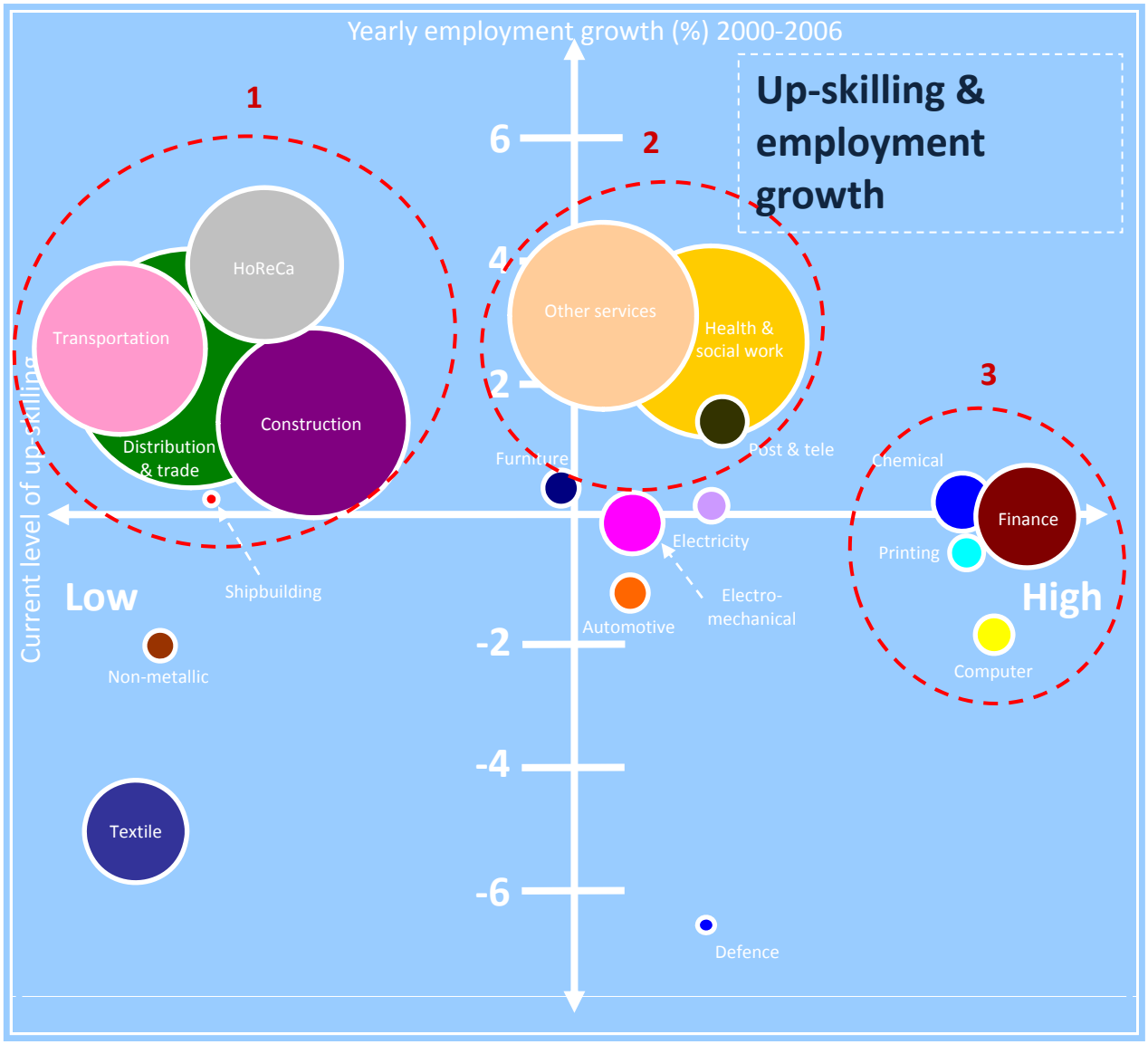
'Changing sectors' (production): These Sectors are under heavy restructurings due to:

- Low or no employment growth
- High level of off shoring
- Increase in high skilled jobs (focus on excellence)
- Significant decrease in the need for skilled labour

'Moving sectors' (production): These sectors seems , to a large degree, to be moving outside the EU:

- High employment decline
- High level of off shoring
- Decrease in high skilled jobs
- Dramatic decrease in both skilled and low skilled manual jobs

Note: Off Shoring defined as the relocation by a company of a business process from one country to another.

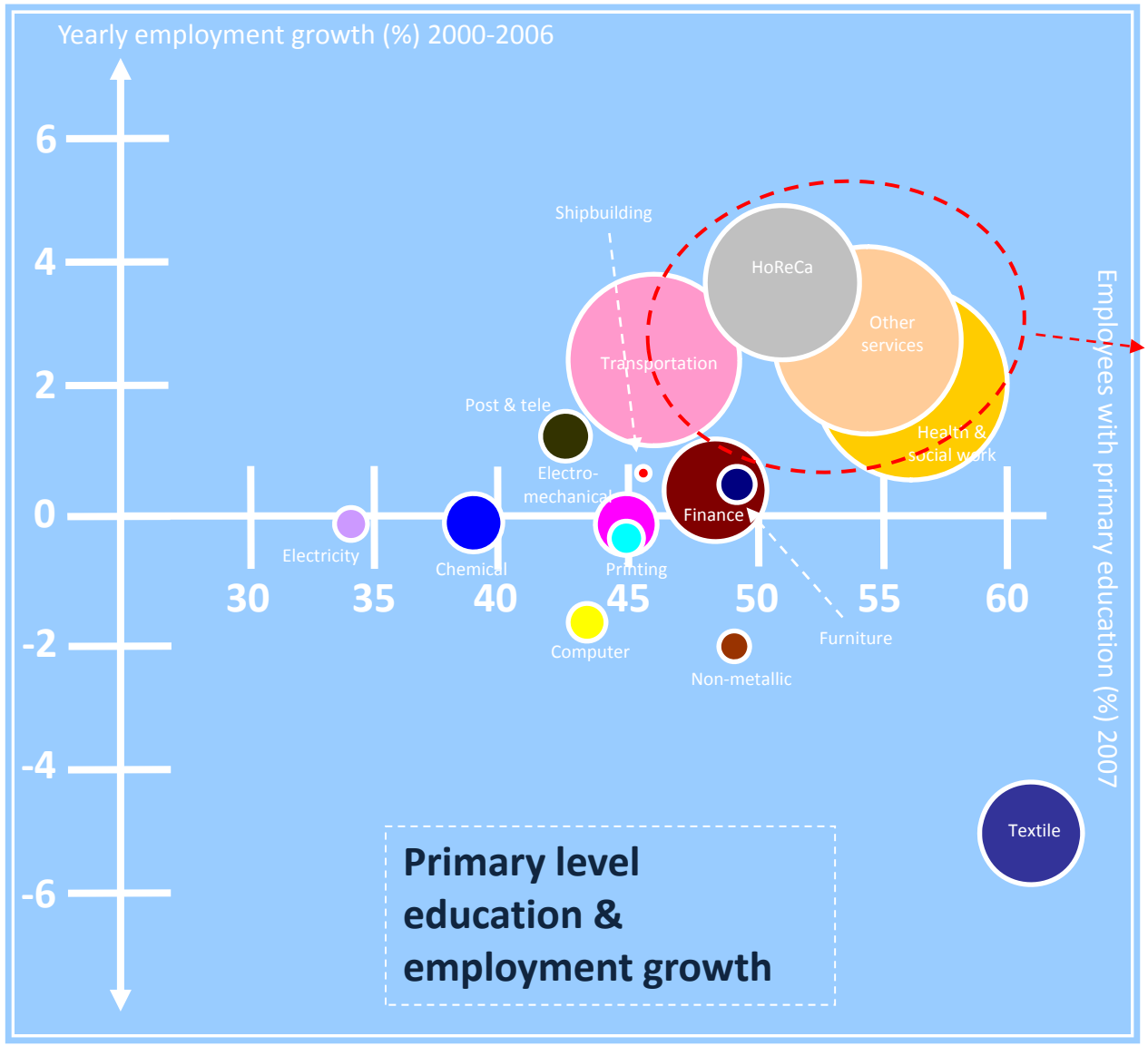


When looking at the **level of up skilling** in sectors together with yearly employment growth, there seems to be a connection between high up skilling and low/no job growth and vice versa:

1. **Low up skilling + job growth:** primarily low knowledge intensive **service sectors** with much manual labour and little off shoring susceptibility.

2. **Medium up skilling + job growth**: primarily medium knowledge intensive **service sectors** but still with many highly manual tasks.

3. **High up skilling + low/no job growth:** knowledge intensive **service or production sectors** with high or medium off-shoring susceptibility and a high focus on excellence.

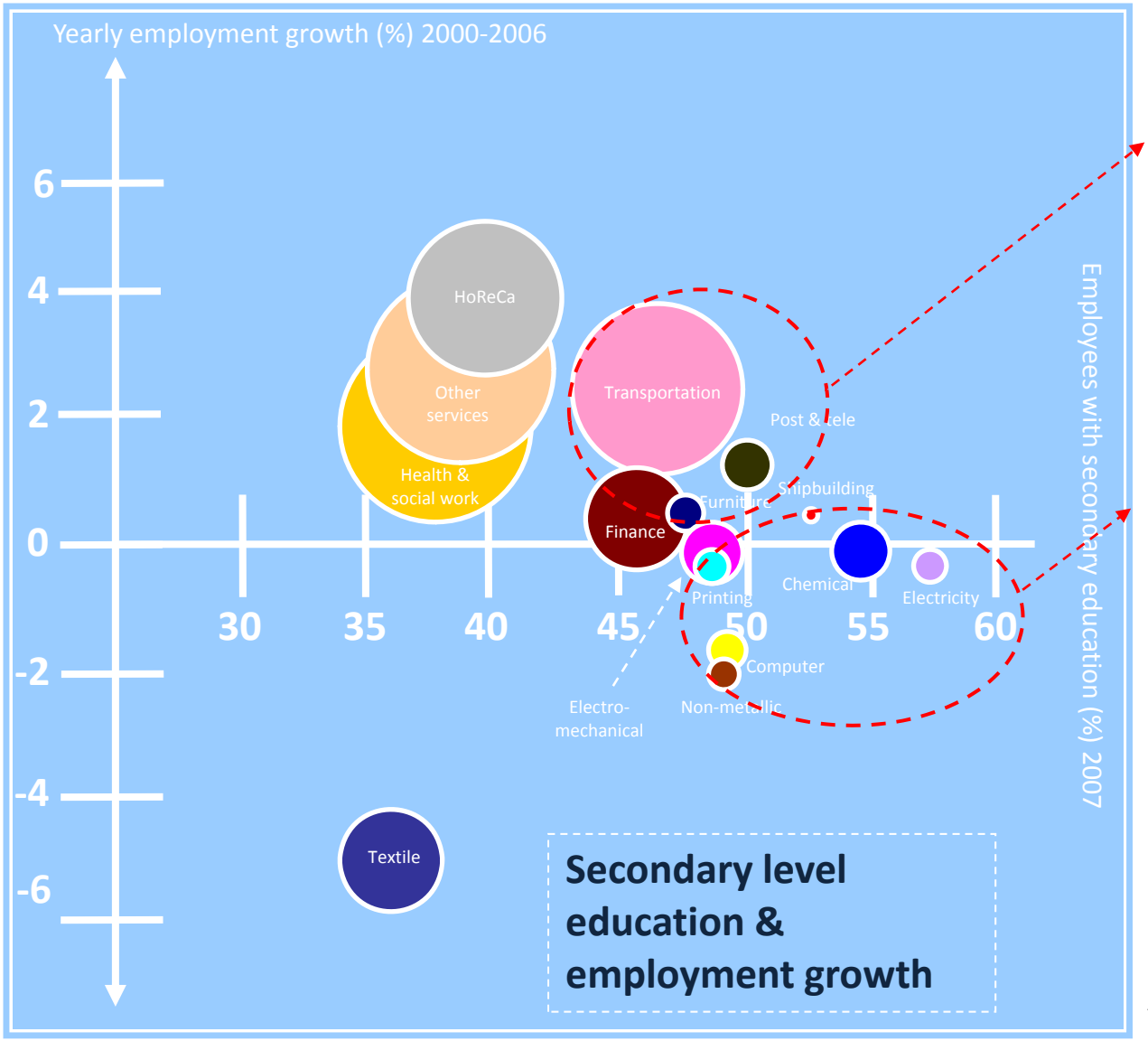


On the following three pages employment growth will be crossed with **employees educational level**, indicating sectors' need for employees with primary, secondary or tertiary education.

Sectors with high need of employees with primary education seem primarily to be the low to medium knowledge intensive **service sectors**. These sectors have high employment growth rates and high shares of employees with only primary level education.

Textile is also a sector with a high share of employees with primary level education. However, the sector has lost many manual and low skilled jobs during the last decade, indicating a more limited need for employees with primary education.

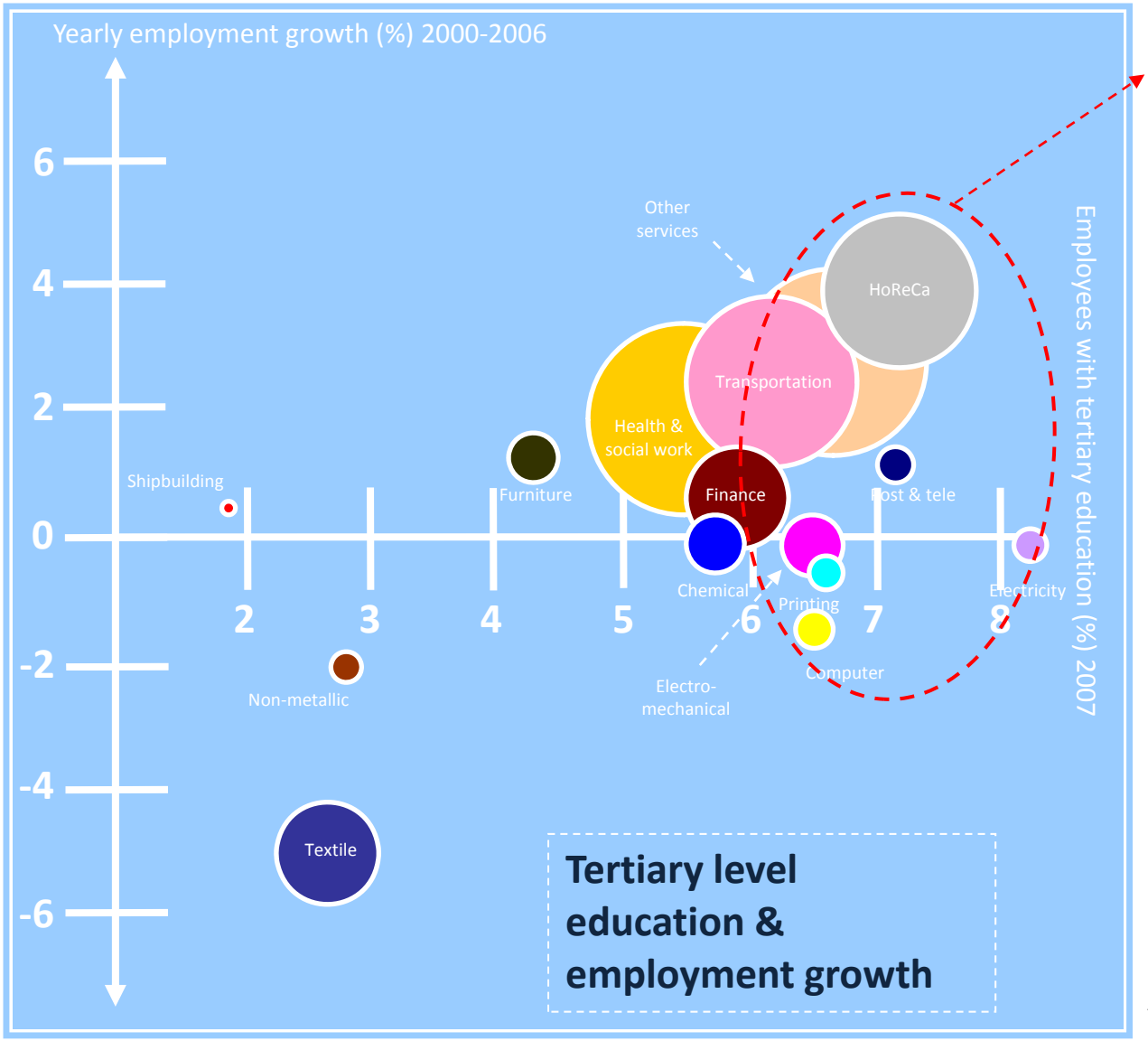
NB! Comparable data not available for Distribution & trade, Construction, Automotive and Defence



Sectors with high need of employees with secondary level education seem primarily to be the medium to high knowledge intensive service sectors such as Post & tele, Finance and Transport. These sectors have high to medium employment growth rates and high shares of employees with secondary level education.

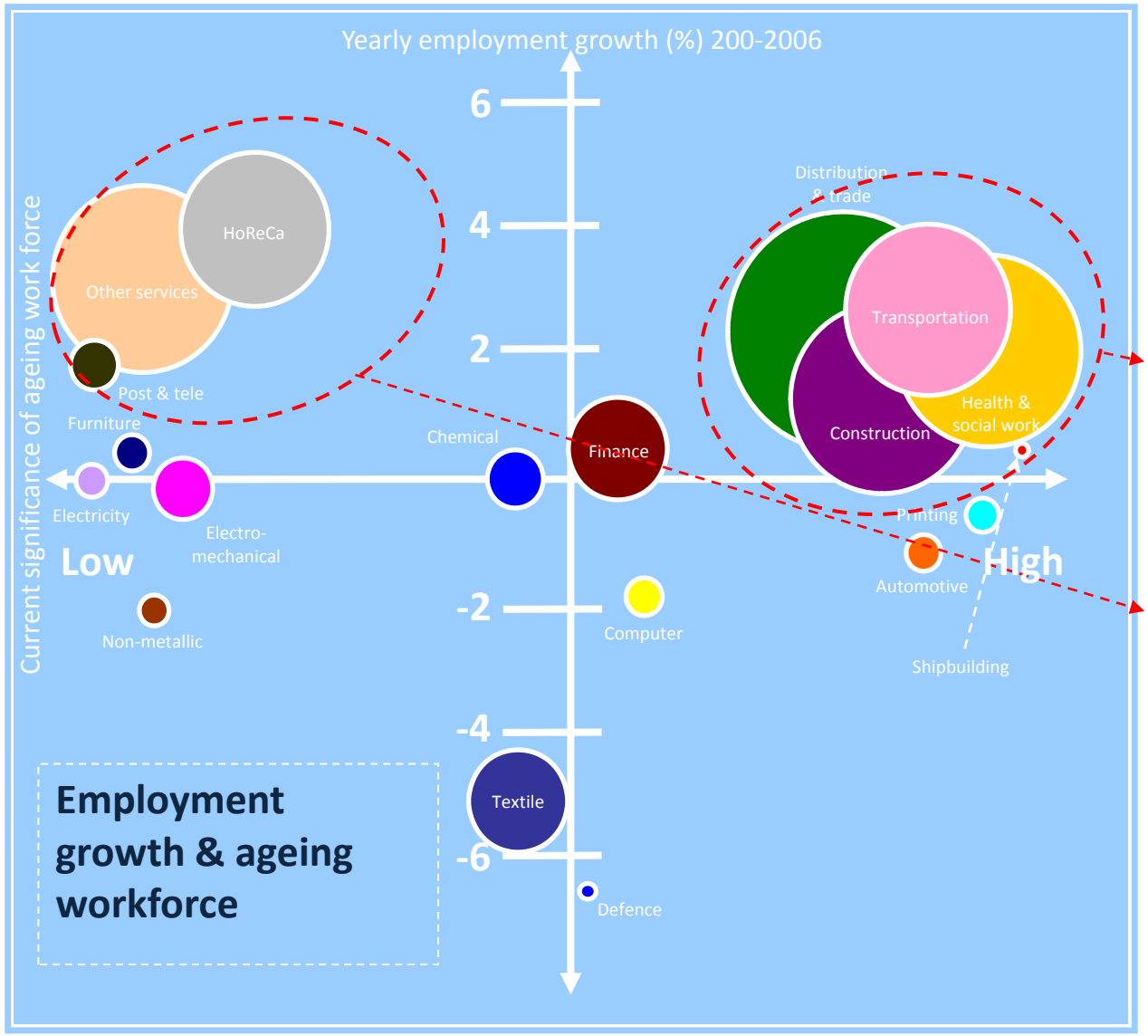
Many production sectors have a very high share of employees with secondary education but has also experienced a decline in the need for skilled workers, which also indicates a declining need for employees with secondary level education. The huge need for replacement can, however, to a certain degree generate a renewed need for employees with secondary education within some of these sectors.

NB! Comparable data not available for Distribution & trade, Construction, Automotive and Defence



Sectors with high need of employees with tertiary level education seem both to be service and production sectors. Though many production sectors have experienced job decline in recent years, the fact that the shares of professionals and higher level technicians are increasing in these sectors indicates a steady or increasing need for employees with tertiary level education.

NB! Comparable data not available for Distribution & trade, Construction, Automotive and Defence



In the figure this page, employment growth have been crossed with the **significance of the ageing work-force** within the selected sectors, indicating the sectors' need for recruitment and replacement:

'Ageing sectors'
Sectors typically with urgent or coming recruitment challenges directly connected to an ageing workforce combined with employment growth.

'Young sectors'
Sectors with urgent or coming recruitment challenges related to job growth but only weakly related to an ageing workforce

4. Drivers of change

After the mapping of main economic and employment trends, next step of the European Foresight Methodology is to identify important drivers of change. In the boxes below, the **most important drivers of change** across the studied sectors until 2020 are listed. The drivers all have a high presence in the sector studies and all have major impact on sector structures, employment and skills needs (see annex 9). The drivers have been categorised into three main groups being 1) Economic; 2) Social & political; and 3) Technical and natural drivers.

Economic

- Economic development
  - Growth vs. recession
- Globalisation
  - Off shoring & outsourcing
  - Competition from emerging economies
  - New market possibilities in emerging economies

Social & political

- Market segmentation
  - Individualisation
  - Climate and health concerns
- Regulations
  - Climate
  - Health
  - Safety and security
- Ageing
  - Workforce
  - Customers

Technical & natural

- ICT and Digitalisation
- R&D
  - New marketing concepts and business models
  - New materials
  - New processes
- Energy price
  - Oil, gas and electricity

On the next page, a table showing the impact of seven of the most important drivers of change on each of sectors is presented. As can be observed, the drivers with the highest impact on most sectors are competition from emerging economies, climate & environmentalism, ICT & digitalisation and R&D. Also , in general it seems as if production sectors are more sensitive to the drivers compared to most service sectors.

Selected drivers impact on sectors

Sector/Driver	Competition from emerging economies	Off shoring & outsourcing	Climate & environmen-talism	Ageing workforce	ICT& digitalisation	R&D	Energy prices	Sum
Automotive	++	++	++	++	++	++	++	14
Shipbuilding	++	++	++	++	+	++	+	13
Chemical	+	++	++	+	+	++	++	11
Computer	++	++	+	+	++	++	-	10
Construction	-	-	+	++	+	+	++	7
Defence	++	++	+	+	++	++	+	11
Distribution & trade	++	+	++	++	++	+	++	12
Electricity	-	-	++	-	+	++	++	7
Electromechanical	++	++	+	-	++	++	+	10
Finance	++	+	-	+	++	++	-	8
Furniture	+	+	++	-	+	+	-	6
Health & social work	-	-	-	++	+	+	-	4
HoReCa	+	-	+	-	++	-	+	6
Non-metallic	++	+	++	-	++	++	++	11
Other services	-	++	-	-	-	-	-	2
Post & tele	+	-	+	-	++	++	-	6
Printing	++	+	+	++	++	+	+	10
Textile	++	++	++	+	+	+	++	11
Transport	+	++	++	++	++	+	++	12
Sum (++=2 +=1 -=0)	**25**	**23**	**25**	**19**	**29**	**27**	**21**	

++ High impact **+ Medium impact** **- Low impact**

4.1 Main challenges and opportunities

All sector studies contain a SWOT analysis of the sectors' most important strengths, weaknesses, opportunities and threats. The most common and most important of challenges and opportunities across the 19 sectors are presented in the boxes below (see also annex 9). Challenges and opportunities are closely interlinked, meaning that most of the challenges, if overcome, also contains the most important opportunities for many European enterprises . As can be observed, the main challenges and opportunities are also closely linked to the most important drivers of change.

Challenges

- **Competition from emerging economies:** both production and R&D
- **Climate and environmental concerns and regulations**
- **Risk of skills and labour shortages** due to poor sector image among young candidates, ageing workforce and/or problems to attract women (or men)

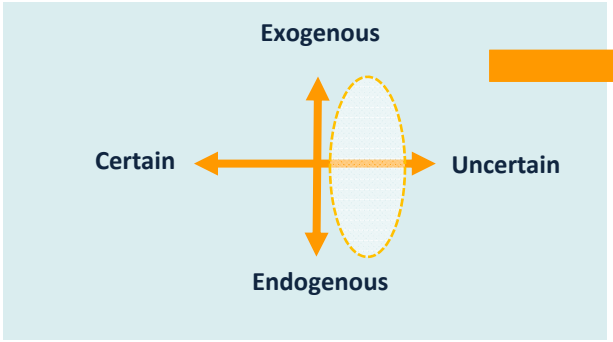
Opportunities

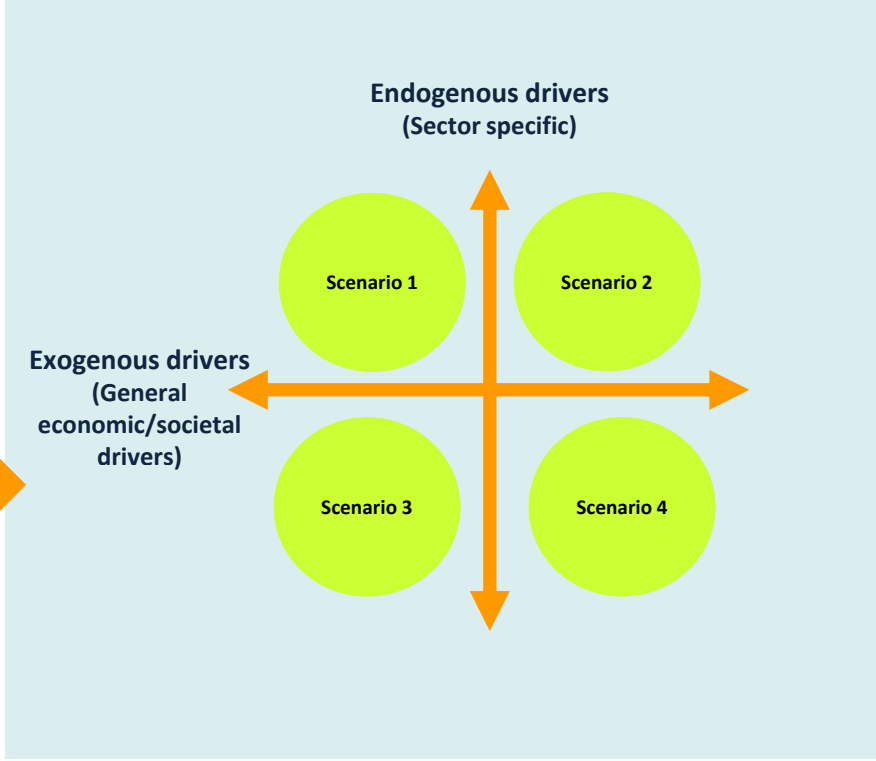
- **Emerging markets**
- **New climate and environmental friendly solutions**
- **Specialisation and excellence** (there is a growing worldwide demand for specialised products and services)
- **Automatisation and digitalisation** which means big innovation potentials and the ability to make work and production processes much more effective and secure

5. Scenarios

An important part of the European Foresight Methodology is to build a number of different sector scenarios describing possible different developments and to identify the scenarios impact on employment and skills needs. The scenarios in the sector studies were build following the methodological approach illustrated in the figures below. The time horizon for the scenarios was set to 2020.

By crossing a number of selected drivers within two axes, four different scenario spaces are created - each with their specific combinations of dominant drivers. The drivers should be important in terms of impact and should be uncertain, meaning that it should be hard to predict the future development of the selected drivers. Furthermore, the scenarios were created by crossing both endogenous and exogenous drivers as exemplified in the figures. Inputs for the different scenarios were made by sector experts.

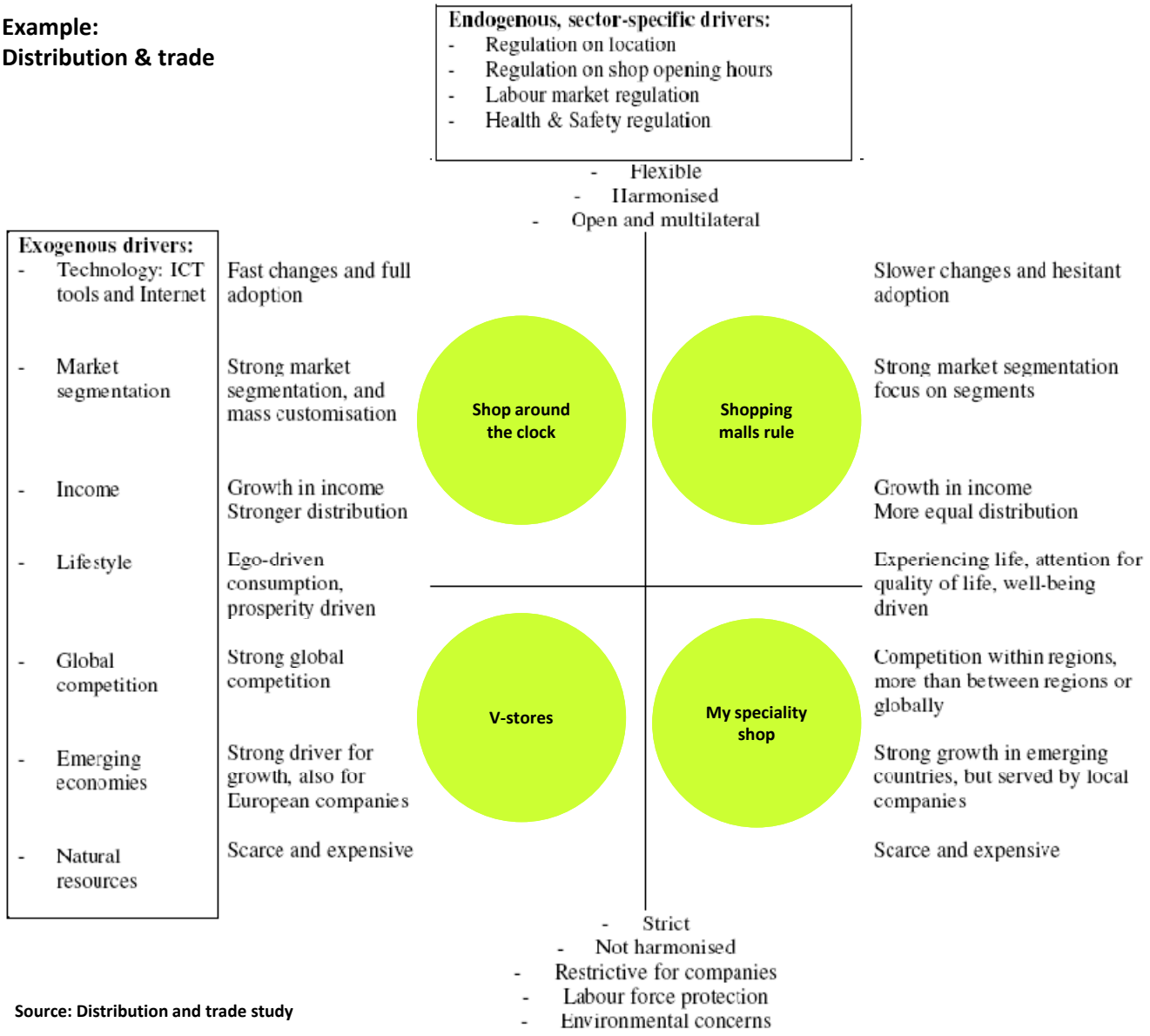




The figure on this page is an **example of scenario building** in praxis . The example is taken from the study of the Distribution & trade sector.

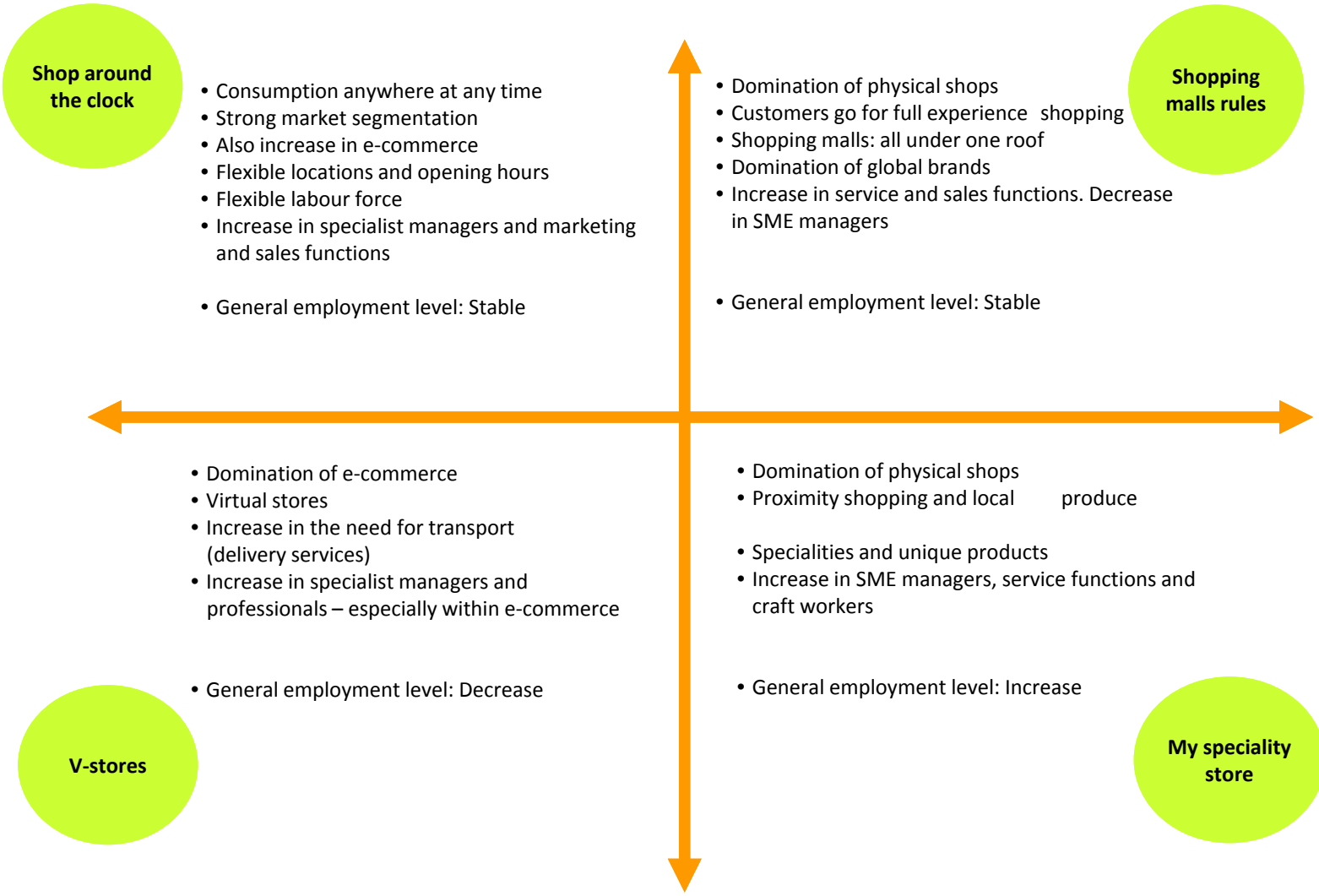
On the next pages the characteristics and implications of each scenario is presented in bullet points.

Example:
Distribution & trade



Source: Distribution and trade study

5.1. Implication of scenarios: Example - Distribution & trade



Source: Distribution and trade study

5.2 Impact of the financial crisis

Most of the sector analyses and scenarios were made before the depth of the financial crisis was known. Oxford Research therefore carried out validating research of the newest reporting on the impact of the crisis on the sectors concerned (mostly journalistic articles and communications from EU and sector stakeholders). The impact of the crisis on the sectors are qualitative assessments made by Oxford Research on the basis of the desk research.

The most severe hit sectors seems to be:

- Automotive
- Finance
- Horeca
- Textile
- Transport
- Construction

The less impacted sectors seems to be:

- Defence
- Electricity
- Health & social work
- Post & telecom

Impact of the financial crisis on sectors

Sector/Driver	Job loss	Company restructurings (bankruptcies of dominant players, change of ownership, etc.)	Sum (++=2 +=1 -=0)
Automotive	++	++	4
Shipbuilding	n/a	n/a	n/a
Chemical	+	-	1
Computer	+	-	1
Construction	++	++	4
Defence	-	-	0
Distribution & trade	+	+	2
Electricity	-	-	0
Electromechanical	+	+	2
Finance	++	++	4
Furniture	+	+	2
Health & social work	-	-	0
HoReCa	++	++	4
Non-metallic	n/a	n/a	n/a
Other services	+	-	1
Post & tele	-	-	0
Printing	+	-	1
Textile	++	++	4
Transport	++	+	3

++ High impact + Medium impact - Low impact

5.3 Impact of scenarios on employment

Oxford Research has carried out employment forecasts for all of the 19 sectors based on historical data, the forecasted employment impact in the individual sector scenarios and the reporting on the impact of the financial crisis on sectors (see annex 8). Forecasts based on the scenarios, have been made by assessing the 'sum' or the 'average' employment situation of the different scenarios of each sector (see annex 9). It should be emphasised that most of the scenarios only contain qualitative indications of the possible employment development. Hence the forecasts should be seen as an approximate indications of the possible development.

When the employment forecast of the sectors are grouped into service sectors, production sectors and combined production and service sectors, it becomes evident that employment within production in the EU, in general, will continue to decline while employment within services, in general, will continue to increase. Furthermore, the financial crisis seems to speed up the already ongoing development with continued job losses in the traditional production sectors. Many of the sector studies do, however, contain quite positive scenarios including consolidation and/or job growth also within many of the production sectors. Thus, post crisis, the forecasts predict a consolidation within production employment in total and renewed employment growth within services.

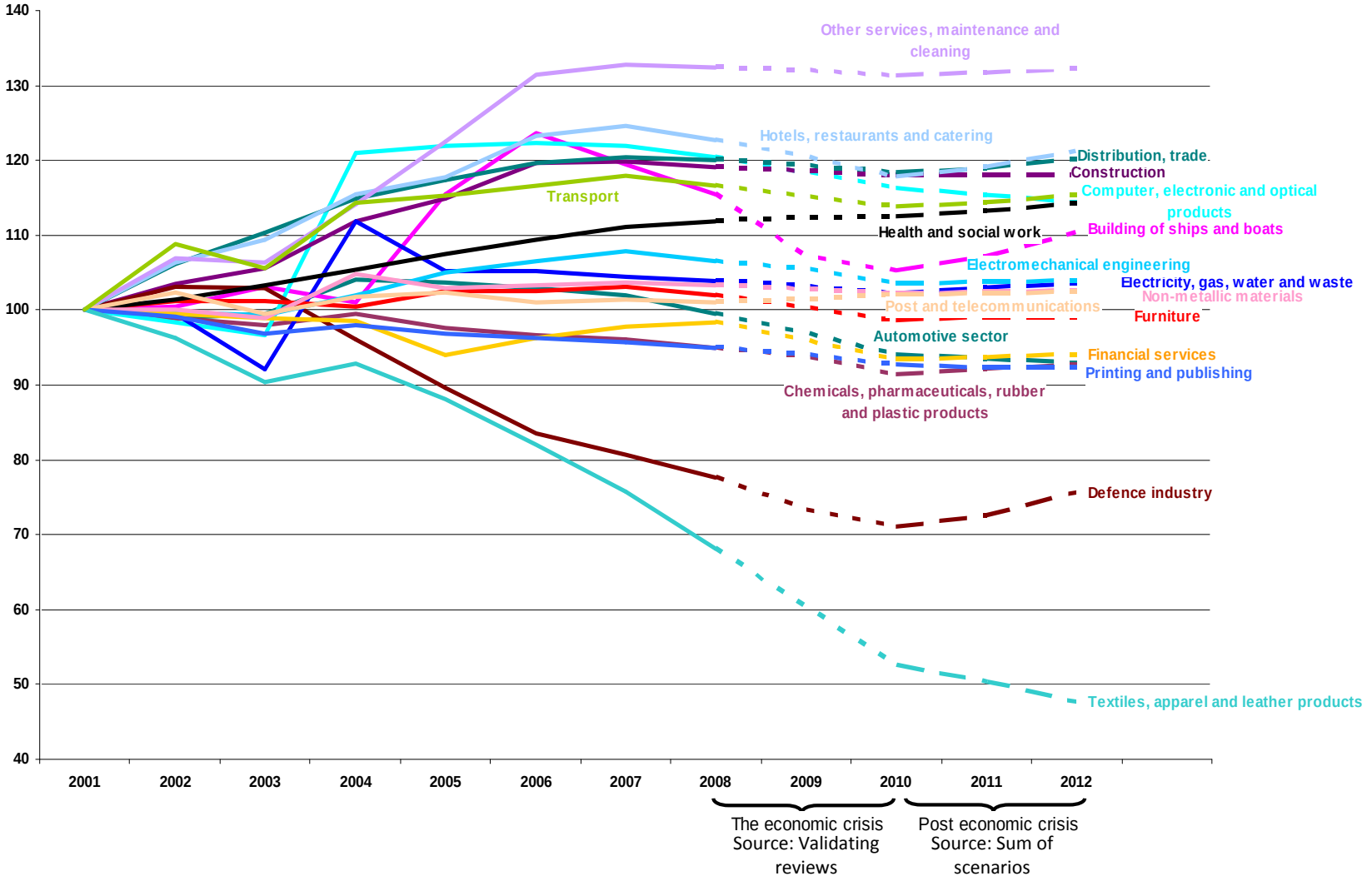
The forecasts are presented on the following pages.

Employment index for the 19 sectors

Based on historical data (Eurostat 2009), validating reviews and scenarios (see annex 8)

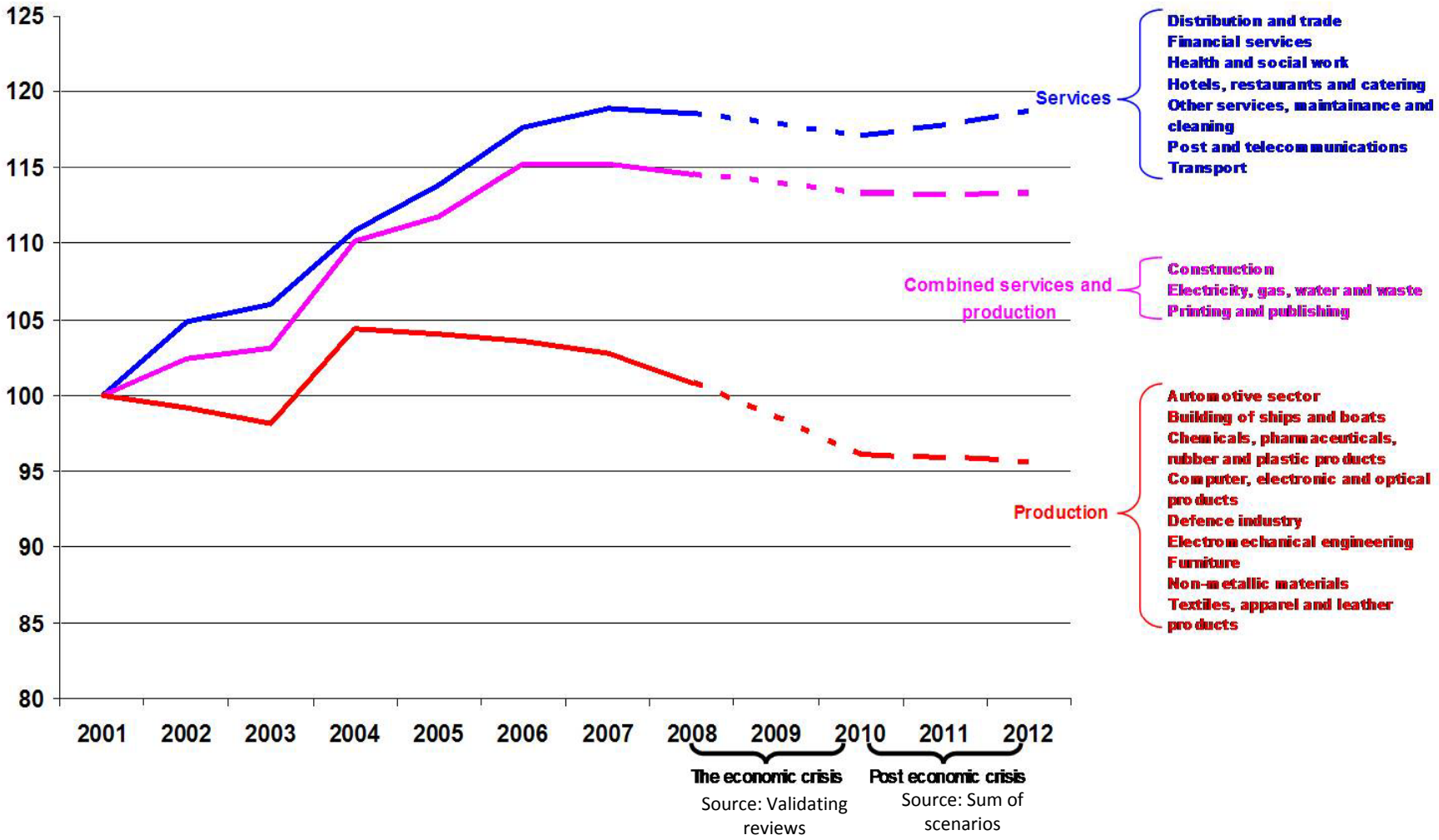
2001 - 2003: **EU-25**

2004 - 2012: **EU-27**



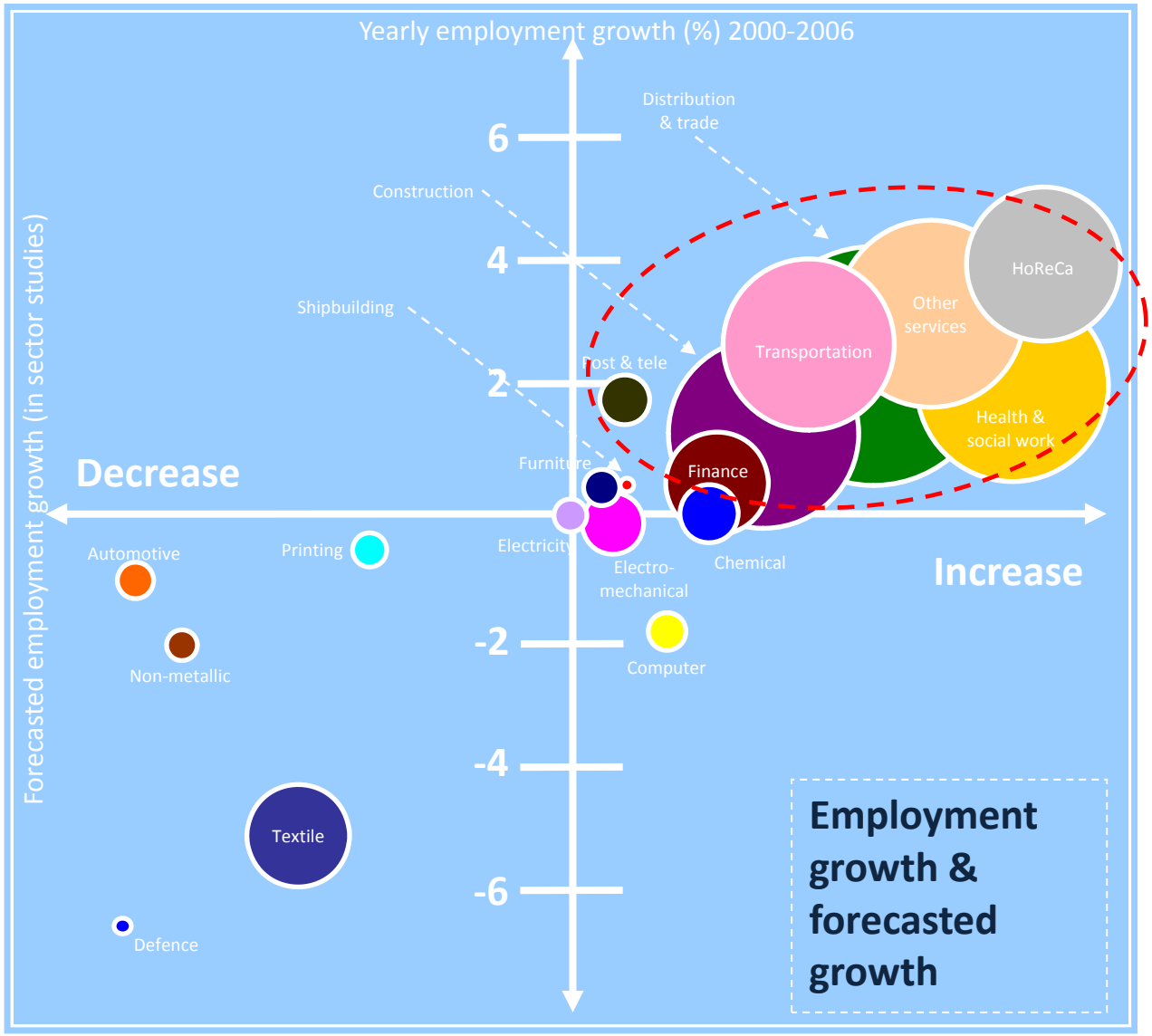
Grouped employment index

Based on historical data (Eurostat 2009), validating reviews and scenarios (see annex 8)



Source: Validating reviews

Source: Sum of scenarios



When crossing the historical employment growth with the future employment growth as forecasted in the sector studies, the development and division between service and production sectors is confirmed.

Services: High growth sectors. Both high historical employment growth and high forecasted employment growth.

Note: Future employment forecasts have been made by assessing the 'sum' or the 'average' employment situation of the different scenarios of each sector study. It should be emphasised that most of the scenarios only contain qualitative indications of the possible employment development. Hence the forecasts should be seen as an approximate indication of the possible development.

6. Emerging competencies

After building the scenarios and forecasting employment growth the sector studies analyses the impact of the different scenarios on skills needs and emerging competencies. A myriad of different emerging skills and competencies is mentioned in the sector studies. Some emerging skills and competencies, however, seems to be more common than others across the sectors. These are presented in the boxes below. The emerging competencies have been categorised into three main groups being: 1) Economic; 2) Social & political; and 3) Technical. Also, there seems to be a tendency towards multiskilling and the need for new combinations of skills and competencies within many sectors. As an example managerial competencies, such as financial management and strategic planning, seems increasingly to be needed in occupations not traditionally related to management.

Social/cultural

- Intercultural skills
- Team work
- Self management
- Entrepreneurship and innovativeness

Technical

- ICT and E-skills (both at user and expert level)
- Skills/knowledge related to new materials and new processes
- Health and green skills (related to health and climate and environmental solutions)

Managerial

- Intercultural management
- International value chain management
- International financial management
- Green management (implementing and managing climate and environmental friendly policies and solutions)

+ Multiskilling and new combinations for skills and competencies
(E.g. combining two sets of skills normally belonging to two different occupations in the same organisation)

On the next page, a table showing the importance of selected types of emerging competencies within each sector is presented. The types of competencies includes social & cultural competencies, technical competencies and managerial competencies. As the table shows, the most required emerging competencies seems to be within technical (hard) skills and Social/cultural (soft) skills.

Types and importance of emerging skills and competencies at sector level

Sector/type of skill/competence	New soft skills (Social and cultural skills. See page 41)	New hard skills (Technical skills. See page 41)	New managerial skills	New combinations of skills	Sum (++=2, +=1 -=0)
Automotive	-	++	++	++	6
Shipbuilding	++	++	+	+	6
Chemical	++	++	+	+	6
Computer	++	++	+	+	6
Construction	-	++	+	+	4
Defence	+	+	+	+	4
Distribution & trade	++	+	++	+	6
Electricity	++	++	++	+	7
Electromechanical	+	++	+	++	6
Finance	+	+	+	++	5
Furniture	+	++	+	+	5
Health & social work	++	++	++	+	7
Horeca	++	+	+	++	6
Non-metallic	+	++	++	+	6
Other services	++	++	+	+	6
Post & tele	+	+	+	+	4
Printing	++	++	++	+	7
Textile	++	++	++	+	7
Transport	++	-	+	-	3
Sum (++=2, +=1 -=0)	**28**	**31**	**26**	**22**	

++ Highly required **+ Medially required** **- Lowly required**

6.1 Emerging competencies at occupational level

Many of the sector studies identify emerging competencies at occupational levels. Due to different approaches to and definitions of competencies and occupations in the sector studies it is not possible to make a complete list with the most important emerging competencies within all types of occupations. In many of the sector studies It has, however, been possible to identify emerging skills and competencies within management occupations and basic production and service occupation. These are listed in the boxes below.

Production and service occupations

- ICT and E-skills (user level)
- Intercultural skills
- Team work
- Multiskilling (combining two sets of skills normally belonging to two different occupations in the organisation)
- Self management
- Knowledge about health and environmental sustainability
- Entrepreneurship and innovativeness

Management

- Intercultural/diversity management
- International supply chain management
- International financial management
- Green management (implementing and managing climate and environmental friendly policies and solutions)
- Strategic knowledge about ICT and E-solutions
- Entrepreneurship and innovativeness

6.2 Emerging competencies within service and production sectors

As illustrated in the boxes on this page, some emerging skills and competencies, such as for example ICT and E-skills, are, more or less, of equal importance in all types of sectors while other competencies are of quite different importance to different types of sectors. Where service sectors especially seem to be in high need of soft/social competencies such as intercultural skills and conflict solution, emerging competencies within production is most often related to new processes and materials, and the internationalisation of supply and values chains.

In service sectors

- Intercultural skills
- Conflict solution
- Multiskilling

All sectors

- ICT and E-skills (both at user and expert level)
- Health and green skills (related to health and climate and environmental solutions)
- Entrepreneurship and innovativeness
- Team work
- Self management
- New combinations of skills and competencies

Production sectors

- Skills/knowledge related to new materials
- Skills/knowledge related to new processes
- International value chain management

7. Strategies to meet skills and labour needs

Before turning to the final conclusions and recommendations the sector studies identifies strategies for companies, training & education institutions and other relevant stakeholders on how to meet skills and labour needs.

In the text box, this page, an example on strategies is given. Here it is strategies on how to meet the demand for SME managers within Distribution & trade.

Since most strategies, naturally have the characteristics of an actual recommendation, the strategies have in the present report been incorporated into the final recommendations.

Example: How to meet the demand for SME managers within Distribution & trade?

Option	Is this option viable?	Actors[1]
A. Recruiting workers from other sectors	Yes, for larger SMEs in the growth scenarios.	C
B. Recruiting workers from other Member States	Less likely for local SMEs.	C
C. Recruiting workers from Non-member States	Less likely for local SMEs.	C, G
D. Recruiting unemployed with or without re-training	Yes, for larger SMEs in scenarios where numbers expected to increase.	C, E, I, G
E. Recruiting young people from the education system	Yes, for larger SMEs in scenarios where numbers are expected to stay stable or increase.	C, G
F. Training and re-training employed workers	Yes, for all managers an important option.	C, E, S, I
G. Changing work organisation	Yes, for larger SMEs e.g. teamwork to combine several skills.	C
H. Outsourcing and offshoring	Yes, for larger SMEs outsourcing certain management functions to freelancer is viable in all scenarios.	C
I. Changing vocational education	Yes, stronger integration of practice cases and support of especially bachelor students in finding placements.	E, C, I, G
J. Designing and offering new courses	Yes, in the emergent skills, and for transferring business and for migrant business.	E, S, I, C, G
K. Providing information about emerging skills	Yes, in particular for Micro businesses.	E, S, I, C
L. Improve the image of the sector	Yes, necessary for young high educated managers in their first job	S, I, E
M. Stronger cooperation between stakeholders	Yes, in particular to develop new courses and to exploit the innovation potential of the sector.	E, S, C, I, G, U

Notes: 1. C (company), S (sector organisations and chambers of commerce), E (education & training), G (governments and regulators), I (intermediary organisation, public or private), U (trade unions).

Source: Distribution and trade study

8. Main findings

One of the most important findings of the transversal sectoral study seems to be the polarisation of the labour market and skills needs. This means:

- **Decline in skilled jobs** (E.g. craftsmen, etc.)
- **Moderate increase in very low skilled elementary jobs** (E.g. elementary occupations)
- **High increase in high skilled jobs** (E.g. Professionals, managers, etc.)

Another clear conclusion is that significant job growth, both historically and during the next 10-15 years, mainly has and will happen within service sectors. Furthermore, in contrary to many production sectors there has been a steady increase in the need for both low skilled and high skilled jobs within the services sectors. Therefore it can be concluded that:

- **Services will continue to grow in importance to the European economy the next 10-15 years**

Within production there has been quite significant job losses during the last decade, this especially within skilled jobs. However, due to enlarged focus on specialisation and new value adding activities there seems to be a development towards European excellence within production resulting in higher added value and more high skilled jobs:

- **European production goes towards specialisation and excellence** meaning significant loss in skilled jobs but increase in high skilled jobs

Regardless of job losses and other structural developments there is a clear tendency of up-skilling:

- **Up skilling in all sectors** both historically and in the future
- **Increasing educational levels in all sectors**

Another common theme in the sector studies is the dissolution of traditional sector divisions most often due to new technologies , new customer demands and enlarged supply and value chains. The dissolving sector divisions also results in new job profiles and new demands to employees' skills and education:

- **Need for new types and mixes off employees and educational backgrounds** in most sectors
- **Traditional job profiles and work tasks are increasingly combined** demanding new combinations of skills and competencies

When looking at emerging skills and competencies many sectors especially experience new emerging skills need within areas, which are closely connected to the major trends in world policy and economy including climate, ICT and the continued internationalisation of markets and supply chains:

- **New skills and competences** are especially related to **sustainability** (environment, climate, health**,** etc.), **ICT**, and to the **internationalisation** of both workforce, markets and supply chains

At the same time, many sectors will face serious recruitment and skills problems in the coming years if no actions are taken. The ageing workforce, poor working conditions and/or a faded sector image will for many sectors result in problems in getting sufficient labour and the right skills:

- **High risk of skills (and labour) shortages in many sectors** due to an ageing workforce, poor image among young candidates and/or problems to attract women
    - Production sectors: Faded and heavy technical image (Ex. ship building, energy(-production))
    - Service sectors: Poor working conditions and career opportunities (Ex.: Horeca, Other Services)

9. Recommendations

The following recommendations are the most mentioned recommendations in the sector studies. Firstly, the more general recommendations on how to improve innovation, skills and jobs within the studied sectors and the European economy as such are presented. Secondly, the more specific recommendations regarding training and education are listed. Finally, recommendations are grouped with the main findings to give an overview of the correlation between the two.

9.1 General recommendations

- Enhance **innovation and R&D**
- Invest strongly in **human capital**
- Improve **sector image** – especially for young candidates
    - Improve **working conditions**
    - Improve **career and personal development possibilities** – especially for low skilled workers
- Improve **collaboration** among all stakeholders
    - Support and enforce **social dialogue**
- Support **diversity policies** and programmes aimed at:
    - Keeping **elderly** employees (active ageing)
    - Attract **female** workers/managers
    - Integrate and attract **immigrant** workers and expats
- Develop **sector monitoring systems** on employment, skills and competencies
- Support **clustering** and cross border networking (for joint training and R&D projects)

9.2 Recommendations for education and training

The majority of the recommendations in the sector studies concerns education and training. The most common and important recommendations within this area seems to be:

- Adapt and **modernise vocational education and training (VET)** and education systems in general
- Increase the **flexibility of the educational system**. New business models demands new skills
- Include **inter- and multidisciplinary approaches** in education
- Closer **cooperation between stakeholders** is important in order **to adapt the education system** to new skills needs
- Promote **sector specific skills** at an early stage by renewing forms of education
- Increase use of **apprenticeship and mentoring programmes**
- Greater emphasis should be put on **teaching cultural and social skills** in the educational system
- EU standardisation and **certification of educations and skills** to ensure free movement of the labour force
- Develop special/joint education and **training programmes for SMEs**
- Develop high quality **online and digitalised learning tools**
- Create a **culture of life long learning**
- Support **in-house up skilling and (re)training** of workers

9.3 Recommendations grouped with main findings

Concluding main findings have been grouped with appropriate/relevant recommendations to give an overview of the correlation between the two. In general there seems to be a sound correlation between the main findings and the recommendations from the sector studies .

Findings	Relevant recommendations
Up-skilling in all sectors	Cooperation among stakeholders to adapt educational system Culture of life long learning Invest strongly in human capital Enhance and improve in-house up skilling and training Increased use of apprenticeship and mentoring schemes Support clustering and cross border networking (for joint training and R&D projects)
Job growth in service sectors	Adapt and modernize educational VET system Introduce more sector specific skills in education Focus on social and intercultural skills in education Improve working conditions and career possibilities
European excellence in production	Adapt and modernize educational VET system Introduce more sector specific skills in education Culture of life long learning (to enhance up skilling) Enhance and improve in-house up skilling and training Enhance innovation Support clustering and cross border networking (for joint training and R&D projects)
Dissolving sector divisions and new combinations of skills	Increase flexibility of educational system Inter and multidisciplinary approaches in education Cooperation among stakeholders to adapt educational system
Emerging skills and competencies especially related to ICT, internationalisation and sustainability	Cooperation among stakeholders to adapt educational system Culture of life long learning Enhance and improve in-house up skilling and training Inter and multidisciplinary approaches in education
Labour and skills shortages due to ageing, poor image, and failure to attract women	Improve working conditions and career possibilities Culture of life long learning Enhance and improve in-house up skilling and training Increased use of apprenticeship and mentoring schemes EU certification of education and skills to ensure international mobility of workers Support diversity programs e.g. to attract women and immigrants and keep elderly workers

10. Summing up: Common paths of sectoral evolution

To sum up, four common paths of sectoral evolution or evolutionary paradigms that encapsulates the most important and essential sectoral developments in the EU can be identified:

- **Sun rises in the East**
- **European Excellence**
- **Mind the gap: Polarisation of skills needs**
- **The greening of jobs**

Following, the characteristics of each of the common paths / paradigms is described briefly

Sun rises in the east

Many sectors in the EU are experiencing increased competition from neighbouring countries and Asia. This has resulted in the **movement of many (mostly basic processing and assembling) functions towards the east** during the last 10 years. This movement increasingly also includes more knowledge intensive activities. In the beginning, many functions were moved to the New Member States. However, this movement now increasingly includes neighbouring EU countries, Asia and other emerging economies.

The evolution is most prevalent within **production sectors** (especially **textiles**, **defence**, **automotives**), but can also be observed within **tourism**. Basic mass tourism has increased in eastern Europe and some Asian countries and competition within luxury and customised tourism from Asia and other emerging economies is increasing as well

Sun rises in the east
Production activities moves eastwards

European excellence

As basic processing, assembling and service functions are off-shored and moved out of Europe, **focus is put on high end value and more knowledge intensive activities** for example connected to R&D, tests, marketing, sales, value chain management and financial management. This generates higher added value and increased need for high skilled labour. Global competition is also increasing within these activities, but in this evolutionary paradigm Europe will stand competition and maintain its position as a world centre of excellence of technology and know-how.

The evolution is most prominent within **production sectors**: (Especially: **furniture, automotives, computer, ship building** and **electromechanical** but can also to a certain degree be observed within highly international service sectors such as **Transport** and **Distribution & trade**).

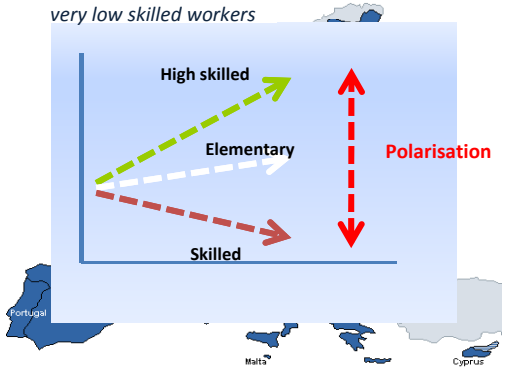
European excellence
Focus on knowledge intensive activities

Mind the gap: Polarisation of skills needs

Several sectors report on **rising skills needs together with a steady need for low skilled** manual workers (elementary occupations): Some functions are still highly manual and are at the same time place bound (they cant be off-shored). At the same time internationalisation, market segmentation and new complex consumer demands creates increased need for highly professional managers, expert technical and administrative staff, specialised service workers , etc. Another trend belonging to the polarisation of skills needs is the decrease in the share of skilled workers.

This trend is **prominent within most sectors** but **especially within service sectors** such as Post & tele, Distribution & trade and Transport. The decrease in skilled workers is, however, most prominent within production sectors.

Polarisation of skills needs
Increased need for high skilled and very low skilled workers

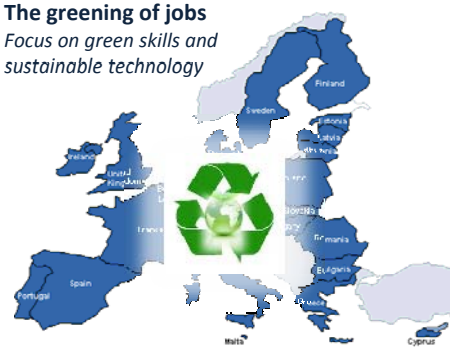


The greening of jobs

The increased focus of both consumers and politicians on climate changes and the need to cut down CO2 emissions and energy consumption is generating a **rising need of skills and jobs related to climate and environmental friendly solutions, technology and services.** Today Europe is among the world leaders when it comes to green skills and technology, so the future opportunities are promising.

The greening of skills and jobs is **prominent within all sectors** but political pressure, which is a lead driver within this area, has especially been put on sectors with high direct impact on climate and environment such as **Transport, Electricity and Automotives.**

The greening of jobs
Focus on green skills and sustainable technology



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